D1.1 State-of-play of Community Bioenergy across Europe

Market Size, Application and Best Practices

Fróes, Isabel; Altsitsiadis, Efthymios

UNLOCKING THE COMMUNITY BIOENERGY POTENTIAL

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

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About

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.

The project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 952930.

Project partners

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List of Abbreviations

AGM	Annual General Meeting
BE	Bioenergy
BEIS	UK Department for Business, Energy & Industrial Strategy
CAPEX	Capital Expenditure
CHP	Combined Heat & Power
DH	District Heating
DHW	Domestic Hot Water (boiler)
DKK	Danish Crowns (Danish coin)
EC	European Commission
ESCO	Energy Service Company
FF	Fossil Free
GN	Generator
KW	Kilowatts
Nm3	Normal Cubic Meter (used for gas emissions or exchanges)
P2P	Peer to peer
PV	Photovoltaic
RE	Renewable Energy
TN	Tons
UNDP	United Nations Development Programme

Executive summary

This report presents and reflects upon the results of task 1.1, with the key goal of **collecting knowledge on best practices, tools and insights on the key success factors of the application of the community energy concept in the fields of bioenergy and RE heating across EU.** The task initiated with a compilation of over 70 cases, which were rated and qualified regarding importance and impact with the help of all the project partners.

Through **desk research, survey and interviews** with specific related cases, relevant information has been gathered regarding existing best practices. Besides the survey results, thirty cases were selected and further analysed highlighting (i) key elements of the bioenergy community concept in terms of citizen participation, technologies used, factors that facilitate or pose barriers to community bioenergy heating projects (and how these factors change across regions); (ii) the environmental, social and economic impact they managed to achieve, and (iii) the lessons that could be derived from their actual deployment and implementation.

For this task, both **qualitative and quantitative methodological approaches were applied** to give a general overview of numbers and representation via the surveys, interviews and desk research. The interviews provided insights into motivations and challenges experienced from within RE cooperatives and associations. The surveys provided an insight of the potential for bioenergy expansion in Europe, while the desk research complemented the interview and survey data, bringing further depth to the analysis. The results were combined and further analysed and summarised through a comparative qualitative approach, where the data intersection provides an overview of the bioenergy market challenges and assets across Europe.

The breadth of the data has provided a richer assessment and analysis, fulfilling the task objectives.

This report results feed into various WPs and Tasks, for example:

WP1 towards T1.4 with an initial overview of existing heating uptakes needs and challenges;

WP2 towards T2.1 and T2.2 with relevant input for the type of content that can help the BECoop assessment tool and toolkit;

WP3 towards T3.1 towards understanding reasons behind the various stakeholders' motivations and how best to tap into those for a valuable mobilisation supporting the project development.

Furthermore, this report provides a baseline towards key findings that support creating valuable engagement and help the deployment of bioenergy communities in the upcoming future.

1 Introduction

This report presents and reflects upon the results of task 1.1, which aimed at **collecting knowledge on best practices, tools and insights on the key success factors of the application of the community energy concept in the fields of bioenergy and RE heating across EU**. The task initiated with a compilation of 70 cases, which were rated and qualified regarding importance and impact. One of the aspects that was investigated was the identification of the bioenergy co-benefits that have been created through the case studies identified. Through desk research, survey and interviews with specific related cases, relevant information has been gathered regarding existing best practices. Twenty case studies were selected and further analysed highlighting (i) key elements of the bioenergy community concept in terms of citizen participation, technologies used, factors that facilitate or pose barriers to community bioenergy heating projects (and how these factors change across regions); (ii) the environmental, social and economic impact they managed to achieve, and (iii) the lessons that could be derived from their actual deployment and implementation.

A comparative analysis of the identified practices, presented in this document, provides meaningful insights with respect to good practices, challenges and gaps, and highlights commonalities and differences among the identified cases that may have a considerable influence on the design, implementation, and impact of community bioenergy schemes. Both quantitative and qualitative data were collected towards achieving the highest level of results.

While surveys offer a set of quantitative data[1], qualitative data offer reasons behind the choices and allow for broader insights regarding user interaction and behaviours that might influence their responses and perspectives. Interviews, as a qualitative research approach, provides the "ability to penetrate the experiential social worlds of intentional, self- directing actors, whether through the spoken or written word" (Mangen, 1999). This task included both approaches to enrich the knowledge base and create more rounded results and detailed pictures regarding the RE scenario across Europe.

Beyond the introduction, this deliverable is structured into three sections to follow.

Section 2 presents the state-of-play regarding the establishment of energy and bioenergy communities. With the help of the project partners, 70 initial cases were identified and later assessed for selected interviews. The analysed and summarised interview results are then presented together with key insights.

Section 3 of this report presents the potential for bioenergy expansion through the analysis and results of the online survey in a structured manner, complementing the insights from the interview, which focused on key aspects related to RE, such as reveal the community bioenergy market potential and getting an overview of which types are currently most popular and also how they are used.

Section 4 of this reports presents the combined results of desk research, survey and interviews into a set of findings indicating the keys lessons about barriers, best practices and overall insights regarding the BE market across Europe.

The Deliverable final section offers a succinct conclusion (***Section 5***) in how these learnings can be applied towards the project development and bioenergy market uptake.

[1] Quantitative data provides a set of data that 'can be straightforwardly collected, coded and analysed in accordance with universal conventions of sampling representativeness'(Livingstone, 2003, p. 19).

2 State-of-play regarding the establishment of energy and bioenergy communities

The energy communities concept is officially recognised and addressed under 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 (Caramizaru, A. and Uihlein, A., 2020). During the last decade, energy communities across Europe established common communication channels and created groups of cooperation in national and international level in order to better safeguard their rights and promote their work. In Europe, a small group of RESCoops started to cooperate in 2009 and by 2013 officially set up RESCoop.eu. RESCoop.eu aims to represent citizens and RESCoops towards European policy makers, to support new RESCoops to start-up and to create a financial service that would facilitate European RESCoops (Huybrechts Benjamin et al.).

When talking about cooperatives it is valuable to remember how cooperatives are perceived and described in diverse environments. As part of the initial desk research in this task, it became prominent that cooperatives do not define themselves equally and there are a wide range to cooperatives focusing on a variety of topics. Within the International Cooperative Alliance (ICA)[2] they describe cooperatives as:

> *… people-centred enterprises jointly owned and democratically controlled by and for their members to realise their common socio-economic needs and aspirations. As enterprises based on values and principles, they put fairness and equality first allowing people to create sustainable enterprises that generate long-term jobs and prosperity. Managed by producers, users or workers, cooperatives are run according to the 'one member, one vote' rule.*[2]

ICA also offers a set of principles to which cooperatives should offer[3]:

- Voluntary and open membership
- Democratic control by members
- Economic participation by members
- Autonomy and independence
- Education, training and information
- Cooperation between cooperatives
- Attention to the community

This identification was a starting point towards the desk research that followed to map and gather data if and in which ways do RE cooperatives align of diverge from such principles. To achieve this goal, CBS collected knowledge on best practices, tools and insights on key success factors of the application of the community energy concept in the field of bioenergy; this was immediately followed by preparing an initial interview guide with the support of the task partners. The purpose of the interviews was to uncover some of the stories and reasons behind the engagement towards RE energy. Furthermore, the interviews were to shed a light into citizen participation, technologies used, factors that facilitate or pose barriers to community bioenergy heating projects (and how these factors change across regions); (ii) the environmental, social and economic impact they managed to achieve, and (iii) the lessons that could be derived from their actual deployment and implementation.

[2] https://www.ica.coop/en

[3] https://www.ica.coop/en/cooperatives/cooperative-identity

For this task, a qualitative approach was applied to both give a general overview of the results collected through the desk research, while the interviews provided insights into motivations and challenges experienced from within RE cooperatives and associations. For the interview, an interview guide (see *Appendix 2*) was put together and discussed among task partners to achieve best data for the task results. In parallel to developing the interview guide, an online spreadsheet was shared among the project partners with a specific request for them to fill out 3-5 cases each, which could be used in the task research, through either desk research or interviews.

Twenty cases were then selected from the list, while the other cases were analysed through desk research and imported into the comparative data software used towards the more detailed data analysis.

The breadth of the data has provided a richer assessment and analysis, fulfilling the goals of uncovering existing best practices and relevant materials that can inform and guide the development of upcoming RE cooperatives.

2.1 Cases identification and cases analysis

An identification of existing cases related to community driven renewable energy federations, organisations and cooperatives was carried out. To identify these cases, an online spreadsheet was prepared, where all project partners were requested to suggest at least five renewable energy cases, which they thought were valuable to the project and with examples that could fit into BECoop's ambitions. An initial list of 70 cases were identified by the project partners. We added a snapshot of the list below in table 1 (the full list can be found in *Appendix 1*).

Table 1: Snapshot from the list of early-identified cases[4]

Cases	Country	Description/link
Emissions-zero	Belgium	https://www.emissions-zero.coop/ *Citizen's cooperative investing in the production of renewable energy in Wallonia and Brussels.*
UrStrom	Germany	https://www.urstrom.de/gas-argumente/ *As an association of more than 15,000 citizens, the Bürgerwerke are committed to the decentralized expansion of renewable energies.*
Our power	Austria	https://www.ourpower.coop/page/strom-kaufen *This cooperative operates the online marketplace ourpower.coop, building connections around the topic of electricity.*
Suno	Spain	https://suno.cat/en/projects/ *Suno is an energy services engineering company specializing in renewable energy.*
Minoan Energy	Greece	https://minoanenergy.com/ *The Energy Community is an institutional tool that allows local communities to claim their share of economic and social development through their participation in energy production and energy rational projects.*

[4] The descriptions are in most direct quotes from the cases' websites and/or interviews.

2.1.1 Interviews

Following a thorough evaluation of the initial pool of cases, assessing criteria such as energy used or relevance to the BECoop's ambition, the 70 cases were narrowed down, leading to a shortlist of 20 cases selected for interviews and they are presented below in *Table 3*.

Table 2: List of selected cases interviewed.

NAME	COUNTRY
1. Biogas association	Denmark
2. Coopérnico, REScoop	Portugal
3. Danish District Heating Association	Denmark
4. Ecopower	Belgium
5. Electra Energy	Greece
6. EW PRAD	Italy
7. Ispaster	Spain
8. Okina, Sabando, Araba	Spain
9. Sestao DH	Spain
10. Eurobios	Italy
11. Sharenergy COOP	England
12. Soria	Spain
13. Springbok Wood heat COOP	England
14. SEG Schluderns	Italy
15. Toblach FHW	Italy
16. Txantrea, Pamplona	Spain
17. UR BEROA , San Sebastian	Spain
18. ZEZ, Green Energy Cooperative	Croatia
19. Vineyards4heat	Spain
20. SEM Morbegno	Italy

Following the short overview from Table 2, the results of the interviews and desk research are summarised and further presented in the following subsections.

2.1.2 Key findings from interviews

1. BIOGAS ASSOCIATION, DENMARK

GENERAL ASPECTS: The association works for the entire biogas value chain, which includes everything from the recovery of manure and organic residues from agriculture, households and industry to the production and use of biogas and green manure. The membership includes biogas plants, suppliers of residual products, technology, service, trade, consultancy and financial solutions as well as purchasers of biogas and manure from the biogas plants.

Biogas Denmark has approximately 170 members, 70 of whom are biogas producers. Farmers in cooperatives, private people, individually own 50 plants and the rest of them are owned by companies. Around 75 companies are producing biogas plants, pumps, silos - some of them are energy companies, some of them are local cooperatives supplying manure for the biogas plants, some of them are financial institutes, with a smaller number are organisations interested in biogas. Biogas has been mostly used in electricity production since the late 80s and this increased until 2003 with little improvements in 2008, and further improvement of the feeding tariffs for electricity in 2012 (tax exemption for biogas used for heating). They got the final state approvals in 2013. Prior to this date, all the biogas production was used for electricity production.

TECHNOLOGIES USED: Biogas pumps. Different technologies depending on the member. In Denmark, they got combined plants (for heating and district electricity). Thermophilic anaerobic digestion is the most widely used technology in Denmark:

- With short retention times (<20 days) the thermophilic biogas yield from slowly degradable biomass like cattle manure is around 30% higher than from mesophilic.
- Thermophilic AD can be problematic with high ammonia content (>3 g NH4-N/L) in the biomass

CITIZEN PARTICIPATION: Farmers, cooperatives, companies and private people are members of the association and combined produce over 95% of the Danish biogas production.

FACILITATING FACTORS: A huge asset has been the country's push for green energy – they have designated a person to go around municipalities to inform them about opportunities in the RE field. Local subsidies have also helped the expansion of biogas production.

BARRIERS: The main barrier deals with the regulatory framework (energy policies) and economic investment.

ENVIRONMENTAL ASPECTS: Currently 20% of the natural gas consumption in DK is biogas, produced through using 20% of the national livestock manure. Thus, farm scale plants are likely to achieve 4.6 DKK/Nm3 reduced methane emission; and larger centralized plants are likely to achieve 6.1 DKK/Nm3 reduced methane emission.

SOCIAL AND ECONOMIC IMPACT: The development and managing of biogas plants impacts job creation and creates new opportunities within the waste and farming sectors.

KEY LESSONS:

- Proper technology design is key towards an efficient production, thus reducing CO_2 emissions.
- Food waste is a key resource for biogas
- By optimizing the technology, by-products of biogas production can be fed back into the market, for example, the digestate from biogas plants can be commercialised as a valuable fertilizer product.

2. COOPÉRNICO, RESCOOP |PORTUGAL

GENERAL ASPECTS: Coopérnico is a renewable energy cooperative, with a social goal to support of solidarity, educational or environmental protection related projects. Started in 2013 through a personal network, and now it has over 2000 members, with over 1.75M€ invested in projects of renewable energy and over 1500 supplier contracts. Coopérnico produces energy in a centralised way and is an energy supplier.

TECHNOLOGIES USED: They use Photovoltaic Panels only.

CITIZEN PARTICIPATION: Members joined their savings towards investments in RE projects and they can own whichever parts they might be interested in owning based on their own investments. The energy produced is integrated in the local grid. In the case of Coopernico, it was a group of friends who started the process of setting up a cooperative. The main motivation from citizens is to promote RE, to support more production of RE in Portugal, part of the movement and transition against the big utilities.

FACILITATING FACTORS: One of the assets is how fast they are able to gather funds for new projects. Before 2016 they didn't have enough money for new projects, but after that they were able to gather the amount of money required for new projects in a very short period (€40K in one week at first, then €40K in a couple of hours). Another asset deals with the economy aspects, for the members they get a 3% income - as the cooperatives are not for profit, they can offer competitive prices. Besides the economic benefits, the democratic management is also a key asset.

BARRIERS: There are no barriers to getting involved in the cooperative, but there are many barriers regarding developing the work the way they want due to regulations. The sector is built for big utilities, so new projects with different approaches struggle to fit with existing regulations, as the regulatory framework is very challenging. Other aspects worth mentioning are not necessarily barriers, but more challenges in the cooperative process; one of them is involving other people. However, media outlets have been successfully deployed to tackle this shortcoming.

ENVIRONMENTAL ASPECTS: 25 photovoltaic cooperatives – Almost 2000 Tons of CO_2 savings/Year

SOCIAL AND ECONOMIC IMPACT: They describe themselves as non-profit and they prioritize local partners when developing their projects. This creates local jobs and promotes the transition to a sustainable economy. However, it is hard to assess the overall impact. Besides the profit to the members (3% of the income), these projects are initiatives from the citizens to the citizens (no bank involved), they pay rent to the charity institutions to occupy their roofs (share the economic profit with them, where they get 10% of the revenue). In recent years, people have become more aware about opportunities.

KEY LESSONS:

- To involve more people, cooperatives need to use different touchpoints, word of mouth, press, google.
- Although it is a challenge to gather funds in the beginning, after being established, raising funds is fast and efficient.
- To tackle not being able to get loans from banks, an option is to loan money from other cooperatives at the start.

3. DANISH DISTRICT HEATING ASSOCIATION | DENMARK

GENERAL ASPECTS: Danish District Heating Association (DDHA) is an active and visible stakeholder in the Danish energy sector. DDHA has an overall objective of CO_2 neutrality in the district heating sector in 2030 by 100 pct. sustainable energy. This may contribute significantly to the Danish objective of 70 %. CO_2 reductions by 2030. Members supply heat to 2/3 of the country. 80% of the members are consumer owned cooperatives, the rest are municipally owned utilities. The distribution in size is that the small/medium size cities are consumer owned, while the larger cities have municipally owned utilities.

TECHNOLOGIES USED: Biomass primarily as an alternative to gas and coal. Solar and geothermal, very few. Biomass and wet waste are the primary sources (around 90%) for DH. Heat pumps are not enough and solar and wind are not enough to heat the country in cold winters so far.

CITIZEN PARTICIPATION: Members have to be willing to commit and take the responsibility when signing up for the job.

FACILITATING FACTORS: A key asset is that the association facilitates the process of engaging in DH by providing a template and consulting resources, providing knowledge and processes towards strategy, structure finance and infrastructure requirements.

BARRIERS: One of the barriers is to find people who are willing to dedicate their time for free when helping manage associations and cooperatives. Another aspect that might hinder the spread of RE are the many regulations that small COOPs need to comply with and even though they have some exemptions for smaller groups, there are still a lot of admin tasks. Furthermore, the technologies are becoming more complex with risks involved.

ENVIRONMENTAL ASPECTS: 60% of the heat in DK pipes is carbon neutral – but largely Denmark is out of fossil fuels and plan to be fully 100% free of fossil free (FF) in district heating in DK by 2030.

SOCIAL AND ECONOMIC IMPACT: Economic benefits, bringing value to before 'wasted' heat or fuel - while also lowering energy costs.

KEY LESSONS:

- For biomass, people need to be aware that their behaviour regarding waste (sorting different types of garbage, which may affect the amount and quality of biomass) affects the quality and amount of biomass and energy production, right now these pieces are disconnected.
- The legitimacy of waste sorting needs to be transparent and the recycling needs various outlets.
- Size, competence and capacity are key to a good process and outcome when dealing with RE due to the many stakeholders and technologies involved.
- A higher level of professionalism in the consumer owned small cooperatives can positively impact the success of the cooperative as a business driven setup can bring the engagement of different stakeholders and transform how the cooperatives are perceived thus facilitating further citizen engagement.

4. ECOPOWER | BELGIUM

GENERAL ASPECTS: Ecopower, together with its co-ops, invests in renewable energy. They make green heat for home in the form of wood pellets and wood briquettes. Delivered straight from their factory to people's home. Ecopower was founded in 1991 by green-minded people who were also part of the Green Party in Flanders. The first idea was to renovate the watermills in the area and perhaps produce electricity from them. Initially 30-40 people joined the cooperative and the first capital raised was 10,000 euros. One of the members in late 1990 saw the new energy directive from EU and started looking for people to reinforce the board of the cooperative.

TECHNOLOGIES USED: Wind turbines and biomass are the main technologies used for heating purposes

CITIZEN PARTICIPATION: The cooperative started as a hobby club and as something that the members were doing after work. Members had different roles. When in 1998 electricity from the wind got extra value and a new law in Belgium secured that one could get one extra franc on top of the initial tariff for every kW produced by wind or hydro, making wind energy profitable. At this time, Ecopower made an offer in a municipality that had two owned places and they wanted to develop wind energy. This was the basis of the cooperative. The municipality liked the cooperative's offer because they wanted to assure that the citizens would accept the wind turbines and they would not oppose to the project. This was more possible through the cooperative approach as everyone would be invited to put money in the project. Citizens themselves invest in the production of renewable electricity. Those who are cooperatives can also become customers and thus consume the green power of the shared installations.

FACILITATING FACTORS: A clear asset is that the cooperative has helped families switch to biomass instead of burning oil. Nowadays a large number of people choose to use biomass due to its environmental quality or because they do not have other sources of energies for hating in their area.

BARRIERS: A key barrier deals with the fact that the biomass/pellet is not profitable and the investment risk is very high compared to other energies. Also gathering initial funds can be challenging.

ENVIRONMENTAL ASPECTS: The cooperative is committed to reducing the environmental impact of fossil fuels through producing their own pellets according to their vision, securing that the resources are coming from a radius of 150 km mainly from Flanders, South of Holland and Wallonia. Ensuring that the sources follow sustainable guidelines.

SOCIAL AND ECONOMIC IMPACT: In order to build and operate the factory you need iron workshops to prepare the equipment, people to work in the factory and people to install the infrastructure to each home. Today there are 50 people working for Ecopower. Energy bills could be reduced to 0 euros. Currently 20% of the clients produce more than what they consume. Committed to a decentralised, democratic and sustainable energy model; profit flows back to the local community; all costs are included in the price per kWh, with the exception of the Energy Fund Contribution and the possum rate; follow the ICA principles.

KEY LESSONS:

- To make biomass profitable governments need to follow the same strategy with wind energy back in 1990's, for example paying an extra franc on top of the initial tariff for every kW produced by bioenergy.
- The best way to secure the expansion of biomass would be through small (5-100) houses district heating. In this case, a common heating infrastructure would be used by all houses and therefore the capital for investment would be significantly reduced.

5. ELECTRA ENERGY | GREECE

GENERAL ASPECTS: ELECTRA energy is a social enterprise working for the transition to a decentralized, efficient and sustainable energy system with citizens and local communities at its core. ELECTRA energy is a certified social cooperative (registered under L4430/2016), not an energy community. It was founded in 2016 and is based in Athens, Greece. The main purpose is to support energy communities and collective models of energy production and savings. They help in the creation of energy communities and deal primarily with advocacy activities, mainly with state authorities in order to modify and improve the legal framework. They also participate in scientific projects, mainly European and in some energy communities that they have helped developing, and individually, they are a member of an energy community. Overall, they do training, advocacy and research for the energy communities.

TECHNOLOGIES USED: Mainly in solar plants and virtual net metering,

CITIZEN PARTICIPATION: People are benefited by their participation in energy communities. By participating in an energy community, members make decisions with others in democratic ways; they learn how to co-decide with others. Everyone has one vote and everyone is equal. It is something like "schools of democracy" for them. They also promote social acceptance in these kinds of projects.

FACILITATING FACTORS: Among the assets, there is the economic motivation, and more specifically, the reduction of energy bills (power and heat) regarding the households. There is a lot of significant interest in energy communities and some communities have involved the regional authority, municipalities, citizens and businesses as their members.

BARRIERS: Regarding barriers, there are issues with the legal framework, the technical and management aspects and communication. However, the legal framework could potentially have a great effect on the projects' implementation and future.

ENVIRONMENTAL ASPECTS: The environmental impact is not measured per cooperative, but instead a combination of initiatives between the public and private sector.

SOCIAL AND ECONOMIC IMPACT: Local stakeholders run the energy communities and it is easier for the projects to be developed, rather than being developed by external companies. Bioenergy and biomass provide more jobs locally.

KEY LESSONS:

- Dedicated RE companies with expertise and local knowledge can be key facilitators in helping establish new cooperatives
- Local companies can be a support group towards both adhering and changing regulatory aspects.

6. EW PRAD | ITALY

GENERAL ASPECTS: Under the motto "Energy from home", the Energie-Werk-Prad Cooperative (EWP) is endeavouring to supply the municipality of Prad, which has a population of about 3400 and is located in the Stelvio National Park, with renewable energy produced as independently as possible, with the best possible efficiency and at reasonable prices.

The electricity is mainly generated by 4 hydropower plants and 4 combined heat and power modules. The electricity is supplied to customers and members via a 120 km long POWER line network MS/NS.

From 2 district heating centres, the heat is supplied to the buildings via a district heating network of approx. 28 km. It started in 1923 when a committee decided to build a hydroelectric power station. In 1926 the Constitution of the cooperative with 45 members was established, the cooperative was founded officially on 21st June 1927 by a private initiative.

Today the cooperative has more than 1,400 members, > 80 % of households and businesses in the municipality.

TECHNOLOGIES USED: Hydropower: approx. 4,000.00, kW electric PV system: approx. 103.00 kW electric. FW centrals: approx. 1,600 kW electric, approx. 7,400 kW thermally.

The cooperative operates several hydropower plants, is a DSO, supplies district heating from biomass and biogas, owns photovoltaics, and through the infrastructure they are able to connect every household with FTTH (multi utility cooperative).

CITIZEN PARTICIPATION: The EWP Cooperative is organized and regulated according to the principles of cooperative promotion without the purpose of private speculation, and its purpose is to supply members with environmentally friendly energy at the most favourable conditions possible, as well as to serve members in all matters relating to energy supply and other technical utility services. The cooperative may also conduct business with non-members, but there is a prevalence of 70% with members.

FACILITATING FACTORS: A main asset deals with economic gains, as members save money through discounted tariffs and the local investments benefit all citizens.

BARRIERS: Due to its history, low or no barriers to establish a cooperative in this location, however for any related initiative, there are always initial risks. However, the main challenge for new projects is the regulatory framework and the lack of funding.

ENVIRONMENTAL ASPECTS: They are saving more than 5.000 t of CO_2 through our district heating plant every year, and they produce through our hydropower plants about 20.846MWh of renewable electricity.

SOCIAL AND ECONOMIC IMPACT: The population is more aware of energy issues and is increasingly using renewable energies in their private lives e.g. Photovoltaic. Several companies dealing with renewable energies have established themselves in the municipality e.g. solar energy manufacturer, thus creating jobs in a rural area. Furthermore, they keep developing new services and promoting renewable energy communities.

KEY LESSONS:

- Technical challenges can always be overcome, while legislations take longer to adapt.
- Well-established cooperatives can help define process blueprints to help the development of new cooperatives.
- A cooperative heritage influences personal engagement, which is key towards the establishment and further development of cooperatives.

7. ISPASTER | SPAIN

GENERAL ASPECTS: Rural village with biomass DH. There is an ESCO with a cooperative legal figure employing 4 partners and 10 small energy services companies. The cooperative is supported by both public and private funds. It has DH 60-70% subsided. Heating and sanitary hot water distribution network (ACS) that works with forest biomass waste and supplies different consumption points of the village. The cooperative also provides components for electric (PV) panels and heat production (Biomass boilers + solar thermal), the storage equipment and the various monitoring tools employed. The facility consists of a biomass boiler that will burn splinters (the boiler has 90 kilowatts) and a network of pipes.

TECHNOLOGIES USED: The DH is fed by 2 * 220kW woodchip boilers + solar thermal installation for increasing the return of the circuit. They also have PV panels for electric self-consumption networks. "the timber stocks of the Basque forests currently exceed 62.6 million m^3, more than double the stocks of 40 years ago, and that the Basque Country is therefore the autonomous community with the highest density of timber stocks, with an average of more than 160 m^3 per hectare" (energias-renovables.com).

CITIZEN PARTICIPATION: Through meetings and cooperative talks, all projects implemented in the municipality need plenary acceptance, as they are long-term projects so the stability during more than 4 years (legislature) is necessary.

FACILITATING FACTORS: The main assets deal with lowering the energy costs and sustainability, self-management and creation of stable and quality local employment.

BARRIERS: A big barrier deals with perceptions concerning mistrust and negative perception of the environmental impact of biomass by not considering the whole life cycle of the technology. Another barrier deals with a top-down project development instead of following a bottom-up approach. Another barrier is weather related as to improve the combustion efficiency, the humidity levels need to be around 12-15%. Currently, it is very difficult in Bizkaia/Gipuzkoa (high humidity areas) to reduce the percentage of humidity from 30% in a natural way.

The other identified barriers are of economic character, in Bizkaia and Gipuzkoa's forest management is mostly privatised. Another barrier is the high initial investment required to setup the project.

ENVIRONMENTAL ASPECTS: The main impact deals with GHG and primary energy savings besides a larger percentage of renewables.

SOCIAL AND ECONOMIC IMPACT: Barrizar sells 10 cents kWh thermal to the municipality, and then the municipality sells the energy to the neighbouring cities The cooperative has created local jobs and a tighter community.

Furthermore, they keep developing new services and promoting renewable energy communities.

KEY LESSONS:

- To help the expansion of RE installation, subsidies can be a clear incentive and sign of support. The regulatory framework needs changing to better support the growth and further development of REscoops.

8. OKINA AND SABANDO, ARABA | SPAIN

GENERAL ASPECTS: Biomass plant providing heating and hot water. Two municipal heat networks. For disposal of to the wood generated from the cleaning of the forests of the municipality, it was decided to build a biomass plant that would provide heating and hot water to the 20 buildings of the town. About 22-24 people are currently connected to the heat network.

TECHNOLOGIES USED: Chips are produced and heat is traded. 2 boilers 200kW // 300 ton of wet wood (green) per year of consumption. Accumulator 5000 l and the outlet temperature is 80ºC

CITIZEN PARTICIPATION: The local administrative boards are composed of all residents of the village (40).

FACILITATING FACTORS: The most direct asset in having the cooperative is the exploitation of forest natural resources with an economic return (reducing heat bill) and with no need of extra physical effort. Another asset is partial generation of jobs.

BARRIERS: The main barrier deals with processing of documents to carry out the work and once the work is done the knowledge about the system in order not to rely too much in external maintenance services. Another barrier is the uncertainty about whether the new systems will work well or not (guarantee of supply).

ENVIRONMENTAL ASPECTS: The management of the wood available to the people (lots) keeps the forest in better condition (better pastures, less risk of fire, etc.). GHG savings.

SOCIAL AND ECONOMIC IMPACT: Reactivation of the rural environment; Generation of local employment; Reduction of carbon dioxide emission; Work is promoted for local companies (biomass management (cutting and generation of woodchips), installation maintenance, civil works, boilers, pipes, distribution pumps, heat exchangers, etc.). There are two volunteers who help with the installation (one is in charge of keeping the silo full of woodchips with the tractor and the other is in charge of regulating the different variables of the installation by mobile phone (timetables, temperatures, flow rate, etc.). Both are exempt of paying annual CAPEX. They have gone from having the same volunteers to having new people join them, both for network issues and for other village activities. Savings in fuel bills of around 50%. Example single-family house before the installation 2500 € of diesel expenditure now 1000 € + 300 € (without considering first investment need to be done for net connection).

KEY LESSONS:

- Conservation and improvement of forest heritage, since the management of the forest for its use as a raw material will allow the forests to be kept clean, avoiding fire hazards.
- Generate economic activities in the rural environment.
- Improvement of air quality.
- Bureaucracy to register the installation is one of the main challenges faced.
- Separate the heat commercialisation activities from the rest of the general services offered by the council (water, electricity, telephone) under a different IAE (Economic Activities Tax) heading in order to manage the VAT independently, with associated benefits involving renewable activities.
- Advice on the subject of available subsidies.
- The fact of making wood chips with wet wood means that less sawdust (30mm) is generated in the process and therefore better use is made of it. In addition, it dries out (30-25% humidity) before storage.
- Design of the silo hall is more ergonomic or accessible for the tractor.
- Importance of having public woodland available to the municipality.

9. SESTAO | SPAIN

GENERAL ASPECTS: 231 connected homes - public non-profit partnership. The town hall owns 50% and the Basque Government the other 50%. The Cooperative was initially conceived based on the idea to renew the city block, refurbish buildings, and install individual biomass heaters in the process. However, it was more effective to create a DH instead.

TECHNOLOGIES USED: 2 biomass boilers. (500 kW and 250 kW) and 650 kW GN as backup. 3 boilers: first (biomass, 500kW), second one: biomass 250kW + 3rd: 650kW (gas - auxiliary).

CITIZEN PARTICIPATION: Door-to-door approach is valuable and creates more awareness and engagement of locals through informed and committed sources.

FACILITATING FACTORS: The main assets deal with cost savings and greater environmental awareness. Another asset deals with economical gain as DH is cheaper than an individual gas solution; thus outweighing individual boilers.

BARRIERS: An acknowledged barrier deals with behaviour change as when locals are first introduced to the DH ideas. Another barrier deals with the number of residences that the DH can connect due to established ground infrastructure.

ENVIRONMENTAL ASPECTS: The biomass origin is within 20km radius the energy produced. The municipality has signed Climate and Sustainable Energy Action Plan (SECAP) with a carbon neutral objective. Sestao berri aims to generate more energy than consumed (Net positive).

SOCIAL AND ECONOMIC IMPACT: The DH has brought savings for the community and created a few local jobs.

KEY LESSONS:

- P2P can be a key resource towards engaging locals
- Engaging in a new RE venture might require a behavioural change; local perceptions need to be addressed earlier on.

10. EUROBIOS | ITALY

GENERAL ASPECTS: The cooperative Eurobios has started in 2010 and today about 10 people are working including employees (4 of them increase during the summer period) and members.

TECHNOLOGIES USED: Anaerobic fermentation, looking into future opportunities using PV.

CITIZEN PARTICIPATION: The cooperative is small and privately funded, but members have gained value in what they produce.

FACILITATING FACTORS: Use of fewer synthetic fertilizers thanks to the use of solid and liquid slurry, therefore an improvement of the environmental impact

BARRIERS: A key barrier is finding consensus among members besides dealing with administrative and financial hurdles.

ENVIRONMENTAL ASPECTS: Use of fewer synthetic fertilizers thanks to the use of solid and liquid slurry, therefore an improvement of the environmental impact

SOCIAL AND ECONOMIC IMPACT: Economic gains and creation of local jobs.

KEY LESSONS:

- The cooperative increased local cooperation
- Administrative tasks can take a lot of time

11. SHARENERGY COOP | ENGLAND

GENERAL ASPECTS: Woolhope Woodheat (Sharenergy Coop) started 2014 and they have 100+ members. There is one boiler serving 40 people in 20 households in one location, it runs off locally sourced woodchip. Funds were initially raised by a local community share offer. The flats are two main buildings, each of several floors. All the flats owners are connected to the heat network provided (by this BECoop) and connected to the common wood chip biomass boiler. The decision to create the RESCoop (in 2011) was stimulated from high burning oil prices. The use of biomass was an option to switch from fossil fuels to renewable fuels. To encourage the flat owners to use the heat from biomass, the tariff for heat consumption was connected to the oil price – the price of heat from biomass was set 20% lower than the heat price from oil. Unfortunately, oil prices dropped down significantly just after the project was installed – this was good for the flat owners (final heat consumers) but it was not good for the RESCoop Members (who financed the project) as the return of the investment has been zero (although members are likely to see all their capital returned and many benefited from tax reliefs).

TECHNOLOGIES USED: Biomass heat through combustion. 200 kW. It is a Herz boiler with a screw feeder. The heating unit is fully automatic. There are 2 heat cycles (boiler building) connected by a heat exchanger. It does not require 24 hours service/control. If there is no urgent situation, the inspection is organized once a week.

CITIZEN PARTICIPATION: The flat owners are not the members of this RESCoop; they only pay for the heat produced/provided by the RESCoop. The members of the RESCoop (who created and financed the project) are private small investors who supported this project primarily for environmental reasons.

FACILITATING FACTORS: The main assets of the cooperative deal with combating climate change, creating socially just businesses, enabling citizen participation in energy, creating local environmental benefits and creating green jobs and investment opportunities. Their scheme delivers very good carbon reductions against previous oil/coal heating.

BARRIERS: The main barriers can be listed as financial viability in a fast-changing policy environment, access to development funds and support, lack of precedents for district heat models, customer comprehension of model to be used, organizing volunteers to act together and raising funds. Bioenergy is very hard to scale as the fuel is under the control of very few people. We see bioenergy largely as a stepping-stone to electrification – in most cases bioenergy does not provide a long-term solution to our urgent need to decarbonize, but it can be implemented as a better alternative to fossil fuels while lower carbon solutions are found.

ENVIRONMENTAL ASPECTS: A key asset has been reducing carbon emissions in heating production. GHG savings are hard to calculate but clearly large in comparison to fossil fuels used previously (in UK oil is a basic fuel for such calculations). They are also supporting local woodland management with biodiversity benefits.

SOCIAL AND ECONOMIC IMPACT: The heat price was established 20% lower than the heat price from oil. Their heat price was pegged to the oil price, which turned out to be a mistake – oil price dropped and so did our income. Flat owners make profits (pay less) but they are not RESCoop Members (who invested money). On the other hand, they might not have convinced them to sign up without this assurance – both biomass heating and co-ops were new ideas.

KEY LESSONS:

- Avoid fixing prices according to another energy resource as this might impact overall economic gain.
- Implementation processes are slow and might not necessarily initially profitable, however it sets the baseline towards sustainable energy approaches and long-term economic gains
- Engaging in a new RE venture might require a change of perception and behaviour; therefore, such aspects need to be addressed earlier on.

12. SORIA | SPAIN

GENERAL ASPECTS: In Soria, they have the private cooperative model, offering an energy supply from biomass in the form of wood chips, making an offer to end customers who might want to join the network. The network consists of two parts, the production plant (and the different residual energies that they incorporate into the network from recovery) and the part of distribution and connection to the end customer. The grid is established as a link between the consumer and the production plant. They currently have 180 supply points (public and private buildings such as neighbourhood communities) in Soria and a power plant with 24 MW of installed power. The energy is primarily used for residential heating and domestic hot water, sports facilities (swimming pools, etc.).

TECHNOLOGIES USED: There are 3 biomass combustion boilers of 7 MW of woodchips and one of 3 MW of fine woodchips or pellets. With a total capacity of 24MW. Technologies are also used towards communication services. Currently they have a fibre optic system that monitors the exchange and the exchange centres, it communicates online without interruption. On the customer side, they have an incident management service for communications of any kind between customers and the company. This includes billing issues, technical complaints, service problems, legal issues, if they are missing a document or have been required to undergo an inspection. There is an open communication channel with a call-centre.

CITIZEN PARTICIPATION: As a private initiative, the citizens engage with RE as customers of the service.

FACILITATING FACTORS: The main asset involves economic and environmental gains. There is no initial cost for establishing the connection; furthermore, the preventive and legal technical maintenance of the installations is included in the price.

BARRIERS: The hybridisation of gas and biomass - the main barrier deals with culture and perception. There is a deep-rooted culture around fossil fuels, and there is a lack of confidence in robustness or supply from RE sources. Few are willing to take the risk of switching to something new - society perceives renewable energies as something very avant-garde, even if it is a consolidated technology.

ENVIRONMENTAL ASPECTS: Reduction of CO_2 emissions (The city of Soria is one of the least polluted in Spain). Around 16,000 tonnes CO_2/year. Emissions from the plant are closely controlled by regular monitoring bodies to ensure that it complies with European regulations

SOCIAL AND ECONOMIC IMPACT: Local employment has also been created, at both the technical level and field staff, who operate the plants or carry out maintenance. Civil works also contribute to temporary jobs and to the development of the city. The biomass supply part provides employment in rural areas that otherwise would not be able to have the same opportunity. Besides this, customers have experienced a drop in the price of heating supply.

KEY LESSONS:

- Communicating the value of RE needs to be developed to reach and engage wider public.
- Communication technologies can play a strong role in facilitating the administrative tasks and recurring service support.
- Further data on environmental impact and how RE are consolidated technologies need to be disseminated.

13. SPRINGBOK WOOD HEAT COOP | ENGLAND

GENERAL ASPECTS: Springbok sustainable wood heat co-operative has operated a wood chip fuelled district heating system on the springbok estate near Ilfold, surrey since June 2015. The Co-operative started with 122 members, many drawn from the local community. In accordance with co-operative principles, they were offered a fair return for their investment of 5-6% which is reflective of the level of risk involved in this pioneering project. However, many members were motivated to invest by the pioneering nature of the project and its potential contribution to improve the local ecology and environment. There are currently 7 unpaid volunteer directors. All are members of the Co-op as only members are eligible to become directors. All are actively involved in the management of the Co-operative on accounting, finance, energy efficiency, billing, day-to-day operations and maintenance and purchase and procurement of wood chip. Prior to installing the district heating system, the Co-operative commissioned and paid for a full energy audit of the main buildings to identify any potential energy management and reduction work and has paid for £15,000 of energy efficiency and demand management work. They have around 120 members. Energy4All from its offices in Barrow in Furness provides the administration and billing services.

TECHNOLOGIES USED: There are two 199kW Herz boilers which burn woodchip in a centrally located purpose built boiler house. Also in the boiler house are two back-up oil boilers that are used when the woodchip boilers are being serviced or if there is a problem with the woodchip boilers. The other two main occupants of the boiler house are the two 5,000 litre buffer tanks to produce heat and hot water supply to residents of Care Ashore.

CITIZEN PARTICIPATION: There is a network of green-minded friends. They have some people who might have invested because they know each other, while there are a number of members who have invested because they were involved with the local solar schools cooperatives and others who have invested because they learned about Springbok through Energy4All. They always try to prioritize local membership.

FACILITATING FACTORS: The main asset of the cooperative is its impact on climate change and carbon reduction, which is an attractive aspect for the members. Another main asset is to work closely with a small, family owned local forestry company that it employs to harvest wood and a now to do its chipping.

BARRIERS: There are many barriers for projects like this, however in the specific case there were not a lot of barriers.

ENVIRONMENTAL ASPECTS: The system replaced the burning of oil with a locally produced wood chip. The estimated CO_2 average saving is 215 tonnes per annum, using the BEIS factor. Furthermore, the air-quality was improved as recorded. They are satisfied with Herz boilers as they have excellent filters. However, there is a campaign against wood burning (newspapers etc.).

Another impact as mentioned before is that creating a market for very low quality wood including 'brash' (the tops of deciduous trees) from the neighbouring woods has resulted in a dramatic improvement to the ecology of local woodland. For instance, an adjacent 40-acre woodland from which most of the wood chip supply is currently being drawn has seen the butterfly population rise from 1 species in 2016 to about 16 different species in 2020.

SOCIAL AND ECONOMIC IMPACT: Financial return and profit is not the primary objective and the Co-operative adheres to co-operative principles. Therefore, as the project matures it is expected to generate a financial surplus that will be returned to Care Ashore as either a distribution or a reduction on the price of heat. This will be made possible in part by the Co-operative switching to producing its own wood chip from local woodlands, which is expected to reduce the price of the fuel supply by 33%-50% on the price currently being charged by the commercial supplier. 5-6% return of their investment for the members of the cooperative. The capital will be repaid to members during the lifetime of the co-op. The idea is that the capital will be repaid to members during the lifetime of the co-op.

They are managing the woodland primarily for butterfly habitat and working closely with the national charity Butterfly Conservation on its 3-year Wood White Butterfly project.

As the capital is repaid, interest falls. When they get to this position, which was slightly held up because they had to finance the barn.

Once we have to the situation where they are able to pay the 5.5%, the surplus will be returned to the charity. Either as a reduction in heat price unit or as long time payment.

The Co-operative works closely with a small, family owned local forestry company that it employs to harvest wood and now to do its chipping. In the last 5 years, the Co-operative has paid this company just over £50,000 (inclusive of VAT) for its services. They have helped them to get in the chipping market locally and helped them to upgrade their chipper.

KEY LESSONS:

- Initial technical advice is key towards a successful outcome.
- Key financial advice at the beginning can provide a grounding establishment of the cooperative.

14. SEG SCHLUDERNS | ITALY

GENERAL ASPECTS: SEG was founded in 2000 and now has 800 members. They operate in three different locations: Schluderns, Glurns, Taufers and the members are split in thirds between these 3 locations. It provides a sustainable, environmentally and climate-friendly energy in the Comrade area.

TECHNOLOGIES USED: Schluderns: 1 Central-heating Boiler: 3,2 MW – 3.250 kWh heat, 1 Central-heating Boiler: 3.450 kWh heat and ORC with 450 kWh, 2 Biogas engine – two times 60 kWh electricity + two times 400 kWh heat, 1 Photovoltaic with 77 kW

CITIZEN PARTICIPATION: A concern for the environment tends to be a motivation for local engagement. People are not hesitant to adhere to a cooperative as long as the products they buy are within an acceptable price range

FACILITATING FACTORS: A key asset is being energy independent.

BARRIERS: Bureaucracy or incentives can be a barrier, as technology needs to be updated (i.e. pipes, boilers). Another hindering aspect might deal with the biomass sourcing in the early stages of the installation.

ENVIRONMENTAL ASPECTS: The biomass is locally sourced and they are saving around 9.000 tonnes of CO_2-Equivalent each year through their biomass district heating plants and electricity production.

SOCIAL AND ECONOMIC IMPACT: Ecological and financial benefits for local citizens. Value creation and job creation in the region. Commitment to the expansion of renewable energies. They are independent from external energy supplies and they can provide affordable energy. They also now have a 3% in a hydropower plant „Rambachwerk“ together with two other municipalities (municipality Glurns & Taufers) - they are planning to build a big hydropower plant with the municipality of Schluderns and another energy cooperative “VEK”.

KEY LESSONS:

- Environmental concern can serve a hook towards engaging in RE
- Seeking energy self-sufficiency can impact how locals positively perceive their area.

15. TOBLACH FHW | ITALY

GENERAL ASPECTS: Toblach–Innichen district heating plant illustrates the process from biomass to electricity generation. Everything started in 1994 with the foundation of the "Fernheizwerk Toblach Genossenschaft", 1995 the project started with 220 tentative agreements.

Opened on 25 June 2005, the show is the first of its kind in Europe. Come and learn more about the forest as energy storage, wood chips, combustion, the ORC module, the filter technology, district heating and the historical development of the heating plant. 948 Members, 1700 Customers, 49375 m Network length, 20000 kW total boiler power.

TECHNOLOGIES USED: The combustion is controlled fully automatically by a control system in order to achieve the highest possible combustion efficiency. Thanks to the combination of e-filters and flue gas condensation, exhaust emissions are reduced to a minimum (950°C is the ideal combustion temperature for wood chips in the biomass boiler).

In the combustion boiler, the combustion of biomass produces heat that heats thermal oil. This drives turbines; the generator converts the power into electrical energy. The waste heat is used for the district heating supply of the two municipalities. The heat is transferred to the existing heating system by means of a heat transfer station and distributed as usual in the household. The control system enables a fully automatic control of the desired temperature.

CITIZEN PARTICIPATION: They have an educational trail to teach, primarily children, about the use of wood waste and residues.

FACILITATING FACTORS: A clear asset deals with the peripheral location where there was a need for an independent district heating plant. The location in the natural landscapes brings a clear connection to the woods and to the sustainable usage of natural resources. Another clear asset is the fact that money will be reinvested locally, towards a new boiler – total costs about 5.000.000€. Members also save money in their energy bills.

BARRIERS: No barriers were identified/reported

ENVIRONMENTAL ASPECTS: 142.370.000 kg CO_2 saved by the use of biomass since 1994 - The flue gases are dedusted with multicyclones, electrostatic precipitators and flue gas condensers. The emissions from the combustion are continuously monitored.

SOCIAL AND ECONOMIC IMPACT: The economic benefit is that their members are saving money,- they have one of the lowest energy prices for district heating in south Tyrol (0,092€/kWh). 46,060,000 Euro is the total saving of the citizens of Toblach and Innichen in comparison to heating with oil since 1995.

As a social perspective (of economic impact) is the creation of direct and indirect jobs.

KEY LESSONS:

- Using the state the art technology to keep the most effective service
- Reinvesting profits towards service and local community.

16. TXANTREA, PAMPLONA | SPAIN

GENERAL ASPECTS: The cooperatives emerged from an EU funded initiative. It is a district heating service composed of several cooperatives, local administration and a social housing company. Within this project, there was a final part that all these communities could be supplied with heat from a plant whose primary energy source was biomass - woodchips. The process included finding the land, reaching agreements with municipalities, balancing the economic part, the management (concession), tendering, etc. They have collaborated with companies that helped them put together the legal aspects of the tender and concession; and on the techno-economic side, they worked with companies that developed the feasibility study that was going to be put out to tender and the preliminary project on which the concession was going to be based. An underground network from the power plant to households transports the heat. It supplies 8 public buildings and 2,000 homes and in phase II, it can reach up to 4,000 homes.

TECHNOLOGIES USED: A 4.5 MW boiler (a second boiler of the same capacity will be added in phase II) and a back-up gas boiler to accompany seasonal peaks or shutdowns (maintenance, breakdowns, cleaning, etc.). The concessionary company is installing an exchanger in place of the communities' old gas boiler.

CITIZEN PARTICIPATION: All the residents of Txantrea have communal boilers. The first advantage is visual, the exchangers are installed in the boiler room, and they do not have to burn gas in the vicinity of their houses, eliminating fumes, noise, vibrations.

FACILITATING FACTORS: A clear asset deals with local opportunities, generating both new economies and new jobs. In addition, local residents do not have to worry about buying a new boiler, breakages, preventive or corrective maintenance. That is a saving as the service covers for that. Another asset is EU projects that can support these initiatives as it creates a more feasible ground towards its development and implementation.

BARRIERS: A clear initial barrier is finding a driving force that is capable of launching this type of project. It takes time and many aspects need to be considered for the project to be carried out efficiently.

ENVIRONMENTAL ASPECTS: Savings of around 7600-ton CO_2 equivalent in the 2 phases (88% reduction in these emissions). Reduction of noise, vibrations and emissions associated with gas flaring. There is a psycho-geriatric centre near the plant, so it must have very efficient sound and vibration insulation, as the noise conditioning factors for this area are very restrictive. Smoke will also be very controlled.

SOCIAL AND ECONOMIC IMPACT: They generate wealth, obliging the company to create a subsidiary in Pamplona, generating jobs (maintenance and operation of the plant, as well as all the construction of the project, management of the biomass, the value chain, logistics, etc.). ENGIE has set up a company with tax headquarters in Navarra, 100% owned by ENGIE (District calor renovable de Pamplona SL), generating local employment and paying taxes that remain in Navarra. The initial share capital is 1M€. The price of heating will be equal to or lower than the price of gas.

KEY LESSONS:

- Collaboration between private and public sectors is fundamental for the success of RE initiatives.
- European initiatives can help jumpstart and help securely develop RE initiatives

17. UR BEROA, SAN SEBASTIAN | SPAIN

GENERAL ASPECTS: Ur Beroa is a cooperative that owns and runs a District Heating network to which 550 homes are connected. They are all co-owners of the installation and consumers of heat and DHW. The declared objective of Ur Beroa is to decarbonize their power station within the next 10 to 15 years. The DH network was constructed at the same time as the housing development, over 40 years ago, with the aim of achieving energy independence for the 500+ families of the neighbourhood, but without considering the commercial aspect of it. The system went bankrupt and after a viability study, the cooperative was founded in order to bring the service back to life. The original oil-fired thermal power plant was replaced with a gas-powered CHP (1MWel power) plant in 2009 to increase efficiency. It was partially subsidised (by an EU project). Premium feed-in tariffs are still offered to promote these efficiency measures and help with the down payment of the investment. In 2014, a 600kWth biomass boiler (cost 250k€, partially subsidised by EVE, the Basque Energy Agency) and solar thermal panels (300kWth, financed through the H2020 THERMOSS project) were installed. During 2020, the heating network, which had many thermal losses, was completely replaced. An investment of 2,8M€ (original budget: 2M€). As all buildings were built more or less at the same time, there are only 4 different types of houses. Therefore, the "normal" energy requirements of each type are well known. Since the improvements in the network, consumers pay a fixed monthly access fee (43€/month) and then a metered consumption price of 0,080€/kWth for heating, and 8,30€/m3 for year-round DHW.

TECHNOLOGIES USED: The network consists of a primary ring that distributes the heat to 7 substations. From there two secondary circuits for heating (57ºC) and for DHW (60ºC) lead to each flat. Most apartments have wall radiators; some have installed underfloor heating.
Combustion: There are + 3 natural gas boilers with a 7700 kW total capacity mainly gas-fired CHP (1MWel). In addition, combustion in a condensation biomass boiler is available, but it is not used currently.

CITIZEN PARTICIPATION: There is a real sense of community in the neighbourhood. The role of the association in all this is very important: it develops social cohesion and activity in the neighbourhood - Ur Beroa is an additional element that brings people together. The role of the cooperative model and its collective decision-making process is crucial in this: you have to reach a consensus and therefore you need to be transparent. Perhaps only 20% of the cooperative members are actively involved and concerned with the discussion process and the decisions made. About 10% are quite critical. The others keep silent as long as all goes well.

FACILITATING FACTORS: The main asset is access to heat without the hassle. As the service is all-in, there is no need to contract periodic maintenance or inspection, nor replace any individual installations.

BARRIERS: A key barrier might deal with personal perspectives, as some might prefer a private installation. Currently, with the biomass boiler installed, the pellet price is a bit more expensive than Natural Gas per thermal kWh, this affects people's perception.

ENVIRONMENTAL ASPECTS: There is a rising awareness in the community toward environmental protection, sustainability and energy efficiency. Recently the 10-15 year decarbonisation goal has been put forward. There is a working group studying the possibility of biomass-fired CHP. There are also intentions to install PV panels and promote self-consumption, as well as develop other neighbourhood services such as fibre-to-the-home internet and mobility. At the 2020 AGM, a motion was put forward and accepted to report GHG emissions from the 2021 AGM onward. Reduction of CO_2 emissions, which in the case of UR BEROA would be 1,214 tons of CO_2/year.

SOCIAL AND ECONOMIC IMPACT: A private initiative sustained by all members with some support from EU (about 450k€ spread over the past 10 years from EVE, and from EU funded projects -THERMOSS). The plan has created jobs; they have 2 full-time employees and one student in practice. In addition, GIROA, the energy services company, has 2 technicians permanently assigned to maintenance and problem solving, plus an additional 15 technicians who attend regularly (but not exclusively) to the installation.

KEY LESSONS:

- Price of energy can be a key aspect to motivate or demotivate citizens.

18. ZEZ, GREEN ENERGY COOPERATIVE | CROATIA

GENERAL ASPECTS: ZEZ is an umbrella organization that fosters development of energy cooperatives in Croatia and the region through providing various support from the idea to execution stage. ZEZ is an active member of Rescoop.eu, the European federation of energy cooperatives and Terra Hub, a spin-off association from UNDP Croatia. ZEZ is one of the co-founders and co-founder of the energy sector at the Cooperative for Ethical Financing (ZEF). In addition, as members of the Energy Community, they coordinate the work of a technical group to engage citizens in the development of renewable energy sources.

TECHNOLOGIES USED: They serve as an umbrella organisation, so the cooperative itself does not produce anything, however they use solar energy (photovoltaic) and biomass and support projects that focus on RE.

CITIZEN PARTICIPATION: ZEZ is a cooperative, a group of 20 members, only individuals not companies. All these people have knowledge and experience on energy, economy, environment and alternative finance. They are different people sharing the same idea and motivation and, as members of the cooperative, they focus on the positive impact on the environment and communities to make sure that citizens participate in planning, deciding, building and producing energy and participating in the division of profits.

FACILITATING FACTORS: Among the assets, encouraging the development of social entrepreneurship in the energy sector, there are always mentors who support you in the process of learning about RE. Another key asset of cooperatives is that they are an innovative type of company, bringing the coolness factor in the energy sector, which can be more attractive to young generations, who might be concerned about environmental impact.

BARRIERS: The main barrier is that there are no funds, thus you have to work mostly on a voluntary base. Additionally, you will have to work overtime and sometimes on the weekends. You need to have some passion to do so. That is the reason why this may not be appealing to some people. Another barrier deals with legislation, energy production is currently only for households and self-consumption.

ENVIRONMENTAL ASPECTS: Helping citizens' uptake of RE sources instead of fossil fuels.

SOCIAL AND ECONOMIC IMPACT: Providing services for cooperatives generates jobs. Help citizens to participate in planning, decision-making and investments in locally available energy sources; Services for low-income households; Exploring the use of Blockchain and crowdfunding in the energy sector.

KEY LESSONS:

- Biggest challenge deals with the legal framework.
- High price of equipment affects the number of households able to install photovoltaic panels.
- Lack of subsidies to support RE.

19. VINEYARDS4HEAT | SPAIN

GENERAL ASPECTS: Thermal energy production from vineyard pruning for winery and district heating. Driven by the municipality of Vilafranca del Penedés (not actually a REScoop). They produce heating and cooling for wineries and DH in public buildings.

TECHNOLOGIES USED: The boiler has been made specifically to burn this type of product without problems. It is a 500 kW boiler. They were looking for the best available techniques at the beginning of the project but they have been improving: the boiler worked well but the problem was how the chips reached the boiler. If it was not cut properly, there were problems with blockages. The humidity is not so important, it only affects the ashes and burns worse, but as far as I know it is not the problem because the biomass dries out quite quickly as it is shredded, it is not the main problem.

CITIZEN PARTICIPATION: People demand these initiatives, in the framework of the green economy and jobs, people need it and they go for it. They are also tired of not having a say in energy concerning aspects.

FACILITATING FACTORS: A big asset for the cooperative deals with the cooperatives sourcing the biomass, they are very interested in lowering the carbon footprint, this way they are going to sell ecological and healthier products, which helps the brand and the consumers from the area.

Another asset deals with burning the biomass in a boiler instead of in the middle of the field.

BARRIERS: A key barrier deals with regulations, laws, how they are applied, and the pressure from the lobbyists, which might delay projects and affect the wider project reach. Small obstacles can delay the processes, such as difficulties in feeding energy into the grid from PV panels. These obstacles also impact the policies' adaptation. Besides, the private sector needs to be willing to collaborate to make the process more effective.

ENVIRONMENTAL ASPECTS: Significant savings in CO_2 emissions because these 400-500 ha are not burned directly in the field, so the margins are also burned, which is where the biodiversity is, and which is lost in these burnings. We installed some probes to see the pollution of the boiler in the surrounding area (a city of 40000 inhabitants) burning for five facilities and a social and health centre about 400 tons per year, which generates smoke. With the probes, they saw that there were no emission problems. Sometimes the smoke is whiter or darker due to the humidity of the biomass. Furthermore, they are using biomass from vines and currently carrying out tests on pruning waste so as not to waste anything. They intend to take advantage of all the potential that the area has to offer, because in addition to vines there are many fruit and olive trees. They also want to add the washing of the biomass to improve its qualities to study if that can be used as fertiliser, mixed with the waste from the organic part and with the compost.

SOCIAL AND ECONOMIC IMPACT: Farmers in particular experience savings in biomass management; wine cooperatives receive cheap heating and the municipality as well. They have tripled the amount of biomass collected.

KEY LESSONS:

- Machinery capability needs to be combined with how the biomass is pruned for higher effectiveness.
- Bureaucratic hurdles have an impact on people's perception of the project results and consequently, further engagement.
- Without DH, the public might refrain from engaging in the project.

20. SEM MORBEGNO | ITALY

GENERAL ASPECTS: SEM (Società Elettrica in Morbegno) is a cooperative company founded in 1897 active in the production of hydroelectric energy, in the production of thermoelectric energy through a cogeneration plant and a wood biomass plant with ORC (Organic Ranking Cycle). The Company distributes electricity to approximately 13,000 users in the Municipalities where its own distribution network is present.

SEM has a staff of 27 employees of which 15 follow the technical part in the electricity production - electricity distribution - district heating departments and the remaining staff follow the user counter activities and the management part of the Company.

TECHNOLOGIES USED: They consume wood biomass to produce electric power and heat for district heating. Heat and power generation with ORC (Organic Ranking Cycle) turbine, they have a 6.5 MW boiler and 990 kW ORC turbine.

CITIZEN PARTICIPATION: Members are kept informed about the state of the art regarding RE and have a say in local developments.

FACILITATING FACTORS: Long and well-established cooperative.

BARRIERS: Some of the key barriers deal with the regulatory framework, which is quite complex and the bureaucracy for the incentives can also be very complicated.

ENVIRONMENTAL ASPECTS: Biomass is sourced locally from sawmills and forests. The plant has reduced CO_2 emissions and it has improved local air quality.

SOCIAL AND ECONOMIC IMPACT: The plant has produced savings for its members and savings for the company. Furthermore, it has created local jobs, thus helping the community in both direct and indirect ways.

KEY LESSONS:

- Supply chain systems need to be continuously revised to keep improving the cooperative values and local impact.

"It is very encouraging that bioenergy community projects can be successfully implemented, despite the difficulties that may arise during their development"

2.2 Additional cases identification

The 10 additional cases, presented in *Table 3* were identified, based on contacts with representatives of cases that demonstrate a high potential for bioenergy integration, as positive examples that can complement the learnings from the interviews and surveys towards the uptake of RE. They demonstrate distinct and focused bioenergy integration initiatives and consequently serve as key examples towards bioenergy uptake in upcoming cases. Their relevance to the field is multifaceted as they have different approaches suited to local culture, perspectives, and resources.

Table 3: List of additional cases

Name	Country	Short description
Bera, Navarra	Spain	Biomass boiler with DH for several public buildings. Generation of a biomass short circuit model
Energie Partagée	France	Energy association facilitating the uptake of RE across their region through mobilizing citizens, encouraging and supporting new projects while also financing RE.
Energy Revolt s.c., Biekerech	Luxembourg	A cooperative society where private individuals, businesses and anyone who is of the opinion that we need decentralised financial flows can invest their money to develop sustainable energy projects.
Green Fox Community Energy	England	Community energy co-operative established by local people, the co-operative aims to facilitate the increase of community owned renewable and low carbon technology in Leicester and Leicestershire.
Kappel Energy Cooperative	Germany	The municipality of Kappel and its cooperative provides basic heat to its citizens by the biogas plant on the outskirts of the village using the waste heat from electricity generation from two combined heat and power plants.
Luleå Energy	Sweden	Luleå energi started in 1896.The Luleå energi group is selling and distributing electricity, internet connections, bio energy and district heating and cooling to the city of Luleå. The main business is district heating and cooling and selling electricity. A total of 450 km of pipes for district heating is currently installed.
Bioenergie Niederösterreich	Austria	Bioenergie NÖ is a cooperative dedicated to the construction and operation of regionally anchored, sustainable and agricultural bioenergy heat supply plants.
RESCoop Wallonie	Belgium	REScoop Wallonia federates 16 cooperatives that produce electricity mainly from wind, but also photovoltaic, hydroelectric, resulting from biomethanation (electricity + heat), as well as heat from biomass, for 54 MW installed or under construction.
Solroed biogas	Denmark	The Biogas from the plant ensures a stable supply of an environmental friendly renewable energy. The biogas produced is sent to the Solrød District Heating Plant where it is converted into 23 GWh of green electricity – corresponding to the consumption of about 3800 households.
Aran Islands Energy	Ireland	Using solar, wind and tidal energy towards heating and energy. It is a non-profit cooperative open only to residents and businesses located on the Aran Islands.

3 Assessing the potential for bioenergy market expansion

The task started with the preparation of an online survey (see *Appendix 3*) targeting European RE cooperative members, policy makers, associations, and authorities. The survey focused on key aspects related to RE, such as revealing the bioenergy market potential and getting an overview of which types are currently most popular and to which purpose they are used.

The survey was divided into 3 parts, the respondent affiliation, the types of RE resources are being used (if any), and if they would be interested in supporting related RE initiatives. The full survey can be seen in *Appendix 3.*

3.1 Survey methodological approach

The quantitative online survey ran **from February 2021 until ultimo April 2020** and had a target of 500 respondents. The survey distribution was done through the project partners' own social media accounts and through the project media outlets. The survey was originally created in English and project partners contributed with translating it into the the six languages of the consortium, French, German, Greek, Italian, Polish and Spanish.

The survey targeted REScoop members, authorities and policy makers across Europe, so it was not aimed towards the general public. With this focus, we could gather data related to practice and, consequently, relevant to the project's scope and objectives.

In order to create a structure for the survey distribution, CBS set up an online file with the companies, services, organisations to be reached and for the partners to indicate when they have communicated with them. CBS also sent out instructions towards various social media platforms dissemination, including text and hashtags; in addition, a text for direct personal communication was also included. The communication took place throughout the months of February, March, April and May, where various media were used towards reaching out to the relevant stakeholder groups. The BECoop dissemination manager was key in this whole process together with the help of all partners that engaged in spreading the word to get more respondents from their countries and beyond. All BECoop partners further distributed the survey among their relevant networks.

3.2 About the survey

This survey had one primary objective: **to elicit insights on the potential for bioenergy market expansion** in RESCoops. Therefore, as previously mentioned, this survey was targeted to two categories of stakeholders:

1. Members of RESCoops
2. Policy makers / Members of Local authority group / Energy Federation

The survey questionnaire was designed in a way that would allow a swift practical exploration of the potential and interest of key stakeholders in bioenergy market uptake/expansion, taking into account the requirement of keeping the survey time short. This would not only limit dropouts, but it would also result in better quality of responses (given how busy the respondents are).

The survey results presented in this report have followed a simple inclusion protocol – out of 360 collected responses at the point of analysis, 301 were selected based on percentage of completion[5]. No other rejection criteria were applied (time to completion was assessed as a complementary variable). Due to the continuous interest of participants, the survey was decided to be left open to collect more responses as the project matures.

3.3 Survey findings about RE in Europe

3.3.1 Sampling and descriptive statistics

We managed to collect a relatively balanced mix of the two stakeholders. 35.5% of respondents identified themselves as members of RESCoops (Group 1), and the rest belonged to the group policy makers / members of local authorities / energy federation (Group 2) presented on Table 4. As the second type of stakeholders is broader, it collected a bigger percentage.

Table 4. Which is your main affiliation?

		Frequency	Percent	Valid percent	Cumulative percent
Valid	Group 1: Members of Renewable Energy Source Cooperatives (RESCoops)	107	35.5	35.5	35.5
	Group 2: Policy makers / Member of Local authority group / Energy Federation	194	64.5	64.5	100.0
	Total	301	100.0	100.0	

As expected, the responses came from a variety of countries, but the majority of them came from countries where our network is present as seen on Table 5. While this arguably limits the representativeness of the sample, it also emphasizes the usefulness of the findings for the piloting work at hand (the countries of direct BECoop interest).

Table 5: List of Countries of participants that fully completed the survey

Countries	Frequency	Percent	Cumulative percent
Andorra	1	.3	.3
Austria	2	.7	1.0
Belarus	1	.3	1.3

[5] We adopted a 44% delivery percentage as the minimum threshold.

Countries	Frequency	Percent	Cumulative percent
Belgium	11	3.7	5.0
Bulgaria	1	.3	5.3
Croatia	1	.3	5.6
Denmark	2	.7	6.3
Ukraine	1	.3	6.6
France	3	1.0	7.6
Germany	9	3.0	10.6
Greece	83	27.6	38.2
Hungary	1	.3	38.5
Italy	37	12.3	50.8
Norway	1	.3	51.2
Poland	97	32.2	83.4
Portugal	4	1.3	84.7
Romania	1	.3	85.0
Slovakia	1	.3	85.4
Spain	44	14.6	100.0
Total	301	100.0	

Our respondents' living regions were balanced, with 54% living in rural areas, and the remaining living in urban (38%) and peri-urban areas (8%) as seen on Table 6.

Table 6: Living Region

		Frequency	Percent	Valid percent	Cumulative percent
Valid	**Rural**	162	53.8	53.8	53.8
	Urban	114	37.9	37.9	91.7
	Peri-urban	25	8.3	8.3	100.0
	Total	301	100.0	100.0	

As showcased in *Table 7*, the survey reveals the wide variety of different RE sources used by RESCoops. The table below shows that in our sample, the majority of RESCoop members use solar and biomass RE as sources. The same two RE sources are the most common also for Group 2.

Table 7: RE Sources used

Which one is your main affiliation?			Solar energy	Wind Energy	Hydro Energy	Tidal Energy	Geothermal Energy	Biomass Energy	Do not know
Group 1	Members of RESCoops)	Ticked	56	18	18	1	3	55	10
		Not ticked	51	89	89	106	104	52	97
Group 2	Policy makers / Member of Local authority group / Energy Federation	Ticked	51	16	12	0	5	26	10
		Not ticked	194	194	194	194	194	194	194

We asked the respondents to provide an indication of the particular activity focus of the RESCoops in their area. Given the exploratory nature of the question, respondents could tick more than one option. The findings show that for both RESCoop members and Policy makers, **power was the main focus of energy production, with heat being the second focus.** It should be noted that many of the Group 2 respondents did not indicate any of the three pre-selected foci in this question, as shown in *Table 8*.

Table 8: Focus of RE cooperative energy production

Which one is your main affiliation?		Power		Heat		Cooling		Don't know	
		Frequency	%	Frequency	%	Frequency	%	Frequency	%
Members of Renewable Energy Source Cooperatives (RESCoops)	No	30	28.0	67	62.6	101	94.4	100	93.5
	Yes	77	72.0	40	37.4	6	5.6	7	6.5
	Total	107	100.0	107	100.0	107	100.0	107	100.0
Policy makers / Member of Local authority group / Energy Federation	No	139	71.6	162	83.5	191	98.5	188	96.9
	Yes	55	28.4	32	16.5	3	1.5	6	3.1
	Total	194	100.0	194	100.0	194	100.0	194	100.0

3.3.2 Interest in bioenergy uptake

The key objective of the survey was to find insights on the potential for bioenergy market expansion in RESCoops. One of the most important items in our survey on this regard was to measure the interest in including bioenergy in existing RESCoops (for Group 1 respondents) and similarly the interest of Group 2 respondents to support a RESCoop in their region to include bioenergy in its mix.

We used two simple items to measure this:

[For **Group 1 Respondents: Member of Renewable Energy Source Cooperatives**] *Would you be interested in including bioenergy in your RE Cooperative?*

[For **Group 2 Respondents: Policy makers / Member of Local authority group / Energy Federation**] *Would you support a RE Cooperative in your region to include bioenergy in its mix?*

We excluded the Group 1 respondents who already use bioenergy in their RESCoop (for obvious reasons) and merged the answers from the two questions in one coherent variable that we called 'interest in bioenergy uptake'. We then used this new metric as the primary focus of this analysis and explored different aspects that may play an important role in shaping our respondents' interest in bioenergy uptake.

One first basic finding is that there is no significant difference (p=.858) between the two groups with regard to overall interest. This means that in our sample, it is equally likely that a member of group 1 or 2 will be interested in uptake/supporting bioenergy as shown in *Table 9*. Simpler put, **members of cooperatives and policy makers are equally likely to have an interest in bioenergy uptake.**

Table 9: Main affiliation and interest in bioenergy uptake

		Main affiliation		Total
		Member of Renewable Energy Source Cooperatives (RESCoops)	Policy makers / Member of Local authority group / Energy Federation	
Interest in Bioenergy Uptake	yes	38	98	136
	maybe	29	80	109
	no	5	10	15
Total		72	188	260

The second basic finding is that **the place where respondents live, plays an important role** (p=.32) **in their interest in bioenergy uptake.** As the cross-table below shows, urban respondents are more likely to support bioenergy uptake (61%) than rural respondents (46%), with peri-urban respondents being in the middle of the two other groups.

Table 10 Interest in Bioenergy uptake and type of region respondents live

			In what type of region do you live?			Total
			Rural	Urban	Peri-urban	
Interest in Bioenergy Uptake	yes	Count	65	61	10	136
		% within In what type of region do you live?	46.1%	61.0%	52.6%	52.3%
	maybe	Count	66	37	6	109
		% within In what type of region do you live?	46.8%	37.0%	31.6%	41.9%
	no	Count	10	2	3	15
		% within In what type of region do you live?	7.1%	2.0%	15.8%	5.8%
Total		Count	141	100	19	260
		% within In what type of region do you live?	100.0%	100.0%	100.0%	100.0%

To provide a better look at this finding, we tested the two variables also with a correspondence analysis. The geographical distance from each node in the graph below shows how far from each option each group is. As can be seen, urban dwellers are closer to Yes (and a bit to Maybe) in terms of interest in bioenergy uptake, while rural are closer to maybe and peri-urban are closer to no.

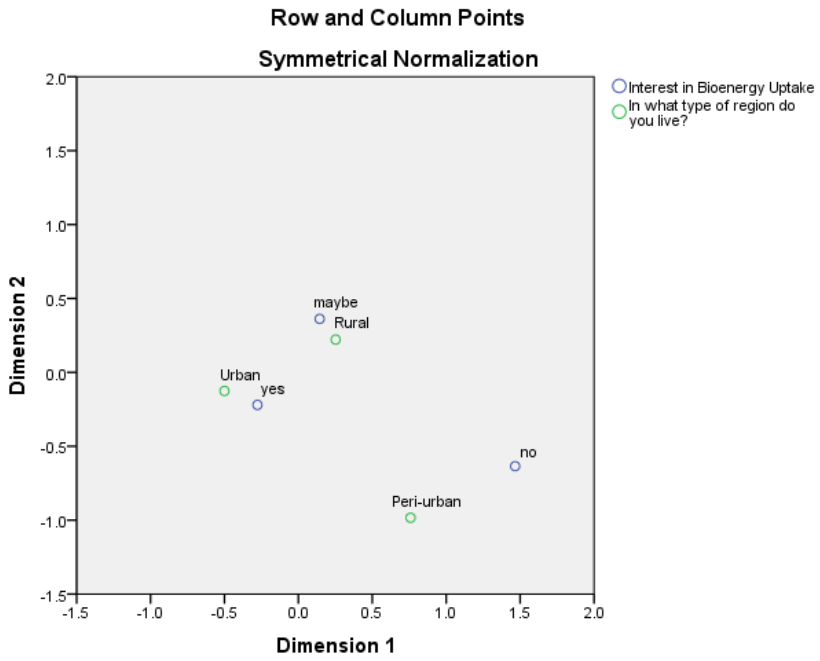

Figure 1 Correspondence analysis results (Interest Vs Region)

The third important finding is that presence of RESCoops active in the region of the respondents (Group 2) plays a significant role in their support for bioenergy. **If the respondents know that there are active RESCoops in their region they tend to have a very high interest** (70%) in bioenergy uptake (p=.002). This means that active presence and awareness can make a difference in intended support, as shown in *Table 11*.

Table 11: Cross-tabulation between knowledge of cooperatives and interest in Bioenergy uptake

			Do you know if there are any Renewable Energy (RE) Cooperatives active in your region?			Total
			Yes	No	Do not know	
Interest in Bioenergy Uptake	yes	Count	49	39	10	98
		% within Do you know if there are any Renewable Energy (RE) Cooperatives active in your region?	70.0%	39.8%	50.0%	52.1%
	maybe	Count	18	54	8	80
		% within	25.7%	55.1%	40.0%	42.6%
	no	Count	3	5	2	10
		% within	4.3%	5.1%	10.0%	5.3%
Total		Count	70	98	20	188
		% within	100.0%	100.0%	100.0%	100.0%

In the next finding we cross tabulated the RE sources that are used (either directly by the group 1's RESCoops or the RESCoops in the area of Group 2 respondents) with the different interest levels for bioenergy uptake. Our results revealed that only biomass energy made a significant difference (if biomass is used then it is more likely that the interest is high / 70%), as shown in *Table 12*.

Table 12: Resources Types

Type of resource	Importance	Sig.
Solar Energy	Not significant	.596
Wind Energy	Not significant	.692
Hydro Energy	Partially significant	.062
Tidal Energy	Not significant	.499
Geothermal	Not significant	.706
Biomass energy	**Significant**	**.007**

We run a similar analysis for the question '*Which types of biomass resources (feedstock) can be considered of great potential in your area?*'. This is a Group 2 only question that our findings revealed that it plays a role on the interest in bioenergy uptake.

As the summary table below shows, only energy crops and wet waste were not linked with an increased interest in uptake. In all the other cases, respondents who thought that a certain biomass resource has great potential, they were more likely to be supportive (interested in bioenergy uptake) shown in *Table 13*.

Table 13: Bioenergy potential

Type of biomass resource	Importance	Sig.
Energy crops.	Not significant	.103
Agricultural crop residues	Significant	.000
Forestry residues	Significant	.000
Algae	Significant	.035
Wood processing residues	Significant	.017
Sorted municipal waste	Significant	.001
Wet waste	Partially significant	.056

Lastly, our findings suggest that respondents with higher interest in bioenergy uptake were much more likely to be open to receive BECoop updates (p=.000). As can be seen below, 60% of respondents that are interested in bioenergy uptake would like to get updates about the project. While arguably this is an expected result, the situation with the 'Maybe's' is more interesting: about half the respondents who opted that they do not want to get updates belong to the middle section of interest in bioenergy uptake (=maybe). This indicates that for our communication arm, this segment could be crucial shown in *Table 14.*

*Table 14: Interest in Bioenergy Uptake * Would you like to get updates about the project?*

			Would you like to get updates about the project?		Total
			Yes	No	
Interest in Bioenergy Uptake	yes	Count	99	23	122
		% within Would you like to get updates about the project?	59.6%	33.8%	52.1%
	maybe	Count	65	35	100
		% within Would you like to get updates about the project?	39.2%	51.5%	42.7%
	no	Count	2	10	12
		% within Would you like to get updates about the project?	1.2%	14.7%	5.1%
Total		Count	166	68	234
		% within Would you like to get updates about the project?	100.0%	100.0%	100.0%

3.3.3 Barriers for RES development

We asked the participants to tell us about barriers for RES development. We used an open-end question for this purpose to collect responses: *What would you say currently prevents the further development of RES in your area?* We present, in *Figure 2,* the results of a multidimensional scaling of the words received in the open answers.

The analysis identified eight clusters; with cluster one being the most central (and big in terms of frequency). **Central barriers in the minds of the participants were the lack of awareness, knowledge, investment/funding, implementation, regulation, and an efficient framework for development. Similarly in cluster 2 (which is in proximity with cluster 1) issues like bureaucracy, legislation, community, financing and costs are mentioned**.

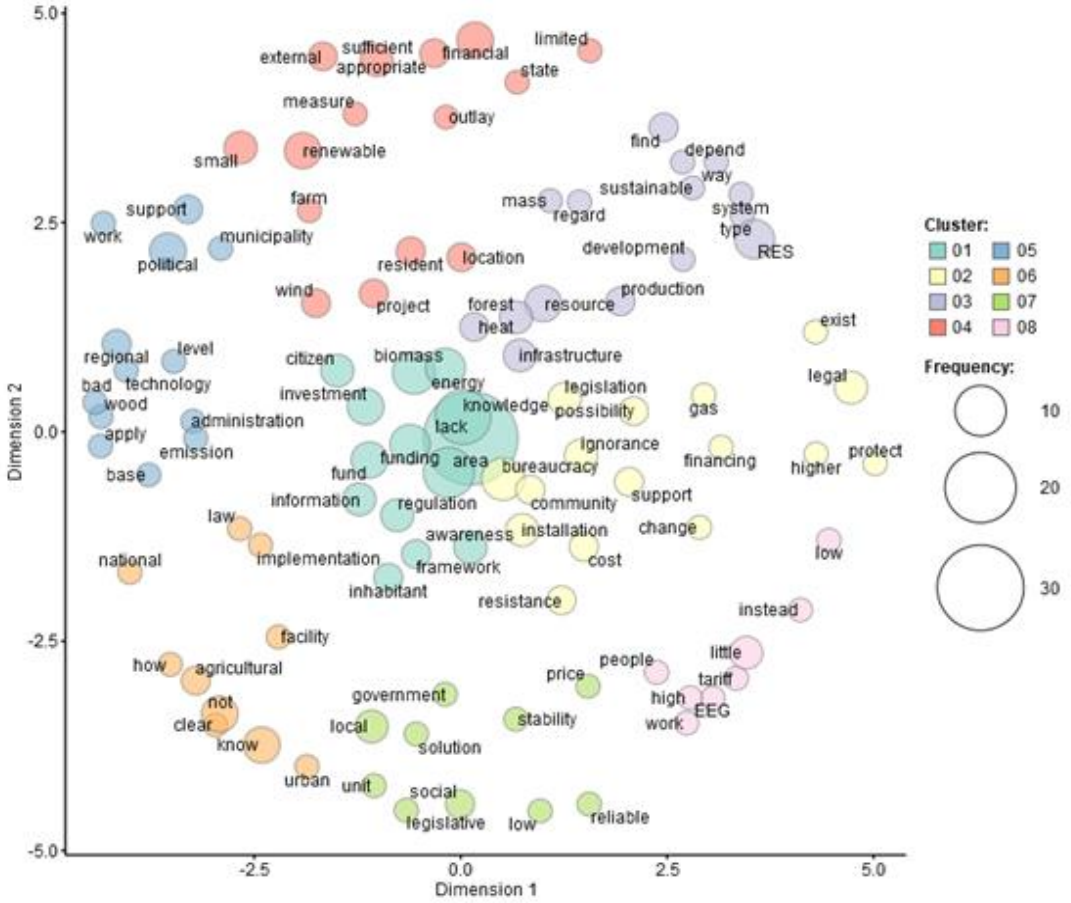

Figure 2: Multidimensional Scaling of the words

3.4 Overview of survey results

The survey ran from February 2021 and it was decided to be left open as the project runs (as more responses are collected). In the period of interest (when this deliverable is drafted) we have managed to **gather 360 responses from 20 European countries**. Although we have run over four rounds of campaigns across every part of the EU – in countries where RESCoops are popular as well as in countries that the concept is underdeveloped –, we attribute not reaching the target number of 500 due to, among other things, an overload of digital communication aggravated by lockdowns during the Covid-19 pandemic. We also received communication from some Nordic countries' associations stating a known difficulty to have respondents to surveys; therefore, the results are also representative of this issue.

On top of the advanced findings presented in the previous chapters (regarding interest in bioenergy uptake) which for reasons of redundancy will not be repeated here, we wanted to mention some broader insights.

The responses show that solar energy and biomass are the most used RE sources from among the respondents, however as we do not have a balanced number of responses from each country, we are aware that these results might be skewed or most representative from the largest number of respondents, which were from Greece, Italy, Poland and Spain. It does not come as a surprise that the countries that are directly involved in the project, had a higher representation than others do, which were reached through more general communication outlets.

- From the responses there was a good representation of the areas lived with 40.94% (104 responses) living in rural areas, 47.24% (120) from urban areas and 11.81% (30) living in peri-urban areas.
- 53,54% of respondents belonged to Policy makers / Member of Local authority group / Energy Federation, while 46.46% respondents were a Member of Renewable Energy Source Cooperatives (RESCoops).
- Over 55% of the respondents knew about Renewable Energy in their areas

4 Main findings from the state of play combined analysis.

- **All the people interviewed had an average of 12.4 years involved with bioenergy**, therefore they all were well experienced in the field and had a broad knowledge regarding various perspectives on cooperatives and bioenergy, both challenges and assets.
- Electricity and heat are the most widespread use of the energy generated and biomass and PVs are the most common types of bioenergy. **While the biomass is mostly locally sourced, it travels an average of 40Km, with some cooperatives having less than 0.5 km and others over 150Km radius**.
- Public funding and incentives have played a big role in helping setup some cooperatives, however at least half of the cases were privately funded but many collaborated with public entities towards wider outreach, from legislative to technical aspects.
- The **creation of local jobs** and working towards common goals were described as key economic and social impacts in the cooperative locations.
- Regarding environmental impact, the **reduction of CO_2** was the one most mentioned, while a number of interviewees also called attention to helping secure forest and species preservation through **more attentive collaboration among parties involved in agro and forest exploitation**.
- While the term cooperative is broadly used, the cooperatives are described in various ways, there is no single concept that intersects the description, as **sizes, formats, and goals vary**. **For the field to be better structured and evaluated, a clear definition could help towards impact assessments.**

The results of the desk research, surveys and interviews were combined into a full set of data towards gaining a perception of the bioenergy field across Europe in distinct regions. A qualitative comparative analysis was then carried out through using research comparative analysis software (nVIVO).

A query of the most frequent 300 words from all the results was visualised in a word cloud in *Figure 3*.

Figure 3: Word cloud from interview results

Based on the qualitative comparative analysis, all the 30 cases and survey results were coded accordingly creating 25 codes shown in *Table 15*.

Table 15: List of codes

Name	Files	References
Barriers	14	26
Benefits being a member	18	26
Best practices	7	16
Biomass price per ton	10	10
Challenges	18	43
Economy impact	15	28
Environment impact	15	25
Funding	12	14
Future	16	20
How are cooperatives described	18	24
How far does the biomass travel	13	13
How is the biomass sourced	11	14
Implementation cost	11	12
Initial price to join	17	20
Key Learnings	14	42
main use of the energy	19	20
Motivation for joining a cooperative	19	29
Other perspectives	8	28
Public incentives	13	21
Social impact	15	26
Success story	16	29
Tech capacity	14	14
Technology	20	29
Time involved with bioenergy	19	19
Types of bioenergy	20	23

Regarding the types of RE reported, the chart in *Figure 4* gives a quick overview of the respective results whereas *Figure 5* depicts reported types of RE per country.

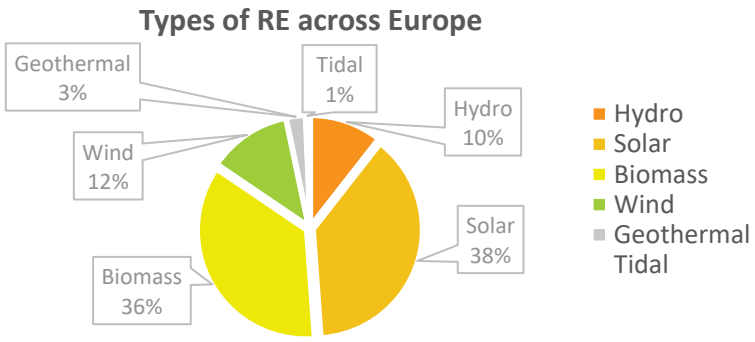

Figure 4: Types of RE across Europe

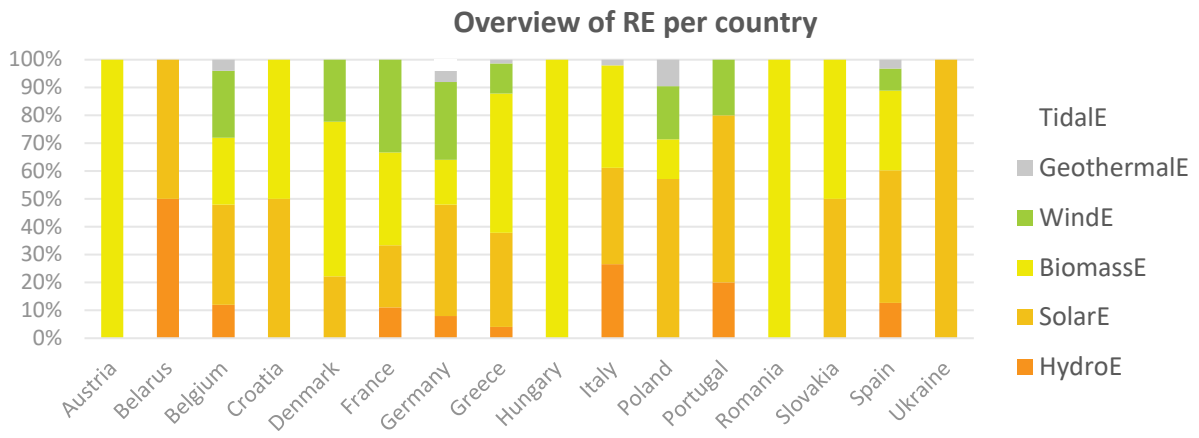

Figure 5: Overview of RE per country

In regard to where people lived and their affiliations, *Figure 6* demonstrates that the vast majority of results were collected from the urban and rural areas.

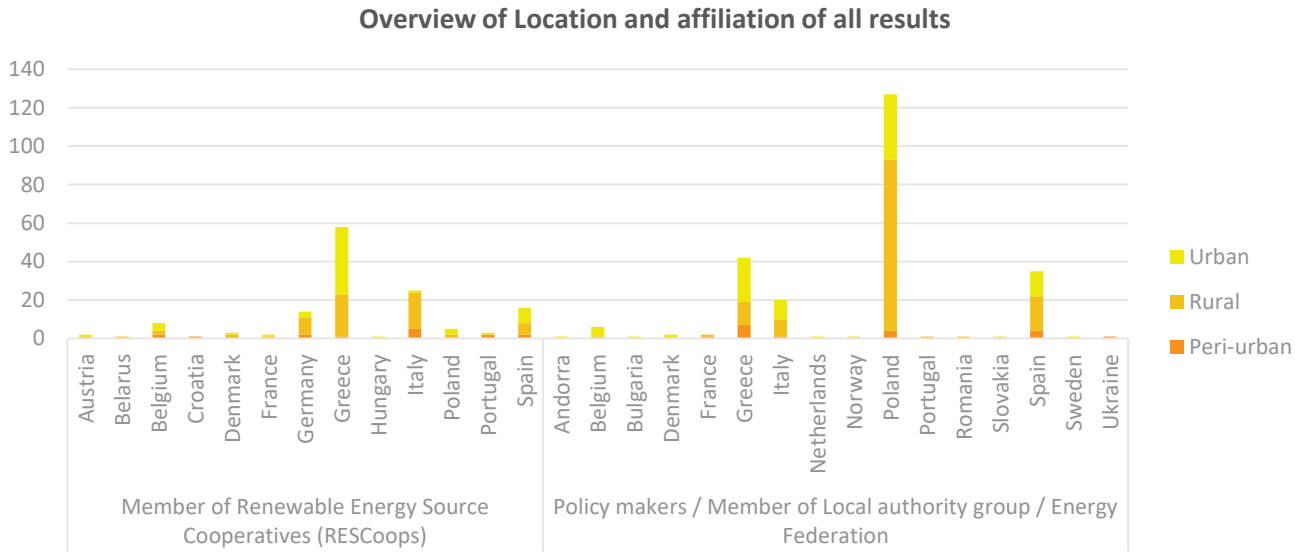

Figure 6: Overview of location lived and affiliation

The overall analysis of the interviews and extra cases' results has been combined into current challenges and barriers, best practices and key learnings, all presented in the following sections.

4.1 Current barriers and challenges in bioenergy in Europe

There are **barriers to both join, manage and setup the cooperatives** – they have been combined in a word cloud in *Figure 7*. The main challenging points are listed below:

- Financial viability in a fast-changing policy environment.
- Lack of access to development funds and support.
- Raising funding.
- Lack of precedents for district heat models.
- Customer comprehension of RE models.
- Volunteers to act together.
- At the start, there are no or few funding, thus one needs to work mostly on a voluntary base, with overtime and weekends included.
- The time spent in the management of an energy community.
- Coordinating different viewpoints is part of the engagement process and it takes time.
- The biomass/pellet project is not profitable at the start.
- The investment risk is very high with biomass/palletisation compared to other energies.
- There is a deep-rooted culture around fossil fuels, and in some regions, there is a lack of confidence in robustness or supply or RE. In one example, although there is a biomass boiler installed, the pellet price is a bit more expensive than natural gas per thermal kWh, and this is negatively affecting the uptake of RE as the boiler is often switched off.
- Despite some incentives that might exist, one cannot rely solely on national funds.
- Existing regulations might delay or impede how the work could be developed by RESCoops.
- The initial cost or the amount one needs to invest to join a cooperative might limit the wider member enrolment, jeopardizing growth. The setting up equipment tends to be very expensive for average households (around 10,000 € for one household).
- In some countries, the cooperative model has a bad reputation linked to control and lack of transparency, though it has been changing during the last years for the best.
- There is still a lack of governmental economic support and framework.
- Size, competence, and capacity are key words for setting up and managing cooperatives successfully.
- The technologies are getting more efficient but also more complex with risks involved.
- Personal aspects were also mentioned as barriers for collaboration: individualism, mistrust, negative perception of the environmental impact of biomass by not considering the whole life cycle of the technology, concerns about the project development not following a bottom-up approach.
- It is valuable to understand the documents required to carry out the initial work and once the work is done, have a good knowledge about the system in order not to rely too much in external maintenance services.
- There is always a share of people really hard to convince because they prefer the individualism of a private installation.
- Interviewees cited local legislations and bureaucracy as a core barrier in the development and uptake of RE process -how these laws are applied and the pressure from lobbyists that make it difficult to carry out projects that would benefit citizens.
- 20 years ago, a cooperative was something that people often did not consider positive. At the same time fossil fuels deeply rooted in society, so it is difficult to create the necessary change of mentality.

Among the **challenges of further expanding and running RE cooperatives**, the following aspects were raised through the task's research:

- Bioenergy is seen as a key stepping-stone to electrification, but the access to biomass for heating purposes is limited and regionally depended across the country, thus it is perceived as being very hard to scale up as the fuel might be under the control of very few people in some cases.
- Keeping up with laws and regulations is difficult - the regulatory framework is complex and linked with bureaucracy to register an installation.
- Conflicts within the community due to distinct perspectives and opinions regarding bioenergy emerge, so any bioenergy community project should deal with this.
- Difficulty in conveying to users the confidence in an energy that is efficient as there is always the comparison with gas, diesel, coal - society perceives renewable energies as something very avant-garde, even if it is a consolidated technology.
- Some countries, such as Croatia, do not allow virtual net building therefore, you cannot gather people who will produce and trade energy among themselves in a building. The energy production for energy communities is only for self-consumption and only for households.
- The energy sector is built for big utilities, so different approaches struggle to fit within existing regulations.
- Ensure humidity (12-15%) and size to improve combustion efficiency. It is very difficult in high humidity areas to reduce the percentage of humidity from 30% in a natural way.
- Separate the heat commercialisation activities from the rest of the general services offered by the council (water, electricity, telephone) under a different IAE (Economic Activities Tax) heading to manage the VAT independently, with associated benefits involving renewable activities.
- The price of gas (which is cheaper than pellets) can threaten the longevity of a running project.
- It is often a difficult path to find the land, reach agreements with municipalities, balance the economic part, the management (concession), tendering, etc.
- Plants require a lot of maintenance work in comparison to the comfort of natural gas or other traditional heating means.
- The farmers often consider the logistical as a challenge, as they must go and collect the biomass from the vineyard when the farmer has already pruned and crushed it, because they want to start ploughing.
- Keeping the communication flowing among members, in case of larger cooperatives.

Figure 7: Barriers and Challenges word cloud

4.2 Best practices in community bioenergy in Europe

Throughout the interviews a number of **positive examples of best practices** while running RESCoops and related associations became apparent and are presented in the following list. A word cloud of best practices can be seen in *Figure 8*.

- The initiatives are open to all local residents.
- Upgrading local homes and other buildings as a part of the cooperative implementation plan.
- Participating in many different research studies related to creating a micro-grid and smart sustainable technologies.
- Keep a fluent communication with public administration to foster the implementation of new facilities in its buildings and in other local entities.
- Funds can be raised by a local community share offer.
- Biomass is locally sourced from managed woodlands.
- Collaborate with companies that help put together the legal aspects of the tender and concession; on the techno-economic side with companies that develop the feasibility study that is going to be put out to tender and the preliminary project on which the concession was going to be based.
- Keep the research perspective towards improvement as in the case of biomass from vineyards where they are carrying out tests on pruning waste so as not to waste anything.
- Engaged in involving other related companies (such as paper idustry) to consume biomass for cogeneration, while still trying to keep everything in the immediate vicinity.
- Some cooperatives have increased the amount of biomass collected, and now look at expanding their market by reaching out to other companies who might use it.
- Current installations facilitate reaching environmental goals as the biomass is burnt in a boiler instead of in the middle of the field.
- Existing cooperatives strive to supply local municipalities with renewable energy generated as independently as possible, with the best possible efficiency and at favourable prices.
- By investing locally, the local economy benefits from the investments – these investments and discounted tariffs for the producing industry create jobs in a rural mountain area.
- Farmers have recognised the need to work more closely together in the harvesting, processing, and marketing of their products. In the banking sector there are also cooperatives across the country that meet the needs of the domestic economy.
- Cooperative is managed by its members in a democratic way. The members elect the administrative bodies from their own ranks.
- Long-established cooperatives' main purpose is supplying their members with heat at the best possible price and that see this as their primary goal.
- The cooperative is run by a volunteer steering group, they have no employees, they take turns sitting in the board of directors to inspect the facility from time to time, they have outsourced the management to a neighbouring utility - but few people are willing to spend the time, so the steering group is primarily composed of older members (retired people) and too few women to run the utility, which is not representative of society.

Figure 8: Best Practices word cloud

4.3 Key lessons learned from RESCoops deployment and implementation

A variety of aspects were summarised creating a set of key lessons regarding RE cooperatives. A word cloud can be seen in *Figure 9*.

- In one case in Spain, woodchip was tried initially, but the supplied feedstock was of low quality (high humidity) and therefore the switch was made to pellets; they offered a better result, albeit at a higher price.
- Technical advising is required and should integrate all the processes involved since the beginning of this type of projects.
- It is necessary to test different species and locations in addition to improve the measures with the aim of achieving better results in humidity content of the products.
- It is important and necessary to establish synergies and to share experiences with other owners of this kind of facilities with the aim of learning from mistakes and correcting issues that may occur in the better way possible.
- The regulatory framework is very complex and the bureaucracy for the incentives is very complicated.
- In some cases, instead of renewing a city block and refurbish buildings with individual biomass heaters, creating a DH appeared to be a better solution.
- Some citizens might be very reluctant to change and to the risk of switching to something new - society perceives renewable energies as something very avant-garde, even if it is a consolidated technology.
- To tackle people involvement a cooperative in Portugal uses different touchpoints, from word of mouth in the beginning, to local press and online services .
- The door-to-door approach is important.
- Citizens tend to trust more the energy communities when they are “co-owners” - they are not clients and want to explore and find the best solutions for themselves.

- RE solutions are technologically mature and economically feasible.
- The basic characteristic of a successful energy community in Greece is that it has involved the regional authority, municipalities, citizens, and businesses as their members.
- By participating in an energy community, the members make decisions with others in democratic ways; they learn how to co-decide with others.
- The field of energy is becoming very complex and it is difficult for small cooperatives to exist as small entities.
- It is difficult to find people who are willing to dedicate their time for this.
- There are many regulations that small coops need to comply and even though they have some exemptions for smaller groups, there are still a lot of admin tasks.
- Geothermal, solar and wind are not enough to provide the electricity requirements in cold winters (Denmark - as of 2021).
- For biomass, people need to be aware that their behaviour regarding waste affects the quality and amount of biomass and energy production; right now these pieces are disconnected.
- The legitimacy of waste sorting needs to be transparent and the recycling needs various outlets.
- Hazel is a fabulous wood for biomass. There was some concern that with the overstood coppice, that there would be too much bark, but so far, it has not been a problem. Good technical boiler installers who have carried on advising a British coop (they also have invested in the coop as individuals) think one of the advantages is that they are on clay, so there is less silicon in the bark than if you were on a chalk subsoil. They found out that quite low-quality wood could be burnt, hardwood in particular. They also got quite a lot of ash now in the area and ash is a good wood for biomass purposes.
- In the UK case, they have demonstrated that they can help with the not insignificant costs of bringing woodland back into management by creating a market locally.
- The fact of making wood chips with wet wood means that less sawdust (30mm) is generated in the process and therefore better use is made of it and dries out (30-25% humidity) before storage.
- Importance of having public woodland available at the municipality level.
- The role of the cooperative model and its collective decision-making process is crucial: you must reach a consensus and therefore you need to be transparent.
- There are cases of mixed capital, of concessions where the public sector provides an investment, the concessionaire also provides an investment, and there is a fee or others where a private manager with institutional support can carry out the project more quickly.
- It is crucial to choose the best available techniques at the beginning of the project. In one case, the boiler worked well but the problem was how the chips reached the boiler. If the chips were not cut properly, there were problems with blockages.
- There are two ways of pruning. One is directly and you leave the vine shoot on the ground and the other is before the trellised vines are pre-pruned and then the pruners cut them back by hand. In Spain, they tried to prevent these pre-pruning jobs from falling to the ground, and they have not been able to achieve this as is. They are trying to create a machine so that the trellised vines also contribute when this biomass is pre-pruned.
- Successful energy communities are communities that involve a mixture of things such as energy saving simultaneously with energy production, virtual net metering etc. They help with the reduction of energy poverty by providing a percentage of the energy produced to households in need (an amount of kW for free to vulnerable households).
- Creating a market for very low quality wood including ‘brash’ (the tops of deciduous trees) from the neighbouring woods has resulted in a dramatic improvement to the ecology of local woodland.
- People are not hesitant to adhere to a cooperative as long as the products they buy are within an acceptable price range.
- Creation of jobs and new markets for the local community.

Figure 9: Key Lessons word cloud

"PEOPLE ARE BENEFITED BY THEIR PARTICIPATION IN ENERGY COMMUNITIES. BY TAKING PART IN AN ENERGY COMMUNITY, THE MEMBERS MAKE DECISIONS WITH OTHERS IN DEMOCRATIC WAYS, THEY LEARN HOW TO CO-DECIDE WITH OTHERS. EVERYONE HAS ONE VOTE, EVERYONE IS EQUAL."

5 Conclusions

The richness of the data emerging from the desk research, survey and interviews has provided a richer assessment and analysis, fulfilling the task objectives towards exploring aspects revealing the potential for the bioenergy market expansion.

The comparative analysis undertaken in this report reveals good practices, challenges and gaps, and highlights commonalities and differences within the bioenergy field. These findings have an influence on the design, implementation and impact of community bioenergy schemes, policy recommendations and regulatory framework to be developed in the coming years.

Furthermore, this report results feed into various WPs and Tasks, for example:

WP1 towards T1.4 with an initial overview of existing heating uptakes needs and challenges;

WP2 towards T2.1 and T2.2 with relevant input for the type of content that can help the BECoop assessment tool and toolkit;

WP3 towards T3.1 towards understanding reasons behind the various stakeholders' motivations and how best to tap into those for a valuable mobilisation supporting the project development.

The best practices and key results from the desk research, survey and interviews presented herein can guide the evaluation of existing RE cooperatives, while also guiding future project developments tackling energy poverty issues and bioenergy. Furthermore, the results can guide campaigns and formats towards communicating and disseminating RE cases and opportunities.

6 References

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.

Huybrechts Benjamin, Creupelandt Daan and Vansintjan Dirk. *Networking Renewable Energy Cooperatives – the experience of the European Federation REScoop.eu, If not for Profit, for What, and How,* Belgian Science Policy, chapter 45

Livingstone, S. (2003). On the Challenges of Cross-National Comparative Media Research. *European Journal of Communication*, *18*(4), 477–500. https://doi.org/10.1177/0267323103184003

Mangen, S. (1999). Qualitative research methods in cross-national settings. *International Journal of Social Research Methodology*, *2*(2), 109–124. https://doi.org/10.1080/136455799295087

7 Appendix

Appendix 1: Table of identified cases

CASES	COUNTRY	DESCRIPTION/LINK
Emissions-zero	Belgium	https://www.emissions-zero.coop/ *Citizen's cooperative investing in the production of renewable energy in Wallonia and Brussels.*
UrStrom	Germany	https://www.urstrom.de/gas-argumente/ *As an association of more than 15,000 citizens, the Bürgerwerke are committed to the decentralized expansion of renewable energies.*
Our power	Austria	https://www.ourpower.coop/page/strom-kaufen *This cooperative operates the online marketplace ourpower.coop, building connections around the topic of electricity.*
Suno	Spain	https://suno.cat/en/projects/ *Suno is an energy services engineering company specializing in renewable energy.*
Minoan Energy	Greece	https://minoanenergy.com/ *The Energy Community is an institutional tool that allows local communities to claim their share of economic and social development through their participation in energy production and energy rational projects.*
Ecopower, Flanders	Belgium	https://www.ecopower.be/groene-warmte/onze-aanpak *Flemish REScoop. Supplier of pellets. DH project under development.*
Uberoa, San Sebastian	Spain	https://www.urberoa.com/ *DH cooperative promoted by citizens. Consume pellets as well as gas (cogeneration).*
Ispaster	Spain	https://www.energetica.coop/wp-content/uploads/2020/11/Presentacion-Inaki-Ispaster.pdf *Rural village with biomass DH (astilla).*
San Sebastian	Spain	https://www.districtheatingtxomin.eus/ *New housing development. DH with biomass. Promoted by town hall. Includes Social housing.*
Barrio de Coronación, Vitoria-Gasteiz	Spain	https://smartencity.eu/about/lighthouse-cities/vitoria-gasteiz-spain/ *Deep renovation with biomass DH. Promoted by local town hall. Financed by H2020 project SmartEnCity.*
Racibórz	Poland	https://www.wedistrict.eu/demonstration-cases/raciborz/ *Non-renewable DH retrofitting with biomass heat generation and PV.*
Luleå	Sweden	https://www.wedistrict.eu/demonstration-cases/lulea/ *Existing cogeneration system, integration with fuel cells using biogas or hydrogen as fuel.*

CASES	COUNTRY	DESCRIPTION/LINK
CMVMC Tameiga	Spain	https://nosaenerxia.gal/index.php/gl/actualidade/item/101-comunidade-enerxetica-na-cmvmc-de-tameiga *A rural commonwealth managing natural resources as a common good in the hills of Galicia. Firewood service.*
Ecoenergies Barcelona	Spain	https://www.ecoenergies.cat/es *DH with biomass cogeneration (wood, agricultural and forest residues, energy crops).*
Txantrea, Pamplona	Spain	https://www.efidistrict.eu/ *DH - several cooperatives, local administration and social housing company involved.*
Navarra Social Housing	Spain	https://www.nasuvinsa.es/ *Various DH housing developments. Promoted by town hall.*
Okina and Sabando, Araba	Spain	https://promobiomasse.eu/en/progress/actions/identification-of-good-practices/ *Biomass plant providing heating and hot water. Two municipal heat networks.*
Bera, Navarra	Spain	https://promobiomasse.eu/wp-content/uploads/2019/12/27Bera-en.pdf *Biomass boiler with DH for several public buildings.*
Ultzama, Navarra	Spain	https://www.navarra.es/NR/rdonlyres/4F0037F1-7A61-45E7-9EE2-0A7C91B403D1/340456/Redes_de_Calor_AVEBIOMPamplona.pdf *Biomass boiler with DH for several public buildings.*
Asparrena, Araba	Spain	https://www.dropbox.com/s/kh5uv94tb9rp4rp/Propuesta%20alternativas%20gesti%C3%B3n%20biorresiduos_ASPARRENA.pdf?dl=0 *Town hall. DH biomass and they manage own forest residue (woodchip) (for the moment without residents, only public buildings).*
Atea Verdea, Lekeitio	Spain	http://calderas-de-gas-calentadores.com/instalacion-de-calderas/lekeitio/ *Use of bio-combustion boilers for heating.*
Margarethen am Moos	Austria	www.agrarplus.at *Cooperative 'Energy Supply Margarethen', residential DH with biogas.*
Susa Valley	Italy	https://www.score-h2020.eu/pilots-follower-cities/susa-valley/ *Alpine valley with 14 municipalities; replacing diesel and oil fuelled block heating facilities with biomass in the form of locally produced wood chips.*
La foresta SCRL, Piemonte	Italy	https://www.laforestascrl.it/ *Sustainable forestry and lumber cooperative producing biomass for hearting purposes. Also participates in www.score-h2020.eu.*

CASES	COUNTRY	DESCRIPTION/LINK
Solroed municipality	Denmark	https://solrodbiogas.dk/ *Municipal biogas CHP and DH. From seaweed, organic waste and manure.*
Energy revolt	Luxembourg	http://energyrevolt.lu/index.html *An open cooperative society where anyone can invest their money to develop sustainable energy projects.*
RESCoop Wallonie	Belgium	https://www.rescoop-wallonie.be/ *18 cooperatives that produce electricity mainly from wind power, but also photovoltaic, hydro-electric, from anaerobic digestion (electricity + heat), as well as heat from biomass*
Emissions Zero	Belgium	https://www.emissions-zero.coop/ *Cooperative working with wind power, hydraulics, agricultural biogas and photovoltaics to produce green electricity.*
Destilerias San Valero	Spain	http://www.destilerias-sanvalero.com/ *Cooperative that uses the waste of the wineries associated, they use biomass for self-consumption and save cost, in the following years they are planning also to manufacture the biomass (production of pellet) and sell to final consumers, as for instance could be the wineries.*
Cooperativa de San Miguel	Spain	https://sanmiguelcoop.net/ *Cooperative that produces animal feed product and use biomass for drying the Lucerne. There is one associate that brings biomass, the cooperative produces pellets for him, and afterwards he distributes the pellets.*
COREN and COVAP		https://www.coren.es/en/meet-us/coren-group/ *They are a food cooperative that they are planning a plant of biogas for self-consumption.*
Ayuntamiento de Serra	Spain	http://www.itforest.uji.es/wp-content/uploads/2014/09/01_Serra-Municipality_JJMayan.pdf *Municipality that collet the biomass from their forest cleaning activities, they have developed a pellet plant a use this pellet for self-consumption in the public building and other part for selling to residential use*
Puertollano	Spain	https://www.energy.sener/project/puertollano-biomass-plant *Biomass steam generator equipped with a water-cooled grill and two-body turbo generator with intermediate reheat.*
Coopérnico, REScoop	Portugal	https://www.coopernico.org/pt *Coopérnico is a renewable energy cooperative, which combines with its social nature the support of solidarity, educational or environmental protection projects.*
ZEZ, Green Energy Cooperative	Croatia	https://www.zez.coop/en/the-first-solar-roof-in-croatia-in-hands-of-the-citizens/ *Solar power plant of 30 kW on the roof of Development Centre and Technology Park in Križevci.*

CASES	COUNTRY	DESCRIPTION/LINK
Energiegenossenschaft Odenwald eG REScoop	Germany	https://eg-odenwald.de/ *Cooperative focusing on the local energy transition.*
Combrailles Dubrailles REScoop	France	http://combraillesdurables.org/ *Collectively lead local development projects by bringing together communities, citizens, associations and businesses in a single structure*
Middelgrunden Wind Turbine Cooperative	Denmark	https://www.middelgrunden.dk/vindmoelleparken/ *Wind turbine cooperative in Jutland, started in 1996*
Kappel Energy Cooperative	Germany	https://www.energiegenossenschaft-kappel.de/ *Biomass DH for local consumption.*
DHCA	Greece	http://detepa.gr/dhca/ *Municipal District Heating Company of Amindeo (D.H.C.A.) with 2x15 MW capacity biomass plant. Driven by the municipality of Amindeo (not actually a REScoop)*
Vineyards4heat	Spain	http://vineyards4heat.eu/ *Thermal energy production from vineyard pruning for winery and district heating. Driven by the municipality of Vilafranca del Penedés*
Energy autonomy of Sifnos	Greece	https://sifnosislandcoop.gr/en/energyautonomy/index.html *Hybrid Power Station consisting of a wind park and a pumped storage plant*
Electra Energy	Greece	http://electraenergy.coop/ *Social enterprise for the transition to a democratic, efficient and sustainable energy system with citizens at its core*
The energy self-sufficient village Feldheim	Germany	https://nef-feldheim.info/the-energy-self-sufficient-village/?lang=en *Energy supply to the energy self-sufficient village of Feldheim via private local heating and electricity grids*
Energie Partagée	France	https://energie-partagee.org/ *Group that support local renewable energy production projects throughout France*
Laconic Bioenergy	Greece	http://www.bioenergeiaki.gr/ *Leading company in the field of Waste Management, promoting best practices, ecological solutions, financially advantageous for the legal solution of waste in the area.*
TCVVV spa	Italy	www.tcvvv.it *Trigenerative biomass district heating*
Foreste Montagne Fiorentine	Italy	http://www.forestamodellomontagnefiorentine.org/64/e *Network of forest model with small biomass district heating*
Bioenergia Fiemme spa	Italy	https://www.bioenergiafiemme.it

CASES	COUNTRY	DESCRIPTION/LINK
		Biomass district heating that produce pellet from waste heat
La Grande Stufa	Italy	https://www.lagrandestufa.it/ *Experience of start-up of district heating by forest consortium*
Acsm Teleriscaldamento	Spain	https://www.acsmtlr.com/ *Multi-utility that manages 3 district biomass heating*
Som Energia	Spain	https://www.somenergia.coop/ *Produce electricity in generation facilities from renewable sources (solar, wind, biogas, biomass, etc.), financed with voluntary financial contributions from partners.*
SEV Federazione Energia Alto Adige	Italy	https://www.sev.bz.it/en/south-tyrol-energy-association/1-0.html *Support the development of hydropower plants, energy distributors, bio heating plants and photovoltaic systems*
Westmill Solar Cooperative, Oxford	England	http://westmillsolar.coop/about-westmill/ *The cooperative goal is to combat climate change by financing a reliable source of renewable energy, provide local people and other investors with a stable, reliable source of income, and help the area transition to a low carbon future economy*
CooperaSE, Granada	Spain	http://www.cooperase.org/ *Serve as a transmission between citizens and their institutions to advance the energy transition*
Edinburgh Community Solar Co-op	Scotland	http://www.edinburghsolar.coop *Edinburgh Community Solar Co-operative owns and operates 24 solar panel installations throughout Edinburgh with a total generating capacity of 1.38MW*
Tipperary Cooperative, Nenagh	Ireland	https://energycommunitiestipp.ie/about-us/ *A community led, home insulation upgrade and retrofitting organisation.*
GS Energia, Zamość	Poland	https://gsenergia.pl/2014/07/01/nasza-energia-spoldzielnia-energetyczna/ *Focus on creating an integrated network of agricultural biogas plants*
Springbok Wood heat COOP	England	https://www.springbokwoodheat.co.uk/ Sustainable wood heat co-operative operating a wood chip fuelled district heating system.
Energy4all	England	https://energy4all.co.uk/ *An umbrella organisation with currently 28 independent renewable-energy co-operatives*
Green Fox Community Energy	England	https://greenfoxcommunityenergy.coop/ *The co-operative aims to facilitate the increase of community owned renewable and low carbon technology.*

CASES	COUNTRY	DESCRIPTION/LINK
Woolhope Dome Community Woodfuel	England	https://woolhopewoodheat.org.uk/ *Community Co-operative that installs wood fuel boilers free of charge to hard-to heat buildings – and then supply heat at a reduced price over fossil fuel, with woodchip from local, sustainable woodlands*
FHW Toblach	Italy	https://www.fti.bz/ *District heating plant supplying two municipalities*.
EW PRAD	Italy	https://www.e-werk-prad.it/ *The electricity is mainly generated with 4 hydropower plants and 4 combined heat and power modules. The electricity is supplied to customers and members via an approx. 120 km long MS / NS power line network. The heat is supplied to the buildings from 2 district heating centres via an approx. 28 km long district-heating network.*
SEG Schluderns	Italy	https://www.seg.bz.it/ *Large cooperative that provides DH, Electricity and Internet*
LEEG LAAS	Italy	http://www.leeg.it/ *District heating plant for the entire village*
Förderungsgenossenschaft Ulten	Italy	http://www.foerderungsgenossenschaft-ultental.it/ *Providing local environmentally friendly energy*
Danish District Heating Association	Denmark	https://www.danskfjernvarme.dk/sitetools/english *Organizing Danish district heating companies; facilitate cooperation between these members; and promote their interests towards authorities and other organizations, both nationally and globally*
Biogas association Denmark	Denmark	https://www.biogas.dk/biogas-danmark/ *The work for the entire biogas value chain, which includes everything from the recovery of livestock manure and organic residues from agriculture, households and industry to the production and use of biogas and green manure*
Nordlys Energy association	Denmark	https://norlys.dk/om-norlys *Providing green energy to over 600K residents through wind, hydro and solar sources*

Appendix 2: Interview Guide

INTERVIEW GUIDE T1.1

GUIDELINES FOR THE INTERVIEWER

- The interview should be planned for a maximum duration of one hour.
- Be considerate to people's times, make sure to thank them in the beginning and at the end of the interview.
- You should record the interview, as it will allow you to pay attention instead of taking notes - in this case, let the respondent know that you are recording for notes purpose and this won't be shared.
- The interview should be conducted in the local language.
- Consider conducting a test/mock interview before jumping in the field and make any adjustments needed.
- The interviewee must sign the BECoop Informed Consent Form.

GUIDELINES FOR THE INTERVIEW TRANSCRIPT

- The partners responsible for interviewing need to transcribe and translate the interviews and return the English transcription to CBS by March 31st.
- Transcripts must be in English; this is essential as we need to be able to analyse them.
- Please do not select what to translate, translate the full answers as we need that for a qualitative analysis.

INTERVIEW GUIDE – INDICATIVE SET OF QUESTIONS

Warm up / About the interviewee:

1. What's your name and age:
2. What is your main occupation?
3. How long have you been involved with Renewable Energy initiatives(RE)?
4. How long have you been involved with bioenergy?
5. What would you say were the main motivations to get involved in a cooperative/community/federation?
   5.1. Would you say the motivations were in the order you described or different
6. What would you say were the largest barriers in getting involved in a cooperative / community / federation?
   6.1. Which of these (barriers) would you say were the most significant?
7. What is your role in the cooperative/community/federation?

About the Cooperative/community/federation:

1. How would you describe your cooperative/community/federation? (Answer example: We have x number of members, it has started in xx by xx,)
2. How much does one have to pay to join the cooperative/community/federation? (Answer example: xx €)
3. Which types of bioenergy/RE are you or your cooperative/community/federation actively using? (Answer example: consuming biomass, natural gas, etc. to produce community energy, selling pellets to members)
4. How is the biomass sourced? (Answer example: locally, etc.)
5. How far does the biomass travel to be sourced? (Answer example: xx km.)
6. Could you tell us the price per ton (€/t) regarding the harvesting/sourcing/ buying of biomass? (Answer example: xxx €/T per…)
7. How is your Cooperative/community/federation funded? (Answer example: public, public and private, private initiative)
8. Would you know how much is needed in average to start the operation of the cooperative/community/federation? (investment needed for each case: e.g. investment of pellet plant, of boiler, of wind park or solar park, depending on the interviewed case)
9. What is the main use of the energy produced? (Answer example: electricity, heating, cooling, etc.)
10. Which technology is implemented in your cooperative/community/federation? (Answer example: pelletisation, gasification, combustion, just commercialization of biomass, etc.)
    10.1. Would you know the capacity of the technology? (Example: MW of boiler, perhaps tons of pellets produced etc., based on each case, etc.)
11. What are the current benefits in being part of your cooperative/community/federation?
12. (Answer example: have a voice, have representation, the money will be reinvested locally, avoiding profit shareholders)
13. How do the cooperative/community/federation members exchange information/communicate with each other? (Answer example: newsletter, specific working groups, participate in general assembly, Telegram, Twitter, email, etc.)
14. How would you describe expansion plans, if any? (Answer example: member mass and offering more of our energy generation, want to be self-sufficient in electricity, offer new services, helping people renovate, insulate their homes…)
15. Could you please share any success story/positive experience you might have had dealing with bionergy/RE? (Answer example: created more community, people have become more aware about opportunities, creating jobs, have improved opportunities in rural areas, etc.)
16. Could you please share any challenge/big learning story you might have had dealing with bionergy/RE? (Answer example: Financial disincentive, lack of biomass availability, technical reasons, regulatory framework)
17. Could you please share any Economic impact of cooperative on members and local community? (Answer example: profits/ savings to members, and as you also mention: job creation etc.?)
18. Could you please share any environmental impact of the cooperative? (Answer example: GHG savings, improvement of local air quality etc.)

Appendix 3: Online Survey

English

Default Question Block

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, 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.

The project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 952930.

Please select the country you reside from the list below:

In what type of region do you live?

- ○ Rural
- ○ Urban
- ○ Peri-urban

Which one is your main affiliation?

- ○ Member of Renewable Energy Source Cooperatives (RESCoops)
- ○ Policy makers / Member of Local authority group / Energy Federation

If you belong to a RESCoop, would you please share your RESCoop's name?

Could you please share the name of the institution with which you are affiliated?

Do you know if there are any Renewable Energy (RE) Cooperatives active in your region?

- ○ Yes
- ○ No
- ○ Do not know

What RE sources do you use? (mark all that apply)

- [ ] Solar energy
- [ ] Wind energy
- [ ] Hydro energy
- [ ] Tidal energy
- [ ] Geothermal energy
- [ ] Biomass energy
- [ ] Do not know

What RE sources do they use? (mark all that apply)

- [ ] Solar energy
- [ ] Wind energy
- [ ] Hydro energy
- [ ] Tidal energy
- [ ] Geothermal energy
- [ ] Biomass energy
- [ ] Do not know

What is the focus of RE Cooperative (s) energy production in your area?

- [ ] Power
- [ ] Heat
- [ ] Cooling
- [ ] Do not know

Would you be interested in including bioenergy in your RE Cooperative?

- ○ yes
- ○ maybe
- ○ no
- ○ we already use bioenergy

Would you support a RE Cooperative in your region to include bioenergy in its mix?

- ○ yes
- ○ Maybe
- ○ No

Which types of biomass resources (feedstocks) can be considered of great potential in your area?

- ☐ energy crops
- ☐ agricultural crop residues
- ☐ forestry residues
- ☐ algae
- ☐ wood processing residues
- ☐ sorted municipal waste
- ☐ wet waste
- ☐ Don't know

General

What would you say currently prevents the further development of RES in your area?

Would you be interested in taking part in an interview related to this topic?

- ○ Yes
- ○ No

Would you like to get updates about the project?

- ○ Yes
- ○ No

Email:

By participating in the survey, you **voluntarily consent** to the collection and use of your information by BECoop as set forth in the **BECoop Privacy Policy**. If you have any questions concerning this privacy policy or the project's data collection practices, you may contact us at contact@becoop-project.eu.

* I have read the **BECoop Privacy Policy** and I agree to the terms and conditions