



D1.4 Definition of community bioenergy heating uptake needs and challenges

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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.

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Project partners



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Abbreviations

BE	Bioenergy
BEC	Bioenergy Community
CEP	Clean Energy Package
EnerCom	Energy Community
ESCO	Energy Service Company
MS	Member States
NECPs	National Climate and Energy Plans
RED	Renewable Energy Directive
REScoops	Renewable Energy Cooperatives
SECAP	Sustainable Energy and Climate Adaptation Plan

Executive Summary

T1.4 provides an overall analysis of the bioenergy heating uptake challenges and needs both at the pilot and EU level, through working groups' sessions and by cross-fertilising the outcomes of T1.1, T1.2 and T1.3. The task leader, GoiEner, supported by the other pilot and consortium partners, led the development of the present consolidated report, which covers three discrete topics:

(a) definition of regional challenges: we provide a set of aspects that have been identified as key challenges for the adoption of community bioenergy in the heating sector;

(b) definition of needs: we deliver the list of identified needs for each pilot region based on the profiling exercise. An attempt is made to categorise the needs of regional stakeholders based on their type, relevance and expertise on bioenergy heating initiatives and activities, highlighting the role of regional specificities in each case;

(c) preliminary definition of intervention areas: insights were used as inputs for a prioritization process targeting specific actions and stakeholders. Thus, this report identifies initial intervention focus areas for the pilot regions.

For the final development of the report, a local consultation process helped us to co-define and co-validate the above with local stakeholders.

All pilot areas were able to identify a set of actions that broadly belonged to 8 intervention areas:

- Raise awareness regarding bioenergy and regarding Energy Communities
- Collaborate with local administrations and lawmakers
- Nurturing local leadership
- Socio-economic benefits for all
- The basics: local resource availability
- A viable and robust business plan
- Keep environmental impact low
- Quality of biofuel and efficient system management and operation

Some pilot regions defined specific actions assigned to different stakeholder groups, others considered the actions from a regional standpoint. Some regions did not have actions in all intervention areas, because there were not critical needs or challenges that required an intervention of such nature.

Although many interventions are region-specific, there are some common elements: greater awareness and understanding must be created of both the potential of bioenergy as a sustainable local resource and of energy communities as a novel instrument to empower citizens in the energy transition. The collaboration with local (in particular rural) municipalities is another common theme. And lastly, all economic actors clamour for legal clarity and stability in order to develop their businesses.

1 Introduction

1.1 Task objective

T1.4 will provide an **overall analysis of the bioenergy uptake challenges and needs both at the BECoop pilots and EU level**, by using outcomes from T1.1, T1.2, T1.3 and contrast them with the judgment of experts and of regional stakeholders, or the BECoop Advisory Board in the case of the EU level pilot.

This assessment will allow each pilot partner to preliminary identify intervention areas to be covered by specific actions. Thus, this consolidated report will help to prioritize what aspects need to be improved or strengthened and what should be the preliminary approach in each field.

For readers not participating in the project, this document should serve as inspiration for their own analysis of needs and challenges and guide them towards specific interventions they could stage adapted to their own region.

1.2 Background information

Previous deliverables of this project whose result feed into this one:

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

A report that presents the identified case studies of community energy best practices as well as the results of the survey on the potential for bioenergy market expansion in existing REScoops.

D1.2: Regional and EU framework and value chain conditions affecting community bioenergy uptake.

A report that analyses the regional/national contexts of our pilot areas as well as at the EU level in terms of investigating the current framework conditions that could act as a barrier or an enabler for the uptake of community bioenergy heating.

D1.3: Stakeholders' perceptions, acceptance levels and needs on bioenergy heating

A report that provides the results of the market research activities of the project and of the respective survey, aiming to provide a thorough understanding of the project's stakeholders along with their practices, perceptions and needs, both at a local/pilot site and EU level.

1.3 Task overview and methodology

T1.4 summarises the results of the entire WP 1 *Definition of community energy application potential in bioenergy heating*. Task related activities were organised in 3 rounds:

Round 1: A PESTLE analysis of regional **needs and challenges based on the opinion of BECoop partners (working groups: 4 regional and 1 EU level)** was performed. Therefore, regional experts were asked to put themselves in the shoes of 12 different types of stakeholders. In order to guide the reflection process, more specific aspects were suggested to the PESTLE analysis, and experts assessed the importance of each aspect: *not important, low importance, high importance, critical importance*. The

“picklist” with these specific aspects is given in Annex I. Additional aspects in a pilot region could be added when deemed necessary. The stakeholders to be contemplated are listed in Annex II.

Round 2: As draft versions of the results from T1.1, T1.2 and T1.3 became available, **the outcomes of Round 1 were reviewed and adjusted when necessary, based on the input provided by the interviews, surveys and workshops.** Specific actions were described to address each of the needs and challenges that had been identified as “*critically important*”.

This list turned out to be very long in most cases, so some regional pilot partners chose to focus on the critical needs and challenges that affected them, not incorporating other stakeholders’ needs and challenges in the Round 3 analysis.

Round 3: Specific regional stakeholders were invited to comment on the Needs and Challenges analysis and the corresponding actions. After incorporating this final input, the **individual actions for each region were ordered and lumped together into preliminary intervention areas.** These intervention areas were nominally the same for all pilot regions, to facilitate comparison, but the actual content and extent of the actions proposed varies widely, depending on the actual regional needs and challenges, as was expected and intended.

1.3.1 Intervention areas’ indicative clustering

Asides from the needs and challenges’ analysis, all pilot areas were able to identify a set of actions that broadly belonged to 8 intervention areas, as presented below:

1. Raise awareness regarding bioenergy and regarding Energy Communities

A lot of work needs to be done around raising awareness of the potential/benefits of bioenergy. These are often not recognised or poorly perceived. Some strong-rooted prejudices in favour of the status quo (fossil fuels, their commodity and reliability) must be overcome. Few people are aware of BE as a viable and a sustainable alternative. There are strong lobby forces at work. As a result, preconceived ideas about the negative impacts of BE persist, but need to be dispelled. Moreover, many citizens have been led to rely on fossil-fuel based systems and have invested in such solutions for heating their homes. BE-based solutions must be shown to be at least as reliable. Also, appealing to social and environmental consciousness has proven to be effective in changing people’s behaviour. The survey of T1.3 indicates that many citizens believe that focus should be given to awareness-raising actions related to economic, environmental, and social benefits of community bioenergy heating.

2. Collaborate with local administrations and lawmakers

REScoops understand that they cannot achieve the energy transformation alone, that they have to collaborate with and rely on local support, in particular of local public administrations. Local administrations are concerned about the local economy (employment and welfare) and value chains. Bioenergy can be a facilitator for achieving this. On the contrary, lack of support from local governance is often perceived as a barrier by citizens.

Also, local public administrations can be great allies for constituting bioenergy communities, as many of their interests and drivers will be aligned with those of a REScoop. Local administrations have an obligation to reduce their ecological footprint and set an example, and they can “get things done”. Therefore, it is important to establish and maintain fluent communication with public administrations. Convince them to commit to long-term BE project development. This can foster e.g. the

implementation of BE in new facilities in public buildings and in other local entities, which can kick-start the BE service and in turn increase awareness and trust in such solutions by the citizens.

Logistics operations such as collection of biomass, transport, drying and distribution all have their requirements and associated cost. All these activities need to be performed in a way that offers a cost advantage for the raw biomass supplier over the alternative: leaving it behind or burning it in the field. Local administrations such as municipalities and regional development agencies can help with setting up infrastructure for logistics related to bioenergy production (collection centres to solve the non-mobilisation of resources due to fragmentation of private property and lack of exploitation infrastructure in some areas, ensure supply of biomass, storage areas etc.). They can provide terrain, technical support and other facilities.

On a national and regional level, it is important to have a legal framework that is favourable to EnerComs (with less bureaucracy), shared renewable-energy distributed systems and transposition of European directives.

3. Nurturing local leadership

Anchoring a bioenergy project to the local community is of primary importance. Therefore, it is essential that the project is carried by citizens and actors who are knowledgeable about and are part of the local community. However, setting up and managing an energy community requires time, effort and specialised knowledge, both technological and administrative/legal. Given the low level of knowledge around bioenergy and energy communities, finding local volunteers willing to lead and champion the project can be difficult. Therefore, any such champions need all the help and motivation they can get (from REScoops, or other local sources such as municipal services or Energy Offices) to spread the concepts and to recruit more volunteers to start and maintain an EnerCom.

4. Socio-economic benefits for all

Renewable Energy Communities as defined by REDII¹ are local actors who seek socio-economic and environmental benefits rather than financial profit. The Bioenergy Community (BEC) to be established needs to deliver on this promise and this must be made clear from the start to all stakeholders. Support to the local economy is a prime driver for BECs according to the survey replies of T1.3. Therefore, the BEC must ensure local return on investment. Full BE life-cycle considerations to promote local circular economy must be taken into consideration, as well as the potential to create durable local jobs. It is important to differentiate between the needs and possibilities for urban and for rural areas (D1.3).

Power poverty is often hidden, but nevertheless an existing problem for many families. Vulnerable families or parts of the community may not be visible or easily reachable. It is however the moral duty of REScoops to promote EnerComs that leave no-one behind: vulnerable consumers should be able to participate and benefit despite their economic vulnerability. The BEC must design ways to engage with and reach out to these vulnerable communities. They should be open to all members of society, and any (unintended) barriers to inclusiveness should be removed or at least lowered.

5. The basics: local resource availability

A bioenergy community or service only makes sense if there is an abundance of raw biomass available that can be collected, processed, distributed and consumed locally. It is therefore necessary to first take stock of the local availability of biomass resources, whether these can be extracted economically and sustainably (i.e. without depleting these local resources), and whether they are not competing with other sectors (e.g. agriculture, paper or wood processing industry).

¹ Directive (EU) 2018/2001 <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L2001>

6. A viable and robust business plan

Ecological sustainability may be the main driver for a BEC, but if the service or business model is not economically viable, it will not survive. Therefore, we aim to highlight here some of the aspects for a viable and robust business plan. The initial investment for biomass production and distribution, and in particular for consumption and heat delivery (in the case of a district heating network) can be high. Whatever your BE service model, setting up an economic venture which offers employment and relies on technical resources/infrastructures, requires cash up front. Large initial investments in equipment or infrastructure and narrow cost benefits or margins may lead to very long payback periods. This constitutes an investment risk from the start and needs to be controlled. Fortunately, there are a large variety of financial instruments and aids (from tax reductions to support programmes). Someone will need to identify and study them, experienced REScoops can usually help with this.

Ensuring sufficient demand from the get-go by convincing enough people to switch from fossil fuels to BE is a great way to cover and distribute fixed operating costs and keep up with investment down payments. What is the minimum number of users required to start off with? And related to this, dimension your system correctly. Make sure that the heat/cold generation and storage capacity is adequate to serve the needs of your customers/community. Over-dimensioning leads to loss of efficiency and makes the service expensive and wasteful. On the other hand, if the capacity is too low, then you will not be able to expand your community and accommodate new users. Is your solution easily scalable? Also, take a holistic energy approach when designing the BEC project: increased energy efficiency due to system and home renovation, fluctuating energy prices, new technological solutions (e.g. heat pumps, district heating) all influence the BEC's business model. After all, the goal is to reduce overall energy consumption. BE is more sustainable than fossil fuels, but its supply is limited in itself and it has an impact on the natural environment.

Having a variety of different types of (local) actors in the value chain, may bring stability to your business and keep more of the benefits in the community. It will also give you broader local support. However, this means that all actors must feel that they stand to benefit fairly from the business and that their value chain role is viable. This should also be a part of a sustainable and clear business plan.

As we mentioned above, many people are willing to accept a somewhat higher cost for "doing the right thing", i.e. act sustainably and be seen to do so, especially if many of their peers do this. However, at least as many people will not. So you should be competitive enough against other existing heating solutions, not only on cost, but also on convenience, as you will have to fight against the status quo (primarily electricity and natural gas according to T1.3 survey results).

7. Keep environmental impact low

Since ecological sustainability is a goal or a requirement for many of the stakeholders questioned, it is imperative that the BE heating solution helps at reducing the life-cycle GHG emissions and does not negatively impact air quality. No impact does not exist, but we must try and keep environmental and climate impact as low as possible. Climate protection is a prime driver for citizens as we have learnt from the survey result of T1.3. This means of course that the BE service and community has to adhere to existing regulations. However, in many MS the regulatory framework is in turmoil, with increasing limitations on burning BE, this causes uncertainty regarding the technical and economic conditions for establishing a BE service. We must anticipate and be able to handle this uncertainty.

8. Quality of biofuel and efficient system management and operation

All actors participating in the value chain have a shared interest in the fact that the quality of the product and service are high, and that the entire system is run and maintained efficiently.

2 Pilot-level analysis

This section describes, for each pilot region, the results of the **needs** and **challenges** analysis and a **preliminary definition of intervention areas** to address these.

2.1 Spanish pilot area

Lead Pilot partner: GoiEner (GOI), an existing RESCoop that focuses on electricity distribution and generation from RE sources and now aims to expand its activities to bioenergy heating.

The Spanish pilot area is restricted to roughly the autonomous community of Euskadi and Navarre, the operational area of GOI. GOI fosters RE in its region through a people-centered approach. GOI is also a co-leader of the Spanish RESCoop federation UNION DE RENOVABLES (including 19 RESCoop members). It has more than 11.000 members (8% comprised by municipalities, SMEs, associations, etc.), while its broader region covers 70 municipalities and 2.8 million people. The two main activities of GOI are energy billing, energy trading and investment in RE projects.

2.1.1 Regional needs and challenges

Spanish Pilot area needs

A total of 59 needs across all 12 types of stakeholders contemplated were identified as “critical” during the PESTLE analysis and subsequent rounds of information captured during the surveys, interviews and stakeholder consultations. We will try to summarise this information here.

One of the most critical needs, across all economic stakeholders, is that of a stable and favourable legal framework, from the transposition of energy communities into Spanish national law, to clear a definition of the conditions under which local biomass is considered a renewable resource, including a criterion for proximity. Although air quality regulation is a general concern, it was not highlighted as a critical issue, because all stakeholders interviewed agreed that the present standards are amply met by modern equipment.

As actors of the social economy, it should come as no surprise that out of the 16 critical needs identified for REScoops during our analysis, more than half fall in the social and economic categories. Gaining support and critical mass from citizens and administrations alike to start and grow, as well as making sure that the business is viable in the short and long term and can get funded are all key for any REScoop or any new service or venture it would like to launch. Of course, sustainably sourcing local biomass is also of paramount importance.

Local authorities and municipalities are the stakeholders with the second most critical needs: 13, fairly evenly distributed across political, legal, economic and social aspects. Many of these needs arise directly or indirectly from the requirement to comply with sustainability, climate and energy legislation, without hampering development. In particular, in rural areas, lack of quality employment and rural flight are concerns. At the same time, the Basque Government is pushing natural gas as a “transition” fuel, outcompeting biomass in infrastructure availability and convenience of use, especially in urban areas.

For the year 2030, the Basque Autonomous Community law 04/2019 sets the following goals that would need to be achieved by each public institution:

- Reduction of energy consumption: 35%.

- Share of renewable energies: 32%.
- Purchase of 100% renewable electricity
- 40% existing buildings achieve energy rating B

From its side, the Navarre government sets the following targets for its 2030 strategy:

- Reduce net emissions of CO₂ and other greenhouse gases by at least 45% by 2030 and 80% by 2050 compared to 2005.
- Buildings with a floor area higher than 500 m² that are newly constructed or undergo a complete renovation or change of use, shall install heating or hot water systems based on renewable energies prioritising biomass to cover at least 50 % of the demand.
- By 1 January 2030, all collective housing buildings, including public ones, in Navarre, must have a class "C" energy rating.

These energy goals might also be considered when defining a municipal Sustainable Energy and Climate Action Plan (SECAP), or through different local actions in order to meet them. However, in most of the cases municipalities need to approach other topics related to sustainable development goals apart from energy issues, so given the positive externalities of BE projects boosted by citizens, all these topics could be targeted in the same project in comparison with other renewable energy sources.

Local authorities or municipalities play a key role and could serve as lighthouses not only in the promotion of BE heating solutions but also for empowering citizens in the democratisation of the energy sector. Therefore, municipalities and REScoops are natural allies as they share similar needs and goals, and this will become very clear when we look at the intervention areas.

The critical need for biomass owners, other than legal, is the need for having access to a local biomass logistics centre where the biomass can be stored and processed.

They share this need with biomass management companies, who in addition feel the necessity of access to assured good-quality biomass, sustainably managed the resources, and matched biomass supply and demand.

Equipment manufacturers as well as ESCOs and installers, mainly need stability legislation and regulations in order to invest in the development of their technology and business and be competitive. Even biomass associations point to the legal stability as their most important need, or that of their members.

For the general public, for investors and for NGOs, none of the needs were valued as critical. This might be surprising and might be due to the composition of the panel of experts, but also to the inhomogeneity of these groups. Either way, it can be safely assumed that any needs of citizens are represented by their delegates in democratic institutions such as REScoops and local administrations, and that those of investors are voiced by market actors.

Spanish Pilot area challenges

A total of 50 critical challenges were identified across the 12 stakeholders considered. None of the challenges were found to be critical for citizens, investors, manufacturers and researchers-academia.

21 of the critical challenges are attributed to REScoops, 14 of which are socio-economic in nature: they are related to convincing citizens and administrations of the benefits and feasibility of bioenergy, to breaking preconceived ideas and to overcoming lock-in to incumbent actors on the heating market

(gas operators, primarily). Another aspect is finding local volunteers willing to dedicate time selflessly to initiate community initiatives that are democratic and inclusive, without forgetting the more vulnerable groups in society (e.g. fighting power poverty). Most of these are addressed by awareness-raising actions and engaging with a broad spectrum of local actors. Ecological and technical concerns are of course not overlooked: making sure that the solutions offered are really delivering on sustainability, with improved indicators compared to existing solutions, requires monitoring, evaluating and communicating.

Here also, municipalities and local administrations are the stakeholder group with the second largest number of critical challenges: 12 in total, touching all 6 facets of the PESTLE analysis. Again we see a fairly strong correlation with those challenges identified by REScoops, so again, the interventions are aligned with this stakeholder.

ESCOs and installers pointed out 9 critical challenges, most of which are technical, and economic in nature: the initial investment is high and kick-starting a service with insufficient or unknown demand can be a risky business. Offering quality and efficiency in operations and maintenance under these conditions can be challenging. The fact that the bioenergy solutions are little known and little used add to this situation.

Biomass owners should live up to the ecological challenge of sustainably managing their resources, not burning residue in the field as if it were waste.

Biomass management companies face primarily technical challenges: maintaining biomass and feedstock quality, overcoming the seasonality of the available resources, efficiently managing complex logistics operations and being able to scale up or down as is required.

The crucial challenge for national policymakers is to transpose the REDII directive and define the legal framework for the creation of energy communities that can serve as a truly democratic instrument for a just and sustainable energy transition, that cannot be hijacked by actors with purely profit-seeking interests.

Only one challenge (and no needs) was identified as having critical importance. This may appear surprising, but it has to be taken into account that there are many kinds of NGOs with widely varying goals. It is therefore difficult to define a common set of critically important needs and challenges. It was found that they mostly converged on one aspect that is highly relevant for this analysis: environmental concern. Environmental concern is common amongst most NGOs and they are working hard to keep this in the public eye and on the political agenda. For the purposes of this project, this can be a two-edged sword: some NGOs recognise bioenergy as a sustainable, low-impact alternative for residential heating, others are against any kind of destruction of biomass for energetic purposes. We deliberately focus on the first kind as they are allies of the BECoop project.

The main task of trade and industry association is to inform the general public and policymakers, so as to create a climate that is favourable for their members: the businesses in their sector. This means that they will try to shape public opinion or highlight aspects in the public debate that are most likely to further their member's interests. Bioenergy can address ecological, social and economic issues as a viable and a sustainable alternative for fossil-fuelled heating. When assessing different variables for selecting heating systems, environmental concerns are not commonly considered first. This is due to not implementing a Life-Cycle Analysis approach or not internalising the environmental impact of different alternatives. Bioenergy must be competitive enough against the rest of heating solutions. A sustainable BE solution based on local resources, means that it should not deplete these resources nor jeopardise the functions of forests as reservoirs for biodiversity and natural carbon sinks.

2.1.2 Definition of intervention areas

The needs and challenges addressed in the previous sections are addressed in the following 8 intervention areas. The discussion of actions is further split among the different stakeholders, whenever appropriate.

1. Raise awareness regarding bioenergy and regarding Energy Communities

There is still a lack of awareness regarding the potential benefits of Energy Communities. In some countries, there is a strong prejudice against cooperatives. This is not the case in Spain or in the Basque country, where there is a strong tradition of worker cooperatives (most famously the Mondragon group). However, the Community Energy model is new and not well known, and the notion of individualism is strong. Despite attention in the press and specialised media, Energy Communities are still an unknown and abstract quantity for most citizens. There is also disinformation fuelled by incumbent energy market actors' interpretation of what an EnerCom is. As at the time of writing there is still no national legal framework for establishing EnerComs, it is hard to dispel the confusion.

Hence it is necessary to increase the level of knowledge amongst the general public regarding EnerComs, their social role and economic activities, how to get organised and participate, and their advantages for potential users and prescribers. In order to illustrate the concept, demonstrate its potential, break down preconceived ideas and convince doubters, successful and representative examples in the local area (lighthouse projects) should be highlighted.

REScoops see themselves as contributors to the local economy and social wellbeing. They think global but act local. They promote a short-circuit circular economy, based as much as possible on locally produced and manufactured products. Energy autonomy is an important driver for citizens according to T1.3 survey results.

The creation process and management of Energy Communities should be assisted in order to become less burdensome for volunteers and promoters. At the same time, Energy Communities need to tread a delicate balance in order to include (and get support from) all relevant actors in society.

The following tasks would have to be undertaken in this intervention area in order to meet the needs and overcome the challenges:

1.a. By REScoops (such as GoiEner):

Run a local awareness campaign emphasising the different positive aspects of both bioenergy for residential heating and of delivering it through a local energy community. This can be done through local meetings and workshops in public spaces (cultural and community centres, libraries, town halls etc.) Involve as many local actors as possible, through local administrations, volunteer groups (or individuals) and other private and public stakeholders. Specific to the province of Alava and the autonomous region of Navarre are the *“concejos”*: local councils below municipal level (hamlets) with direct democratic representation and a certain degree of autonomy. These are considered interesting channels for communication and collaboration. Also, *“mancomunidades”* or commonwealths of municipalities, found in most parts of Spain, provide structures for collaborative local action.

Make sure to stress the economic, environmental, and social benefits for the community, the inclusiveness and social justice of the model. Show (local) success stories that inspire and that people can relate to. Invite others to speak and ask questions. Listen closely to what concerns and motivates them, both individually and collectively.

1.b. By local authorities and municipalities:

Run an awareness campaign oriented at local EnerComs, conveying the benefits of bioenergy. Look for similar initiatives in your area or country, try to invite them to share their experience and identify the most important barriers and provide/publish advice on how to overcome them; share best practices and experiences. This is complementary to the campaigns organised by REScoops, so it could be organised in collaboration.

1.c. By NGOs:

NGO's in favour of small-scale bioenergy should run awareness campaigns directed at citizens and lawmakers about the limited environmental impact of local biomass residential heating, compared to its non-sustainable use for centralised electricity generation. Again, this could be done in collaboration with one of the former stakeholders.

1.d. By energy/biomass associations:

Disclose information and raise awareness for biomass and its heating applications. Create a web page and include an open access tool for calculating the carbon footprint of installations with different fuels (fossil and biomass) in order to address difficulties in capitalising the value of green technology adoption. Compare the emissions generated by each alternative. Promote sustainable ecosystem management considering effects on biodiversity, ecosystem services and climate change adaptation parameters. Raise awareness about the socio-economic and climatic benefits for all, of using local BE compared to (imported) fossil fuels. Highlight the high social cost of fossil fuels and show who really profits from them. In addition: inform on the different financing models in the facilities (public - EVE, IDAE, private - Banks, others), the existence of subsidies for installations and new approaches where the end user pays through savings, Energy Performance Contracts, collective purchases etc. These actions are aligned with actions for REScoops and can be done as a collaborative effort.

1.e. By research centres and universities:

Teach about the potential of bioenergy. Dissemination activities could be carried out, presenting success cases, performing harvesting demonstrations of biomass, validation of biomass, and other support actions in order to visualise the potential of the biomass as a suitable source to cover the energy demands of the residential and industrial sector.

2. Collaborate with local administrations and lawmakers

At the time of writing (August 2021) in most EU countries including Spain, the REDII Directive has not yet been transposed. There is even a risk that EnerComs might be legislated unfavourably for citizens. Local administrations can exert pressure on ("lobby") the lawmakers in their parties. They can also interpret national legislation and prepare public tenders that favour citizen energy solutions over private market actors. Particular to the Basque Country (Euskadi) is that the regional government is favouring natural gas as a "transition energy source" and will continue to support its use and infrastructure for at least 15-20 years. The following actions would have to be undertaken in this intervention area:

2.a. By REScoops (such as GoiEner):

Reach out to local administrations from the start as they can be your strongest allies, both in organising an energy community as well as in providing logistic, technical and financial support. Give them something back: assist them in the elaboration of their SECAPs. Help them with the design of related tenders. Ask them to talk to their colleagues involved in regional and national politics, to promote a favourable regulatory framework for BECs and accelerated phase-out of fossil fuels.

2.b. By equipment manufacturers:

Equipment manufacturers should meet with local/regional authorities and explain to them the importance of having a clear legal framework favourable to bioenergy and to properly develop their business, allowing them to be competitive compared with other energy solutions. So as to leave no misunderstanding about the consideration of locally and sustainably sourced bioenergy for space heating as a renewable energy source, clear legislation about efficiency and emissions of biomass boilers is necessary for all the different types of biomasses, as well as sustainable logistic criteria for the collection of the resources.

In addition, the advantages (economical, environmental, and social) of using local biomass for covering the energy demands of public buildings should be explained. The buildings managed by public administrations form a huge consumer segment for equipment manufacturers. In order to have more impact, associate with ESCOs and installers to carry out this action.

2.c. By ESCOs and installers:

Also ESCOs and installers need a clear legal framework to properly design their business and be competitive versus other energy solutions. This regulatory framework ought to recognise the unique social, economic and environmental contributions that this clean energy generates in the agricultural, livestock and forestry sectors, in particular its unique capacity for job creation and the savings that it induces in the purchase of diffuse GHG emissions and in the prevention of forest fires. So the same actions as described for equipment manufacturers apply to them.

2.d. By policymakers:

Most of the actions are related to a favourable transposition of REDII and to add some proximity requirements to the existing FSC sustainable forest management considerations for defining biofuel as renewable. Policymakers should consult local administrations and regional lawmakers so as to ensure that the legal forms chosen by the Spanish State to set up energy communities are easily accessible to citizens and subject to as little bureaucracy as possible, thus removing uncertainty as to which legal entities can qualify as energy communities. They should periodically review the definition and conceptual framework of energy communities under Spanish law. Proximity criteria (distance between biomass source and end user) should be included for defining biomass from sustainable management forest as renewable. As already explained for ESCOs, policymakers should work towards a regulatory framework with specific considerations which, in addition to the renewable energy aspect, recognises the unique social, economic and environmental contributions that this clean energy generates in the agricultural, livestock and forestry sectors, and in particular its unique capacity for job creation and the savings that it induces in the purchase of diffuse GHG emissions and in the prevention of forest fires.

2.e. By local authorities and municipalities:

Obviously, local authorities should participate and reciprocate in all the recommended actions in this intervention of which they are the target stakeholder. They should keep an active communication with policymakers and national governments in order to share needs/challenges related BE uptake and potential recommendations. They should provide consultation to national politicians for the correct interpretation and transposition of the EU Directive on EnerComs. Once transposed, they should understand the national law and define the perimeter in which EnerComs can be designed according to REScoop principles.

2.f. By energy/biomass associations:

Lobby law- and policymakers to facilitate the process of creating BECs. Associations can brief policymakers by providing consultation to national politicians for the appropriate interpretation and transposition of the EU Directive on EnerComs. They should lobby for the application and enforcement of national and local laws that are favourable to BE. At the same time, they should argue that new laws need to be sufficiently forward-looking so that they do not require frequent revision, as a quick succession of changing laws would create legal uncertainty. These actions provide an opportunity to collaborate with REScoops.

3. Nurturing local leadership:

Despite the Basque tradition of *auzolana* (literally: neighbourhood work or working together in community) in many local communities, social cohesion is low, with volunteer movements few to non-existing, and a lack of perception of the value of the common good. This is particularly true in urban and peri-urban areas. All of this adds to the barriers to setting up collective action (lack of volunteers to dedicate time and effort to create and manage an energy community, preferences for individualist above collective solutions, mutual distrust...) which can be hard to break down. However, once established, Energy Communities are a way to increase social cohesion and can give rise to more initiatives enriching the social capital of a community.

According to the T1.3 survey results, administrative, procedural (energy market integration, legal status, grant application etc.) and legal barriers for establishing BE communities are perceived by citizens in many Member States as high. Again, established REScoops can help volunteers of beginning REScoops and BEC to overcome these barriers and help with clarifying aspects which raise doubt.

The following tasks would have to be undertaken in this intervention area:

3.a. By REScoops (such as GoiEner) and by local authorities or municipalities, preferably in collaboration:

For the Energy Community co-creation process, it takes at least one motivated citizen to start, one local "champion". During the awareness campaigns, REScoops willing to promote local BECs must try to identify such champions, motivate them and carefully attend to their needs so that they can recruit more local support. Municipal services often know these local champions. Map out the community network. Encourage and help them with training material, tools, advice and best practices in as many ways as you can. Empower them to take responsibility for the success of the BEC - it's theirs! Friends of the Earth, REScoop.eu and other NGOs/social organisations provide training courses and material on how to start an energy community. Use examples to inspire.

4. Socio-economic benefits for all

The following actions would have to be undertaken in this intervention area, and again they fall on the same two stakeholder groups, in which they can collaborate and help each other out:

4.a. By REScoops (such as GoiEner):

Although REScoops should have involved as many stakeholders as possible from the start, it is always possible that some have not responded or were not able/willing to participate initially. Make another effort to include local actors who can strengthen the project (additional actors in the value chain) and make sure that vulnerable or disadvantaged groups have not been left behind. Reach out to these through the local contacts or social services.

Make sure statutes consider the inclusive and fair character of the community. Publish easy to understand annual reports with indicators that highlight the socio-economic benefits for the community and how they are distributed.

4.b. By local authorities and municipalities:

Plan the promotion of local RES (through Sustainable Energy and Climate Action Plan (SECAP) for example) considering not only enviro-technical parameters but also impact on local economy and ensure the implementation of these actions by allocating a fixed percentage of the annual budget and getting the approval of the full municipal council to ensure its continuity at the end of the legislature. Also some incentives could be implemented such as property tax reduction for houses with renewable heating or tax reduction for companies delivering renewable heat in the municipality. Consider Models of municipal urban planning regulations where the use of wood construction and biomass heat generation are promoted. biomass heat generation. During the co-creation process of a BEC, involve the municipal social services and regional NGOs in any energy project in order to identify vulnerable collectives in the community and orient specific solutions towards them.

5. The basics: local resource availability

In the Basque Country, the paper industry is currently the largest user of forest biomass energy. Particular to many municipalities in the province of Alava and the autonomous community of Navarre are the traditional wood allotments (“suertes foguerales”, “loteak”): assignments to registered residents to source forest biomass from nearby commons. This is usually limited to a number of tonnes of wood per household but provides a valuable resource for citizens. They must however cut and collect the wood themselves, which is a burden for many people, who therefore leave this resource unused and, when available, prefer the commodity of natural gas piped directly into their homes.

Although the survey results at European and local level seem to indicate that reducing heating bills is not a main driver, increased cost however could be a barrier for adopting bioenergy. Therefore, the BE-based solution must be stable and at least price-competitive with existing solutions. Controlling access to abundant local resources, with low competition for their use and no incentives for speculation, all contribute to achieving biomass-based thermal kWh-price stability. In fact, according to AVEBIOM the price for woodchips in Spain has been consistently low (see their quarterly reports) compared to gas and other heating sources, whereas pellets and gas cost more or less the same. Gas prices have however increased a lot since February 2021 and at the time of writing (August 2021) is twice that of pellets and foreseen to increase even more over the coming winter months. These factors may make your service more economically attractive and viable in the long run - see below.

The following actions would have to be undertaken in this intervention area:

5.a. By REScoops (such as GoiEner):

Design your bioenergy service around the type of biomass that is abundantly and freely available. Consider quality and limits to availability. Make sure these resources are managed sustainably, monitor and communicate about this at the start and during the life-time of the BEC.

5.b. By biomass management companies:

Balance biomass supply and demand: Biomass management companies should first assess, before starting their business, that the biomass available to be collected in a near radius (less than approximately 30 km for agricultural biomass and less than 60 km for forestry biomass) is enough for amortising their initial investment in the machinery and infrastructure needed. Therefore, a biomass

resource assessment as well as a conversation with the local biomass owners should be had before starting the initiative. And secondly, biomass management companies should guarantee that there are sufficient consumers for the biomass collected, since normally the cost operation to collect the biomass is high, so if they can't sell this biomass in a short period of time their cash flow may be constrained, and external financing may be necessary to cover this situation.

5.c. By local authorities and municipalities:

Set up collective logistics centres and services, together with regional admins or development agencies to relieve farmers and other biomass owners from the tasks of collecting and transport. Promote collection services of biomass resources for commercialisation and marketing through local logistics centres. Develop energy information offices as a one-stop shop for energy issues in order to assist citizens regarding different opportunities. Source supplies, resources and personnel for the BEC as much as possible locally. Show to the community how you keep the benefits in your local community and counteract the flight of wealth (and people). Make this clear in the BEC statutes and annual reports.

6. A viable and robust business plan

The following actions would have to be undertaken in this intervention area:

6.a. By REScoops (such as GoiEner):

Assist the community with the elaboration of a business plan. Provide or contract the necessary expertise for this. Consider start-up, initial investments, funding, evolution (growth and decline), scalability, tolerance under variable market and regulatory conditions, diversification potential... Don't forget to account for the socio-economic benefits to the community, they are positive externalities.

6.b. By equipment manufacturers:

Economically competitive vs other heating solutions: Equipment manufacturers need to develop a technology that should be competitive with the rest of heating solutions, and also take advantage of financial aid instruments to minimize the risk of the initial investment to be done by the consumer. Additionally, raise awareness about the socio-economic and climatic benefits for all, of using local BE compared to (imported) fossil fuels or other renewable sources that are not local.

6.c. By ESCOs and installers:

ESCO should develop and promote business models based on a heat supply service, delivered directly to the end-user and taking charge of all intermediate steps. The price per thermal kWh delivered should be competitive and stable over time, so that this becomes an attractive solution for the consumer.

Match supply and demand: ESCOs and installers should make sure to reach a minimum viable number of consumers for the biomass collected, since the high investment of the installations needs to be amortised, so if they can't sell this energy in a short time period, their cash flow may be constrained, and external financing may be necessary to cover this situation. Additionally, to find the correct balance, ESCOs and installers should dedicate considerable effort to determine the demand needed in order to properly design all the installation (power and rest of the equipment) and avoid oversizing, which implies higher return of investment, and malfunctioning in some cases (worse emissions and efficiency of the boiler).

Aim to be economically competitive vs other heating solutions²: ESCOs and installers need to install a technology that should be competitive with the rest of heating solutions, and also take advantage of financial aid instruments to minimize the risk of the initial investment to be done by the consumer. Additionally, stress the socio-economic and climatic benefits for all, of using local BE compared to (imported) fossil fuels or other renewables that are not local.

6.d. By local authorities and municipalities:

When helping the local BEC to set up, assist them by investigating all the different mechanisms that are available for initially funding the activity. Set up a realistic business plan which foresees sufficient revenue streams in order to pay off debts and pay out wages and all other operational costs. Get some experts to look this over. Be aware of the risks of the investment and communicate them to the community members and investors. Ensure that your BEC is robust enough and can grow to provide more than one service, rather than relying on an ever-expanding BE market. Consider future scenarios.

7. Keep environmental impact low

In many MS the regulatory framework is in turmoil, with increasing limitations on burning BE, this causes uncertainty regarding the technical and economic conditions for establishing a BE service. We must anticipate and be able to handle this uncertainty. This does not seem to be the case in the Basque Country, at least not for the moment.

The following actions would have to be undertaken in this intervention area:

7.a. By REScoops (such as GoiEner):

Study and monitor GHG emissions and other potential environmental impacts of the BEC. Strive to minimise it. Communicate about it and compare it to the alternatives. Be prepared for possible changing regulations.

7.b. By biomass owners:

Provide sustainable management of resources: Biomass owners should avoid insufficient forest management or the traditional practices of open burning of the biomass resources in the field. In this way they should encourage the collection of these resources (on their own or by others) to give it a second life, thus contributing to the circular economy of their holdings. Complementary, and related with the forestry biomass, biomass owners should work on the certification of the forest according PEFC, FSC or other criteria in order to ensure the following aspects:

- That all the biofuel comes from forests managed following the sustainable criteria of these certification schemes.
- Guarantee traceability of the resource, indicating the local origin of the resource even giving details at province level.
- Promote cooperative forest management approaches in order to group the existing fragmented property around common targets and allow not only private benefits but also environmental positive impact due to a more holistic approach.

² Natural gas prices in Europe have more than tripled during the first 9 months of 2021. An analysis performed by AVEBIOM, the Spanish Biomass association, shows that the consumer price of pellets and woodchips has remained stable and low for the last 10 years. See <https://www.avebiom.org/biomasanews/calderas-estufas-y-chimeneas-domesticas/combustible-mas-economico-para-calefaccion-espana> or <https://www.energias-renovables.com/bioenergia/calentar-una-vivienda-con-pellets-es-mas-20211013> (in Spanish)

7.c. By biomass management companies:

Sustainable management of the resources: Biomass management companies should obtain biomass that comes from sustainable operations. These sustainable operations are defined in the article 29 of the REDII. Also, there are some certifications of the sustainable management of biomass as for instance SURE (<https://sure-system.org/en/>) that should be considered to have if you want to commercialise your biomass to some consumers (currently installation of solid biomass higher than 20 MW or biogas plants higher than 2 MW). Additionally, they can work on the certification of local value chain based on PEFC, FSC or other criteria in order to ensure the following aspects:

- That all the biofuel comes from forests managed following these sustainability criteria.
- Possibility to guarantee a traceability of the resource, indicating the local origin of the resource even giving details at province level.

7.d. By equipment manufacturers:

Air quality and efficiency standards: Equipment manufacturers need to analyse the parameters indicated about air quality and efficiency of the biomass boilers in the Ecodesign Regulation. They need to achieve these parameters, so firstly they should audit their equipment (it can be done by themselves or by other companies) and if some optimization should be done, they should assess how it should be implemented to comply with the Regulation.

7.e. By ESCOs and installers:

Air quality and efficiency standards: ESCOs and installers must require boiler manufacturers to make boilers compliant with the Ecodesign Regulation, and they should only install boilers that comply with this regulation. Thus, the technology used must fulfil the air quality and efficiency standards.

7.f. By local authorities and municipalities:

Monitoring and control - Environmental impact: When defining road maps for more green heating solutions, performing a technical study to optimize the dimensions of the equipment and delivery system (or hire professionals to do this for you) seems to be critical. The first step for improving energy systems performance/environmental impact is to start a monitoring process to consolidate all this information (energy panel), covering not only energy performance of public buildings but also the impact of current energy systems (CO2 emissions).

It is the responsibility of each municipality to boost BE projects and to set a precedent that could improve social awareness in terms of air quality affection for BE projects, encouraging others to follow suit. Thus, defining criteria one step further beyond the regulatory framework regarding air quality standards in the tendering process or in any BE project seems to be critical. Some examples could be installing continuous monitoring systems, using criteria based on more restrictive standards such as German BAFA.

8. Quality of biofuel and efficient system management and operation

The following actions would have to be undertaken in this intervention area:

8.a. By REScoops (such as GoiEner):

REScoops and consumer organisations have a common interest in the fact that heating distribution systems and thermo-mechanical systems for biomass supply work reliably and efficiently. This is particularly so if the REScoop runs a DH system. This must be taken into consideration from the design phase through to operation and maintenance. They must exert pressure on equipment manufacturers

and maintenance actors. Build up internal technical expertise for maintenance and correct operation of equipment. Share experiences with peer organisations and federations. Report to authorities in case of non-compliance with regulations.

When the REScoop supplies biomass feedstock to its members (woodchips, pellets, briquettes...) it needs to ensure that it is of consistent good quality. It has to ensure that transformation processes (e.g. chip size and humidity) and equipment function correctly. Monitor quality of incoming material from providers (e.g. tree-type, humidity and purity for forest biomass).

8.b. By biomass owners:

Biomass owners need logistic centres or storage areas, in order to remove the biomass from their fields and avoid some traditional practices such as open burning. It is important to remark that many biomass resources are seasonal, so their collection should be carried out in a short period of time, therefore a biomass logistic centre or storage areas are needed to suitably exploit the local biomass without causing problems to the future activities to be carried out on the fields, for growing the new crop or to prevent fires. Biomass owners who already own logistical equipment, can collect the biomass and sell it to the biomass logistic centre. If not, they can contact a biomass logistics operator to withdraw the biomass from their field free of charge, as this saves the biomass owner the effort of what to do with the material and the logistics operator obtains a profit by selling the harvested biomass.

8.c. By biomass management companies:

Biomass management companies should know the target sector they want to distribute the biomass to and the fuel characteristic required by these clients. This will depend on the boiler installation where this biomass is going to be consumed. Some of the characteristics to have in mind are: fuel size distribution, the moisture content required, the amount and composition of ash of the biomass, etc. It is important to have a good overview of your clients in order to ensure the proper biomass type and quality. There are several quality certification schemes such as ENPlus or Biomasud that could be considered to have a guarantee of the quality of your biomass. As a general rule it could be said that:

- Rural and urban areas below 1 MW installations need more processed biofuel such as pellets in order to ensure biofuel quality and reduce issues with particle emissions, storage or logistics.
- In case of district heating above 1 MW with a central heating facility placed in the outskirts, woodchips could be better but with specific limitations related to using debarked wood or following specific standards.
- Industrial sectors with big consumers do not require highly processed biofuels, since normally they can handle cheaper feedstock in their more robust boiler.

It is critical to set up logistics centres to fulfil the following functions:

- A place to store the biomass that will be used for biofuel production close to the consumer.
- A place to store the biofuel and ensure availability matching local resources with nearby heat demand.
- A place to store public woodlots collected by local biomass management enterprises in order to facilitate the use of these resources by citizens.

Logistics centres provide the link between biomass owners and consumers and their presence will attract more actors to the value chain. Biomass normally has low density and the amount that can be collected per hectare is low (mainly true for agricultural biomass), thus the logistic operations are key to having a profitable business. Biomass management companies should assess the suitable way of carrying out the logistic operation from the field of the biomass owner to their clients. The more operations that have to be carried out, the higher the final cost of the biomass, so a balance should be found between the quality to be ensured and the operational and investment cost to be carried out. Also, consideration of slopes and orography of the terrain should be taken into account when

calculating exploitation potential (when the forest is not for productive use, the accessibility is worse and the extraction costs increase, so these are important considerations).

Also, some biomasses as for instance the agricultural biomass, are generated in a certain time of the year, so biomass management companies have the challenge to collect a huge amount of biomass in a short period of time, thus they should assess how to optimize the use of their machinery and/ or if more machinery is needed for the collection operation (if it is profitable).

8.d. By equipment manufacturers:

Equipment manufacturers should guarantee the reliability of the equipment that should be used for covering energy demands with the use of biomass. This reliability should be the same as other renewable energies and current technologies worked with fossil fuels. It is important that the reliability of the technology and the maintenance to be done does not imply a barrier.

8.e. By ESCOs and installer:

Similarly, equipment manufacturers, ESCOs and installers should guarantee the reliability of the equipment that should be used for covering energy demands with the use of biomass, offer regular maintenance and rapid assistance in case of incidents (after-sales customer service). This reliability should be the same as other renewable energies and current technologies worked with fossil fuels. It is important that the reliability of the technology and the maintenance to be done does not form a barrier. In addition, ESCOs and installers need to ensure that the solid biofuel used is suitable for the biomass boiler used (or other valorising technology) and all the complementary equipment, as for instance feedstock systems. The reliability of the installation should be guaranteed in order to avoid bad experiences associated with the use of biomass.

8.f. By research centres and universities:

It is important for them to keep up-to-date about the necessities of the sector, being in continuous communication with different stakeholders in order to have an overview of the main challenges to be faced (for example some stakeholders show the importance of performing comparative studies, including positive and negative externalities, of the bioenergy solutions vs. other thermal technologies such as heat pumps). These centres should investigate the different ways to solve these needs, and for instance in order to reduce the risk of this research, these centres can appeal to programs that finance research and development work at both the European and national levels.

Concluding remarks

This concludes the needs and challenges analysis and the preliminary definition for the Spanish pilot area. Of these, the actions of the first two intervention areas (raising awareness and collaborating with local administrations are, at least from the point of view of a REScoop, the most important ones: getting started by involving citizens and relevant local actors is key. GoiEner has been talking to local communities during the warm-up events, both online and in person, in the Basque region, from larger cities like Vitoria-Gasteiz or Pamplona, to small towns in rural areas such as Leitza, Balmaseda or Murgia, or in more industrialised areas such as Sestao and Lezo/Renteria. In addition, and in parallel to the activities of the BECoop project, GoiEner is presently helping 8 local communities form their own local renewable energy communities, irrespective of the nature of their renewable energy source or activity.

This preliminary definition of interventions will therefore be used as a blueprint for specific actions to be carried out during the remainder of the BECoop project and beyond as new BECs are piloted in the GoiEner operational region. It can also be used and adapted by other REScoops in Spain or in Europe to suit their particular circumstances and necessities.

2.2 Greek pilot area

Lead Pilot partner: ESEK, An existing pellet-production REScoop that aims to expand its biomass supply chain and extend activities to bioenergy production.

ESEK operates in Karditsa, Thessaly, an area with strong agricultural production. The continuous expansion of the local fossil fuel network threatens the uptake of RE heating solutions such as biomass boilers. At the same time, the region has a great biomass supply chain potential through agricultural, forestry and wood processing industries that can easily support the uptake of bioenergy technologies. While, until recently, local governments had little authority on their heating and energy markets, in 2018, the Greek government voted a law that changes this vision and urges local municipalities, companies and citizens to partake in RE production.

2.2.1 Regional needs and challenges

Greek Pilot area needs

A total of 45 needs across all 12 types of stakeholders contemplated were identified as “critical” during the PESTLE analysis and subsequent rounds of information captured during the surveys, interviews and stakeholder consultations.

The most critical needs, across all stakeholders, refer to economical needs such as the variety of financial instruments and aids like tax reduction and support programmes that are required to enhance bioenergy projects. This justifies another critical economical need which is the competitiveness against the rest of heating solutions. Finally, a regional critical economical need is to ensure local positive impact of the bioenergy project on the development of local communities. Following the economic needs, the second most frequently encountered needs were technical, such as the regional needs for local infrastructure/logistics related to bioenergy projects. Another important set of needs were needs related to social aspects such as lack of social awareness and perceptions regarding bioenergy and legal/administrative needs, regarding the need for a favourable legal framework for REScoops and bioenergy initiatives.

In overall, on a per stakeholder basis, 13 of 45 critical needs refer to REScoops. More specifically, economical, technical and legal needs, mainly related to the lack of local infrastructure / logistics of biomass, the supply chain and the lack of a framework that favours bioenergy. For the latter, there are no significant specific benefits regarding heat production activities (from biomass) or biomass mobilization. The vast majority of Energy Communities already established in the country, target electricity production from photovoltaics or wind farms. This leaves a huge potential area of exploitation for energy communities willing to invest in biomass exploitation.

Local authorities seem to have the second most critical needs, mainly related to ensuring a positive impact on local society from the bioenergy concept and the need to raise public awareness of citizens on bioenergy and its benefits. Such needs are depicted also via the NECP (National energy and Climate Plan) that highlights the importance of the contribution of the Energy Communities schemes, as they will contribute to the implementation of RES and energy-saving technologies investments and contribute to the more active participation of the local community in energy affairs. In this context, the goal is to develop innovative energy offset schemes in energy production and consumption, thus supporting decentralized energy production and management.

The critical needs identified for biomass owners and biomass management companies are based on technical and economic needs, mainly related to the lack of infrastructure and value chains, supply availability of biomass resources and difficulties regarding biomass final transportation, storage and management. Mainly they need to have access to a local biomass logistics centre where the biomass can be stored and processed.

The critical needs identified for equipment manufacturers are based on economical and monitoring needs, mainly related to the disproportionate value added tax (VAT) which is 24% in Greece for processed biofuels (e.g. pellets, briquettes), compared to natural gas (fossil fuel) that has a VAT of 6%. Equipment manufacturers need to ensure that the technologies used in the bioenergy sector are well developed and competitive with the rest of heating solutions. There is a need for equalizing the VAT of biofuels to that of fossil fuels in order to be more cost-competitive with them. Also there is a need related to the lack of an institutionalized body that monitors the emission requirements for biomass boilers. Though there are Eco-design regulations for emission requirements for biomass boilers, it is difficult to control the emissions as there is no institutionalised body to make such inspections mainly in the domestic sector and at small scale applications.

Finally, critical needs identified for policymakers are based on legal and administrative needs, mainly related to the absence of a national framework favourable to bioenergy as also the penalization of non-sustainable management of biomass (e.g. burning of prunings in open-fires etc.).

For the general public, for investors and for NGOs, none of the needs were valued as critical.

Greek Pilot area challenges

A total of 53 critical challenges were identified across the 12 stakeholders considered. 19 of the critical challenges are attributed to REScoops, 15 of which are socio-economic and technical in nature. Mainly related to biomass final transportation, storage and management, economic viability due to high initial investment risk and also about engaging citizens, increasing low social cohesion and improving social misgiving about bioenergy. One main challenge for REScoops is that of defining their organisational structures and their business activities. In other words, it is an important challenge to find the end users of the business activity of the developed REScoop. The REScoop should identify the potential end users of the produced bioenergy. Carefully design its business activity and approach the potential clients to see if they are interested in their products and/or services.

The critical challenges identified for energy Authorities / Municipalities are of social and ecological nature, mainly related to motivating citizens for environmentally friendly solutions, convincing them to take care of the environment and to ensure a sustainable management of resources.

The critical challenges identified for energy biomass associations are based mainly on social challenges, related to increasing low social cohesion for collective actions and improving social perceptions about bioenergy benefits

The critical challenges identified for biomass management companies are based on technical challenges, mainly related to ensuring an optimal fuel quality and addressing the seasonality of certain biomass feedstock. Of course, another critical challenge for these stakeholders is the lack of infrastructure and existing value chain and the difficulties regarding biomass final transportation, storage and management.

The critical challenges identified for equipment manufacturers are based on political and legal challenges, mainly related to engaging the local government to commit to long-term bioenergy

development and to overtake administrative and procedural barriers about legal status, grant applications etc.

2.2.2 Definition of intervention areas

The needs and challenges addressed in the previous sections are addressed in the following 8 intervention areas. The discussion of actions is further split among the different stakeholders, whenever appropriate.

1. Raise awareness regarding bioenergy and regarding Energy Communities

Not everyone is aware of bioenergy as a sustainable alternative to fossil fuels. There is also a lot of confusion over what is biomass and bioenergy. There is a misconception on biomass combustion and the pollution it causes. A lot of people believe that biomass combustion has a negative impact on air quality. This misconception (as also stated in the BECoop T1.3 workshop) is due to the lack of knowledge of people around the term biomass (e.g., they think that biomass is something that is not suitable for combustion, such as burning old furniture or old particleboard, fibreboard (MDF), plywood or melamine products).

Furthermore, the community energy model and energy cooperatives is new and not well known to the majority of people as terms. There is also a strong prejudice against cooperatives from failed implementations of cooperative schemes, thus there is a distrust in the cooperative model.

In this sense, the following actions would have to be undertaken in this intervention area in order to meet the needs and overcome the challenges:

1.a. By Energy Biomass associations:

Focus should be given to awareness-raising actions related to economic, environmental, and social benefits of community bioenergy heating.

- Perform awareness campaigns and dissemination activities, by hosting workshops for informing people on bioenergy and its applications, along with existing best cases.
- Publish guidelines and factsheets for the exploitation of several biomass feedstock towards bioenergy production and best practices on how to harvest and handle biomass based on each type of biomass and end-use.
- Successful cases of bioenergy projects should be advertised and disseminated more to inform people of the right applications of biomass and bioenergy.
- Finally, citizens should be informed about the anti-pollution systems that can be applied in biomass plants that minimize the emissions produced and comply with the emission limits set by the national law. People need further education and training about bioenergy.

1.b. By REScoops:

- Perform awareness campaigns about Energy Communities, how they operate, their benefits and show good examples.
- Raise awareness, through workshops, about the socio-economic and climatic benefits for all, of using local BE compared to (imported) fossil fuels.
- Show to the community how you keep the benefits in your local community.
- Run an awareness campaign informing all stakeholders correctly and transparently.

- Bring people from successful energy communities to speak to local people and show the benefits of ECs and bioenergy community projects.

2. Collaborate with local administrations and lawmakers

Solid biofuels (e.g. pellets, briquettes) have a VAT of 24% in Greece, whereas natural gas and electricity have a VAT of 6%, thus affecting the final heating cost of each medium. In this sense, the promotion of natural gas can hinder the development of bioenergy community projects, where natural gas is easily accessible (inside the natural gas network). Thus, bioenergy has to be more competitive (cost-wise) against other heating solutions.

Further to this, expensive and complicated administrative procedures continue to apply, despite the requirement for directives to introduce simplified procedures for energy communities' projects. In addition, the legal framework for energy communities is complex and fragmented into many different laws and ministerial decisions, which exacerbates the complexity of the process of developing REScoop projects by energy communities and can be a barrier to their establishment.

The following actions would have to be undertaken in this intervention area in order to meet the needs and overcome the challenges:

2.a. By equipment manufacturers (pellets, biogas, wood chips production plants, biomass based boilers, DH plants, Cogeneration plants):

Equipment manufacturers need to ensure that the technologies used in the bioenergy sector are well-developed and competitive with the rest of heating solutions. There is a need for equalizing the VAT of biofuels to that of fossil-fuels in order to be more cost competitive with them and perhaps take advantage of financial aid instruments for the initial investment done by the consumer. Finally, the local benefits that can be brought by the exploitation of local biomass resources towards the production of bioenergy (economic benefits to local people, environmental benefits etc.), compared to imported fossil-fuels, can play a significant role and should be disseminated to the local people.

2.b. By Authorities/Municipalities:

It is very important for municipalities through initiatives such as energy communities, cooperatives, etc., to reach out and create partnerships by involving citizens from vulnerable communities in the biomass value chain. Local communities reduce energy poverty, boost employment and ultimately integrate these social groups within society. There should be supporting actions to promote bioenergy users such as tax reduction for houses and companies with renewable heating. Supporting actions such as heating benefits when biofuels are used or financial support for investing in biomass boilers.

Furthermore, though there are Eco-design regulations for emission requirements for biomass boilers, it is difficult to control the emissions as there is no institutionalized body to make such inspections. Emissions monitoring could be performed by an inspection body of each municipality, after buying appropriate emission control equipment and/or by using certified biofuels (e.g., EN Plus label).

2.c. By Policymakers:

The CAP (Common Agricultural Policy) should be adopted and implemented also in other sectors with biomass resources and relevant initiatives. Clarify the legal framework with the penetration of CAP into biomass and bioenergy initiatives along with its penalties, obligations and benefits.

Absence of a national or local framework favourable to bioenergy requires establishing a regulatory framework with specific considerations e.g. quantifiable outputs, specific measures and support to be adopted towards bioenergy production.

2.d. By REScoops:

Increasing the participation of energy communities in the context of the revision of the National Energy and Climate Plan (NECP) objectives, regarding the minimum installed RES power from energy offset schemes and energy communities as well as accelerating the implementation of existing objectives, including all potential actions of energy communities (such as energy production from RES, enhancing the flexibility of the electrical system, combating energy poverty, energy savings, promotion of electrification, etc.).

3. Nurture local leadership

3.a. By Authorities / Municipalities:

Cooperation should be developed. Local municipalities could cooperate with unemployed residents in the area, in order to exploit the utilization of residual biomass for bioenergy. Local authorities could encourage those initiatives, motivate and empower them.

4. Make sure everyone can reap the socio-economic benefits

4.a. By Authorities / Municipalities:

Bioenergy projects should source mainly local biomass resources and utilize local personnel as much as possible. It should be made clear to the local people that bioenergy, compared to alternative heating solutions (e.g. fossil-based), return benefits to the local community (environmental, economic, social etc.)

It is very important for municipalities through initiatives such as energy communities, cooperatives, etc., to reach out and create partnerships by involving citizens from vulnerable communities in the biomass value chain. Local communities reducing energy poverty, boosting employment and ultimately integrating these social groups within society.

5. The basics: local resource availability

A significant barrier towards the development of bioenergy heating projects mentioned also in the T1.3 workshop (D 1.3), was the complexity of the logistics and the lack of established value chain for the harvesting and treatment of biomass (agricultural residues, forestry residues etc.). The logistics of biomass were pointed out as a significant challenge to deal with, for the successful development of community bioenergy projects.

5.a. By Biomass owners:

Lack of harvesting technologies, transport solutions and storage areas for handling harvested biomass prior to its exploitation. It should set up logistics centres and services, together with regional authorities to support biomass owners for biomass harvesting, haulage and transport.

5.b. By Biomass management companies

In order to have a successful bioenergy community, you have to secure the supply of biomass and its seasonality. Map, track and estimate the type, quantity and quality of biomass resources (agricultural and forestry residues, energy crops etc.) locally available, and how they are treated in the area (burned in open fires, left on soil etc.). Design your bioenergy project around the type of biomass that is abundant, untapped and freely available in your local area.

5.c. By REScoops:

The interventions are the same as those defined for biomass owners and management companies:

The logistics of biomass were pointed out as a significant challenge to deal with, for the successful development of community bioenergy projects. Lack of harvesting technologies, transport solutions and storage areas for handling harvested biomass prior to its exploitation. Set up logistics centres and services, together with regional authorities to support biomass owners for biomass harvesting, haulage, transport.

In order to have a successful bioenergy community, you have to secure the supply of biomass and its seasonality. Map, track and estimate the type, quantity and quality of biomass resources (agricultural and forestry residues, energy crops etc.) locally available, and how they are treated in the area (burned in open fires, left on soil etc.). Design your bioenergy project around the type of biomass that is abundant, untapped and freely available in your local area.

6. Co-develop a viable and robust business plan

6.a. By Biomass management companies:

Biomass management companies should assess and design carefully their logistic operations, from harvesting the biomass to transporting and storing it. Based on the type of biomass to be handled, the logistic operations should be planned carefully, in order to have appropriate equipment for its harvesting (right type of harvester), its transportation (optimised itineraries based on the bulk density of biomass) and storage method (based on type of biomass and its seasonality in order to secure supply all year round). The more operations that have to be carried out, the higher the final cost of the biomass, so a balance should be found. Finally, in all the logistic operations of the value chain, high importance should be put on the geographical characteristics of the area where the operations will take place (e.g. slopes, type of soil, distance of trees should be taken into account in order to select the right equipment and method that can work in these characteristics).

6.b. By REScoops:

A huge challenge for a bioenergy community project and its development would be to find the end users of its business activity. Energy Communities should identify the potential end users of the produced bioenergy. It should carefully design its business activity and approach the potential clients to see if they are interested in its products and/or services. A contract or any formal agreement will strengthen the development of the bioenergy community activity. Take into consideration that new equipment that may be needed to be installed for exploiting biomass or biofuels for the bioenergy production (e.g. biomass boiler in a public building etc.).

Furthermore, loans for energy communities (offset projects) are not easily obtained from banks because they do not incur cash inflows. For this reason, they are basically based on equity. Other ways

of financing need to be formed. Design of a specific financial instrument (e.g. in the form of guarantees or micro-subsidies) for the support and development of Energy Communities.

6.c. By Policymakers:

A big problem in the future development of the energy communities is the article 160 of the law 4759/2020 by which from the 1 of January of 2022, each energy community will have to participate in competitive processes, such as to compete with private investors in bids to ensure the operational support of renewable energy projects. Simply put, there will be no separation between the energy communities and private investors. In this sense, there should be a legal framework favourable to bioenergy and RESCoops (national/local level climate level) in general. There should be a design of a complete and functional exclusive collective model for self-generation and virtual net metering, suitable for small shapes, where its members should not be considered tradesmen of energy and be released from the obligation to initiate work in the tax office (less bureaucracy), as is the case today with ordinary self-producers. The introduction of the new model should be accompanied by a long-term strategic plan and should provide appropriate funding tools, as well as support structures and actions.

7. Keep environmental impact low

(No actions identified)

8. Quality of biofuel and efficient system management and operation

8.a. By research centres and universities:

Research centres and universities should stay in close contact and collaboration with all the stakeholders involved in bioenergy projects and develop and demonstrate new technologies that will support bioenergy communities. Research centres and universities, through national and European projects and bilateral collaborations, should keep up with the latest technological advancements and develop new technological solutions that could support and facilitate bioenergy projects uptake. Through dissemination activities, these entities can present the latest technological solutions available in the market to the interested stakeholders by presenting success cases, demonstrating harvesting of biomass technologies, validation of biomass activities and other support actions in order to visualise the potential of the biomass and the benefits of bioenergy.

2.3 Polish pilot area

Lead Pilot partner: Oborniki Slaskie Municipality (OBS), A municipality that leads the development of a new RESCoop on bioenergy heating in a region where both community energy and RE heating currently have a very low penetration.

The Oborniki Slaskie commune is located in the north-eastern part of the Lower Silesia voivodship. The rural parts of the commune are covered by forests indicating large availability of biomass in the form of briquettes, wood chips, straw, wood. In terms of heating, there is no local heating network and buildings use boilers with fossil fuels. The predominant type of heating is coal, covering over 70% of buildings. In 2019, OBS joined the Coalition for improving air quality of the ITI Municipalities project, where old coal-fired heating systems would be replaced.

In the Polish region, the energy transition is a necessity that must at the same time become an opportunity for investments, jobs, reduction of energy production costs (and thus fuel and heat prices), as well as reduction of emissions and improvement of the natural environment. The persuasion of moving away from fossil fuels indicates that the energy mix of the Polish economy will be based on diverse sources, mainly: sun, wind, biomass and water. Biomass, used in a balanced way, can solve the problem of effective decarbonisation of the Polish energy sector in the setting up of energy communities. The involvement of local communities in the energy transition is gradually widespread in western Europe. In Poland, however, there is only one acting cooperative, the question is why new ones are not being set up?

2.3.1 Regional needs and challenges

The energy balance in Poland is based on fossil fuels (mainly coal) and the transformation of the economy to a low-carbon model will require great efforts on the part of the citizens, various sectors of the economy and regions, whose functioning is largely dependent on the use of high-emission fuels. In the case of Poland the cost of achieving the EU's climate targets will be higher than the EU average due to a different starting position and high investment needs. In Poland, more than 50% of households are directly or indirectly heated by coal. Therefore, it is important to ensure that the energy transition is evolutionary and not revolutionary, which will allow its costs to be spread over time – source National Reconstruction Plan 2021.

The development of the use of renewable energy sources (RES) in the region is perceived mainly as an activity reducing the environmental burden and increasing the country's energy security. This is of particular importance in the situation where the Polish power industry is based approximately 90% on coal, therefore the diversification of electricity generation sources is extremely important. Likewise, it is necessary to change heating systems and heat production processes to more environmentally friendly solutions.

During the analysis carried out as a part of task T1.4, during research, interviews and consultations with stakeholders, a total of 75 needs were identified, out of which 20 key actions were selected. This allows for better management of the list of needs and proper definition of key activities. The most important critical challenges are outlined below.

It is crucial to undertake coherent actions of a strategic, legislative, information, technical, control and financial nature at the national, provincial and, above all, local level.

One of the most critical needs, in relation to all stakeholders, is the need to initiate information and educational campaigns related to the issues of air protection in order to increase the awareness of the

inhabitants of the region, village leaders, members of town councils, residents of housing communities, representatives of housing co-operatives, representatives of local governments, representatives of non-governmental organizations (NGOs). There is a need to disseminate knowledge among the local residents by conducting educational and information activities, informing the public about the current air quality and transferring knowledge about the benefits of establishing cooperatives and energy communities, as well as maintaining constant contact with interested parties (local residents, local self-governments and other social environments). The language used in the campaigns should be non-specialized, more understandable and accessible to residents, which will inspire confidence and proper understanding of the subject.

Moreover, it is necessary to increase the interest of local authorities - mayors, voyts, members of town councils, representatives of municipalities and poviats and village leaders by organizing awareness raising meetings in the field of bioenergy, air quality, energy cooperatives, the necessity of fair energy transformation and the fight against energy poverty. Developing the right attitude on the part of the authorities, especially those who are in close contact with local residents, is essential for achieving success.

Lack of cooperation in this area forms a barrier to the development of similar projects, therefore it is necessary to start a discussion on the possibility of mutual cooperation.

What's more, the legal system in Poland currently does not favour energy cooperatives and has many restrictions in the context of their development – high threshold values and the inability to re-sell energy. There are no detailed legal regulations as to how a cooperative would account for the energy produced. Lack of stabilization of legal regulations which causes chaos in the sector accounts also for inability to create a long-term and safe plan for investing in green energy for the residents and the entrepreneurs. The RED II directive is not properly implemented. With the current legal assumptions, issues related to the establishment of energy cooperatives are difficult, which also results in the exclusion of entities from potential support systems.

An important need is to increase the electricity and heat supply security, to improve the efficiency of energy infrastructure, to optimize the use of locally available raw materials and resources, and to reduce the negative impact of energy sector on the environment. Consequently, it is crucial to promote independent electricity and heat generation in small installations (decentralization and diversification of energy production).

There is a need for balanced treatment of all technologies and for rewarding those technologies with high but unused development potential by creating the so-called local value-added chains, a. o. by economic activation of rural areas, increasing employment in local communities and economic units in the agricultural and renewable energy sector. There is also a need to stimulate the development of local businesses related to the use of locally generated heat so as to keep high air quality standards and minimize the cases of exceeding the permissible pollution levels.

In the Lower Silesia Voivodeship, there are three anti-smog resolutions in force: the *Wrocław agglomeration area resolution*, the *resolution applicable in the health resorts in the voivodeship* and the *resolution covering the remaining part of the province*.

On 30 November 2017, the Sejmik (local self-government body) of the Lower Silesian Voivodeship adopted a resolution on restrictions and prohibitions on the operation of balanced treatment of all technologies fuel burning installations (the so-called anti-smog resolution).

All residents of the Lower Silesia Voivodeship will have to adapt to the regulations. It aims to improve air quality by introducing bans and limitations in the scope of fuel used for heating and heating installations for businesses and households.

From July 1, 2018 it is prohibited to use

- lignite and lignite based solid fuels,
- loose hard coal with a grain size of less than 3 mm,
- coal sludge and coal flotation concentrates, i.e. fuels with a particle size of less than 3 mm, and mixtures produced with their use,
- solid biomass with a moisture content of more than 20%.

The resolution does not completely ban the use of hard coal, but introduces certain restrictions and emission requirements, namely:

- from July 1, 2018, new boilers, stoves and fireplaces must meet the emission requirements for solid particles (dust) of no more than 40 mg/m³,
- from January 1, 2024, it will be prohibited to use non-class installations that do not meet the requirements of the minimum dust emission standards according to PN-EN 303-5: 2012,
- from January 1, 2028, it will be prohibited to use installations that do not meet the dust emission requirements for at least class 5 (the use for class 3 and 4 boilers and heating devices will be no longer allowed).
- class 5 boilers are not subject to restrictions - they can be used all the time.

The interviews and inspections conducted by the employees of the Municipal Office from the Department of Environment show that the biggest problem in the household and communal sector is the use of fuels of inadequate quality in heating devices that are not adapted to this purpose. The burning of hazardous and environmentally harmful materials with a high calorific value (e.g. municipal waste, plastic bottles or tires) is also a big problem. These behaviours often result from ignorance of the issue of environmental pollution, but also from insufficient public awareness of the size of the problem. An important issue is energy poverty, which is widespread in rural areas (but also in towns and cities) and the lack of a sufficient number of financial instruments for corrective actions in the housing and communal sector (especially for the poorest social group) and their impact on the quality of air and the related health consequences. Educating residents in recognizing good quality fuel, reading fuel labels, increasing control over the supply of biofuels, as well as increasing the responsibility of producers for their products are also important for achieving success.

There is a need in the region to develop good and effective standards for supply chains, work out a system of being close to the implemented project and to ensure the availability of raw material throughout the year - talks with biomass suppliers about cooperation in supplying each other with raw material. It is necessary to promote good practices and to create real operating systems in the region that could serve as credible examples of potential benefits for local residents.

The data analysis indicates the existence of limitations, especially in the field of systemic, legal, technical, financial, organizational and social solutions, with a direct and indirect impact on the air quality. Without their elimination, it will not be possible to achieve the full ecological effect of the measures taken. The most important barriers and limitations in the process of improving air quality are listed below:

- It is necessary to take additional corrective measures in the housing and municipal sector and transport in all regions in the country, including in particular in those regions where the permissible levels for fine dust PM₁₀ and PM_{2.5} and the target levels for benzo(a)pyrene are exceeded.
- Introducing a sufficient number of financial instruments for corrective measures in the housing and communal sector, allocating funds for corrective measures specified in air protection programs and related backlogs in their implementation.

- Emphasizing the importance of the issue of air quality improvement by consolidating activities at the national level and establishing the partnership for the improvement of air quality.
- Involving the society in activities to improve air quality by increasing public awareness and creating permanent platforms for dialogue with social organizations.
- Creating an inventory of air pollution emission sources for the purpose of carrying out an appropriate diagnosis of the situation in order to determine the appropriate corrective actions.
- It is necessary to change the negative perception of energy cooperatives, especially by older residents, which results from the communist past of the country and bad associations with the common goods management in the past.

Note: an example of notes taken over the needs/challenges assessment by the Polish working group is presented in Annex III.

2.3.2 Definition of intervention areas

1. Raise awareness regarding bioenergy and regarding Energy Communities

Understanding energy issues is an important concept to consider: the more people engage in energy-related activities, the greater the understanding of the energy system as a whole. Local government, together with industry representatives, can be a key actor in supporting the understanding of energy issues and the education of residents by conducting numerous educational and information campaigns among the local community at the municipal and district level are of crucial importance.

In the Oborniki Śląskie municipality, energy cooperatives often lack recognition or are poorly perceived. The term "cooperative" has still very bad connotations because it reminds of the communist period, where everything was state-owned, and the state could give or take anything and everything freely. For the local community, global environmental issues (air quality, use of fossil fuel, rainfall management, water and sewage management or animals and plants protection) are not a problem from their perspective – they believe that they do not concern them directly, or that the impact on the quality of the environment is small. Currently, the residents lack knowledge of what an energy cooperative is, what it consists of and what benefits it offers. In Polish conditions there is also no working model example where one could see on the site the benefits (financial, environmental, social, etc.) it can offer. There is still low environmental awareness in the region, lack of inner conviction, responsibility or a sense of duty to take action to improve the environment. However, the community energy model is new and little known and the concept of individualism is strongly rooted and difficult to change, especially in rural and urban-rural areas.

The communication of information must be carried out in a clear, reliable and credible manner. Indicatively recommended actions:

- run local awareness raising campaigns which will emphasize various positive aspects of bioenergy for heating residential buildings, public utility buildings as well as the obligations resulting from *Resolution No. XLI/1407/17 of the Lower Silesian Voivodeship Assembly of 30.11.2017 on the introduction in the Dolnośląskie Voivodeship, with the exception of the Municipality of Wrocław and health resorts, restrictions and prohibitions on the operation of installations in which fuels are burned* – the so-called Anti-Smog Resolution. It is necessary to spread good practices through the establishment of a catalogue of functioning good practices that bring various benefits to the local community.
- develop communication tools to alleviate possible social conflicts and encourage joint action.

- intercommunication instruments used, useful in the process of social dialogue, such as, above all, direct contact, round table talks, workshops, articles in the local press, social media messages, meetings during field events, scientific conferences with the participation of professionals from the RES industry.

2. Collaborate with local administrations and lawmakers

The Municipality of Oborniki Śląskie is not able to carry out the energy transformation on its own, its activities are dictated by the needs of the local community based on the existing national, local and communal law. Patronage over the promotion of energy cooperatives could be taken by, for example, the Ministry of Development and Technology, the President of the Energy Regulatory Office, National Cooperative Council or National Agricultural Support Centre with the strong involvement of municipalities focused on encouraging the initiation of energy cooperatives in their area. One of the instruments of initiation of such projects by municipalities are the commune's energy plans and local spatial development plans, under which municipalities can designate areas for RES investments carried out by energy cooperatives.

The *Act of 16 September 1982 – Cooperative Law* allows members of cooperatives a wide range of activities in various economic sectors, including the energy industry. The limitation of the economic activity of cooperatives in the energy industry to rural and urban-rural areas resulting from the definition of "energy cooperative" contained in Article 2(33a) of the Act of 20 February 2015 on renewable energy sources, in conjunction with the provisions of Article 38e(1) of that Act, discriminates the entities intending to conduct cooperative energy activities within urban areas.

If the employees of public administration, municipal and community companies, officials of development agencies, activists or investors and politicians want to take responsibility for the energy transition, they must learn from the best practices and learn how to plan their actions. Poland is not properly prepared to carry out the energy transition at the systemic level. The basic problems are:

- ignoring trends in the development of European and global energy,
- no reference to social challenges: socially just decarbonisation, energy poverty or smog,
- erroneous assumptions about the energy mix and plans to build new coal power or heating plants,
- ignoring the role of local government, which is the first to face the consequences of irrational energy policy.

Local public administrations can be good allies in setting up bioenergy communities, as many of their interests and factors will be similar to the interests and factors of energy cooperatives. It is important to persuade local authorities to commit to the long-term development of a bioenergetics project and to promote such projects in local programmes. This may favour, for example, the deployment of bioenergy in new facilities in public buildings and other local actors, which may launch a bioenergy service and thus increase citizens' awareness and trust in such solutions.

Indicatively recommended actions:

- Address government offices with a request for promotional campaigns regarding activities in this area,
- Cooperation with other local self-government institutions – mayors, councillors, village leaders, representatives of local councils – in order to provide relevant information on the functioning of energy cooperatives in other selected EU countries or on the assumptions and objectives of the BECoop project.

- It is also important to build ecological awareness of the society - run a broad information and promotion campaign. This campaign seems to be particularly necessary in Poland, where during the period of the socialist system the idea of cooperatives has devalued a lot and is not currently perceived as an effective form of doing business.
- Involve energy agencies, as in many cases they already work closely with municipalities or investors and can support the creation of community energy systems, e.g. by helping to find members, funders, fuel suppliers (e.g. biomass or liquid biofuels in case of district heating cooperatives) or, most importantly, build good relations with the distribution system operator.
- Clearly define the energy objectives in the Low-Emission Economy Plan and the Assumptions to the plan for the supply of heat, electricity and gaseous fuels for the Oborniki Śląskie Municipality.

3. Nurturing local leadership:

In municipalities there is a model of strong local leadership with the dominant position of the *voit* (mayor, mayor of the town). At the same time, it is the municipal council that holds the resolution-controlling function. In the rural areas, the position of the mayor is held by the village head. The main issue is to examine the involvement of stakeholders in local energy activities. It is not possible to achieve our goals without the involvement of residents. It is also important to know how to involve stakeholders effectively. The openness of the local leaders to the residents' demands, as well as enabling them to co-decide on the most important matters of the commune, is associated with the co-management of the commune by its residents. Given the low level of knowledge about bioenergy and energy communities, finding local leaders willing to lead and promote a project can be difficult, making it an important role for NGOs representatives.

Indicatively recommended actions:

- Cooperate with village leaders, councillors and NGOs in order to improve their knowledge in the field of bioenergy and bioenergy cooperatives, so that they also can pass on the knowledge about the use of energy from renewable sources and support the setting up of energy communities.
- Run trainings and meetings, workshops, one-on-one talks in order to draw attention to the possibility of development of the energy cooperatives movement.

4. Socio-economic benefits for all

An energy cooperative is defined in Article 2(33a) of the RES Act as a cooperative within the meaning of the Act of 16 September 1982 Cooperative Law (Journal of Laws of 2018, item 1285) or the Act of 4 October 2018 on farmers' cooperatives (Journal of Laws, item 2073). As defined in the REDII these are local entities that pursue socio-economic and not merely financial benefits.

Energy cooperatives can become an opportunity for Poland and the region to improve the financial situation of cooperative members and their families, improve the quality of life of households, build economic relations within local communities, improve the quality of the natural environment, create new jobs and create new services at the local level, increase the energy security of the region, improve the image and tourist attractiveness of the region or offer new opportunities for agriculture and the development of a circular economy.

Energy poverty is often hidden, but this problem affects many families in both urban and rural areas. Families or parts of communities at risk of energy poverty may not be visible or easily accessible.

Indicatively recommended action:

- Hold meetings and workshops, one-on-one meetings to include vulnerable citizens and show them the benefits of energy cooperatives and energy communities (financial, economic, environmental and social goods).

5. The basics: local resource availability

Agriculture is currently the largest user of energy from agricultural biomass and the carpentry, furniture and sawmill industries are the largest users of energy from forest biomass or green areas in the Commune.

The use of local biomass should aim at increasing regional competitiveness. The development of agriculture and rural areas in the Commune and the development of renewable energy, especially based on biomass, are strongly interrelated. The potential of solid biomass also includes (apart from straw): forest wood, post-consumer wood, orchard wood, sideroad wood, wood obtained in wood processing (carpenters, sawmills).

Cooperatives or bioenergy services only make sense if an abundance of raw biomass is available that can be harvested, processed, distributed and consumed locally with the sustainable use of wood biomass in the energy industry.

Indicatively recommended actions:

- Determine actual biomass resources in the form of straw for energy purposes, taking into account its demand for agricultural production (for litter and animal feed) and for ploughing.
- Determine the potential amount of wood from wood processing by entrepreneurs.
- Determine the potential amount of wood that can be obtained for energy purposes in the State Forests and private forests or orchards.
- Determine the distribution, quantity and quality of biomass resources available locally which can be harvested during the year.

6. A viable and robust business plan

Initial investments in the production and distribution of biomass, and in particular in the consumption and supply of heat (in the case of district heating), may be high. Regardless of the model of bioenergy services, the set-up of a business venture that offers employment and is based on technical resources/infrastructure requires funding. It needs to be identified and analysed; an existing, experienced energy cooperative can usually help with this. There are at least a few "business ideas" related to the energy cooperative.

An entity can operate purely commercially, selling all the energy produced to the grid under long term multi-year tariffs guaranteed by the government. In order to create an efficient logistics system for the acquisition, processing, handling and transport of biomass, it is important to select the appropriate technologies and devices to adjust their production potential. This is crucial for the cost of supplying biomass to the final consumer.

Due to the systematic increase in costs incurred by cooperatives and communities related to the increase in electricity and heat prices, especially due to the growing fees for CO₂ emissions, members of housing cooperatives and housing communities are also interested in establishing cooperation within energy cooperatives in order to reduce these costs. Hybrid mix of various types of RES can

ensure continuous production of energy for own needs and the sale of its surplus and can significantly reduce energy costs incurred by members of energy cooperatives – energy mix.

Energy cooperatives involve not only their members, thus reducing the costs of project implementation, but also local craftsmen, enterprises providing the necessary equipment and local cooperative banks, which are the most common loaner for energy cooperatives, thanks to which energy cooperatives contribute to the economic development of the region.

Indicatively recommended actions:

- Help stakeholders to develop a realistic business plan.
- Find financial support opportunities for initial investment.

7. Keep environmental impact low

For the local community, global environmental problems (air quality, use of fossil fuels, rainfall management, water and sewage management or species protection) do not constitute a problem from their perspective - they believe that they do not concern them directly. Lack of strategic planning skills, i.e. the local communities plan in the short term. The proposed changes in the RES act will be beneficial because they will contribute to the transformation of the energy system and climate protection, and consequently will have a positive impact on health of citizens and on the regional development.

Indicatively recommended actions:

- Run local awareness raising campaigns and highlight various positive aspects regarding bioenergy for heating of residential buildings, public utility buildings, as well as of obligations and the restrictions and prohibitions resulting from *Resolution No. XLI/1407/17 of the Lower Silesian Voivodeship Assembly of 30.11.2017 on the introduction in the Area of the Lower Silesian Voivodeship, excluding the Municipality of Wrocław and health resorts, restrictions and prohibitions on the operation of installations in which the Fuel combustion* – the so-called Anti-Smog Resolution. It is necessary to show good examples by presenting a catalogue of functioning good practices which bring various benefits to the local community.

8. Quality of biofuel and efficient system management and operation

The biomass used for energy purposes (pellets, briquettes, bales, wood logs, sawdust, sawmill wood logs, etc.) must meet the appropriate requirements for its physico-chemical parameters – it must be of consistently good quality. Indicatively recommended actions:

- Education of end users in the field of monitoring quality of resources coming from suppliers (e.g. type of tree, humidity and purity of forest biomass).

Concluding remarks:

From the perspective of farmers, entrepreneurs investing in rural areas, as well as experts, two groups of barriers are crucial: legal-administrative barriers and economic ones. On the other hand, in recent years, high volatility of the regulatory and investment environment has been observed, which affects the low sense of security and the level of investor confidence in the stability of the investment regime in the RES sector.

2.4 Italian pilot area

Lead Pilot partner: FIPER, an Energy Authority working synergistically with district heating companies to establish a shared production/consumption model

FIPER brings to BECoop a case study in the Valtellina district and the Municipality of Tirano. The biomass district heating in Tirano covers about 80% (58 MW installed) of the thermal energy demand and 1.1 MW of electricity. It is also the starting point for the creation of a renewable energy community in Tirano, as a collective self-consumption system, avoiding the loss of the electricity grid.

FIPER has lead the Needs and Challenges analysis process for the Italian pilot. They treat each identified critical need and challenge in the following sections, and then present a discussion of the intervention areas from a regional point of view.

2.4.1 Regional needs and challenges

Italian Pilot area needs

Forest supply chain structuring and consolidation

The first need concerns the constitution and development of the forest supply chain. Italy withdraws timber from native forests at a rate well below the European average: the Italian usage rates vary between 18.4% and 37.4% of the annual increase, while the European average is between 62-67 %. The forestry heritage cannot be relocated; it also represents an important productivity factor for the country system, both for the building, furniture, and energy supply chain. The paradox is given by having a precious and renewable heritage for the community and not being able to dispose of it accurately. The lack of wide-ranging policies that favour the sustainable management of forest heritage is one of the causes of the failure to increase withdrawals.

A new national policy to promote bioenergy

Instead of promoting biomass use for energy production, after the COVID-19 crisis, the Italian Government has prepared the "Relaunch decree", in which it encourages the construction of new gas pipeline³ in mountain areas without a prior cost-benefit analysis, even though these territories have large quantities of woody biomass that can be used to produce renewable energy.

Advocacy for *building new* natural gas infrastructure at all costs hinders investment in heating and cooling technologies powered by renewable sources, including efficient district heating (fuelled by woody biomass) promoted by REDII itself in art. 24 and, therefore, the achievement of the European objectives. The regulation subject to reporting attests to a clear favour for natural gas infrastructure and consumption: its costs have been reduced under general taxation! It risks discouraging competition between different (renewable) technologies suitable to satisfy the energy demand and legalising a misalignment in the conditions of entry into the energy market. There is a heavy pressure from the fossil (especially gas) lobby to hold an advantageous position and make sure that the gas carrier is the transition fuel for the decarbonisation of the economy.

Replacement of old domestic appliances with the most performing in terms of emission impact

A strong prejudice and lack of knowledge is prevalent about the different possibilities of using woody biomass for energy. Local administrators, citizens do not have adequate knowledge of the advantages

³ Legislative Decree of 19th May 2020- art. 114ter

derived from the biomass-energy chain to promote local development. Traditional home heating systems are often preferred because it is more convenient and (apparently) less risky. The Po Valley is under EU infringement for having exceeded the pm10 limit in the air. For that reason, the Agreement was signed between the regions of the Po Valley and the Ministry of the Ecological Transition for the improvement of air quality. This agreement provides for a series of limitations both for the use and for the installation of woody biomass heat generators in the households. There are restrictions in case of situations of accumulation of pollutants in the atmosphere. The first level of temporary measures is activated in the municipalities concerned on a provincial basis. These measures, as far as heating systems are concerned, include a ban on the use of domestic heat generators fed by woody biomass (in the presence of an alternative heating system) with performance below class 3, and with a maximum limit of 19 °C for average temperatures inside or to promote biomass technology with high performance emissions abatement systems, such bag filters or multi-filters as already employed by biomass district heating equipment.

Distinguish woody biomass from waste and prevent *NIMBY* syndrome

The idea of linking the term "biomass" to "waste" is still rooted in the collective conscience, with the direct effects that derive from it in terms of social acceptability. [NIMBYism](#)⁴ in the local population very often associates the idea of biomass district heating with waste incineration. Some NGOs have also launched communication campaigns against the use of biomass at an energy level; an aspect that certainly does not favour social acceptability.

Training for local administrators

Often, we detect a lack of training for local administrators, who prefer to opt for more "immediate" heating technologies, such as the use of heat pumps, rather than favouring the development and construction of biomass mini-DH (district heating) in their community, even if they have huge availability of local biomass derived from forest management.

Legislative evolution terms and definition of energy community

Regarding the establishment of a renewable energy community, it should be noted that, so far, the legislation only allows the installation of photovoltaic panels in the civil sector up to 200 kW of installed power. Current legislation does not allow the use of bioenergy to access the incentives provided for the establishment of renewable energy communities. The REDII transposition could be the opportunity to broaden the application and related incentives already foreshadow bioenergy use for energy communities.

Italian Pilot area challenges

Push the implementation of the forestry strategy

To reactivate the wood economy, the intervention of public institutions is necessary in the most underdeveloped internal areas, which can provide infrastructures (road network) and services capable of making the supply of timber and its by-products competitive in a short chain. These activities are expected to be included by the Ministry of Agriculture and Forestry into the Forestry strategy program that will be implemented by 2022.

Identify new incentives and support actions to promote bioenergy communities

⁴ NIMBY = "Not in my Backyard", see also <https://en.wikipedia.org/wiki/NIMBY>

The analysis of challenges is closely related to the constantly evolving Italian legislation regarding the implementation of the commitments signed in the European Green Deal. In fact, starting from the indications of the European Plan promoted and voted by the Member States, the Italian Government presented the National Recovery and Resilience Plan - PNRR in which it defines the lines of action it intends to undertake to achieve the ambitious European carbon neutrality objectives by 2050.

It should be noted that within the PNRR a marginal role has been attributed to the production of renewable energy (thermal and electrical) with the use of woody biomass, while the conversion of agricultural biogas plants into biomethane is being promoted (1.8 billion euro) and the creation of renewable energy communities through the installation of photovoltaic panels.

Inevitably, the absence of specific lines of financing and incentives for the start-up of new biomass plants creates uncertainty on the market and little attractiveness of investments in this sector.

FIPER is committed in close collaboration with other associations representing the biomass-energy supply chain to stimulate the government to remedy this shortcoming, especially with a view to developing and territorial control of inland areas as well as for energy production.

Favour gas replacement by woody biomass

FIPER reported to the Energy, Networks and Environment Regulatory Authority - ARERA the risk of *methanisation* of mountain areas envisaged in some regional plans to the detriment of the development and penetration of biomass district heating. The Council of State itself highlighted the inconsistency of the rule. However, no changes have been made to date.

Consequently, on 3 September 2021 last, FIPER sent the notification for violation of European Union legislation by the Italian government to DG Energy, DG Environment, DG Climate and DG Competition of the European Commission.

Consider Bioenergy communities as local development drivers

FIPER's action will be aimed at raising awareness among public administrators and the public that the start-up of biomass district heating plants represents a driver of local development and redistribution of income especially for inland areas as well as the production of renewable energy.

Moreover, the bioenergy supply chain guarantees safe and medium-long term jobs. From the start-up of the plant, the work along the supply chain is guaranteed for the duration of the plant (20-30 years).

Include bioenergy into the renewable community regulation

The Federation will be engaged in discussions with the legislator to evolve the current legislative framework and insert bioenergy in implementing the indications of REDII for the establishment of renewable energy communities.

2.4.2 Definition of intervention areas

1. Raise awareness regarding bioenergy and regarding Energy Communities

- Starting up a communication campaign in collaboration with other sector associations to sensitize citizens and public administrators about the replacement of fossil fuels with woody biomass to produce thermal energy. Art. 23 of the Directive, which provides for an effort by

States to increase the share of renewable energy by 1.3 percentage points annually (woody biomass plays a leading role) in the heating and cooling sector⁵.

- Raise awareness among public opinion and administrators that investing in bioenergy means decreasing dependence on gas / fossil fuels and related sudden increases in bills (see last September 2021 increase of 40% in the bill)

2. Collaborate with local administrations and lawmakers

Promote the use of biomass and increase the penetration of efficient district heating (powered by renewable sources) through a lobbying action at the level of the Alpine regions (Piedmont, Lombardy, Val d'Aosta, Trentino-Alto Adige, Veneto) and at the national level at the Ministry of Agricultural, Food and Forestry Policies and the Ministry of Ecological Transition. This presupposes the development of a support policy dedicated to the promotion of the biomass-energy supply chain in the implementing decrees that will be prepared in the course of 2022.

Set up for a joint "pro-bioenergy" manifesto to be presented during the General States of the Green Economy at Ecomondo - Rimini 26-29 October 2021.

Removing of the main barriers to bioenergy development: convince regional lawmakers to provide a stable legal framework for bioenergy development and avoid stop- and- go regional policies for the prevention of hydrogeological risks and management of the territory, legal instability in the definition of biomass by-products as part of the circular economy promotion package.

Promote good practices and experience gained on the wood-energy supply chain to sensitize the municipalities of the Alpine area to evaluate the opportunity cost of these projects for the development of the territory.

FIPER has initiated several meetings with the mountain communities of Piombella and Valli del Verbano in the province of Varese interested in enhancing the public forest assets that they manage to start up mini-district heating networks. The action of FIPER will develop on two levels:

- Micro: make its expertise available to activate the forest-wood-energy supply chain in the target territories where there is an interest on the part of the public institution to activate mini-biomass district heating networks.
- Macro: actively participate in regional (Piedmont and Lombardy regions) and national working group on the wood-energy supply chain for the implementation of the Forest Strategy and the specific measures of the new CAP (Common Agricultural Policy) to address the current barriers (fragmented private ownership of the woods, inadequate accessibility to forest areas in logistic and economic terms, inadequate agricultural, silvicultural and breeding viability for supply, potential lack of network of companies for the logistical organization of withdrawals - storage – use), that limit sustainable forest management.

3. Nurturing local leadership:

Nurturing local leadership is the basis to develop bioenergy project. To reach this goal, FIPER could organize some events in the territory target, inviting major, such the Municipality of Tirano, that can

⁵ Art. 23, par 1.

share the best practices and the benefit in terms of supervision of the territory, forest management and redistribution of income deriving from the forest-wood-energy supply chain.

4. Socio-economic benefits for all

FIPER, in collaboration with the Polytechnic of Milan, has conducted a study among its associates on the economic and environmental impact deriving from the biomass district heating and agricultural biogas plants. FIPER makes this report available to the project so as to show the socio-economic benefits for all when a new bioenergy plant is put in operation.

5. Local resource availability

- Identify at least two territories in which the conditions exist to start up new woody biomass district heating networks
- Encourage the application of new techniques and methods tested by the Faculty of Agriculture of University of Milan, with which FIPER collaborates, for the definition of the potential use of biomass in a specific territory (Forest inventory by using drones, definition of optimal forest stands, models to estimate logging residues at the stand level...)
- Supervise the regional and national round tables dedicated to the wood supply chain for the implementation of specific measures that favour the increase in wood withdrawals (ex. Forestry roads, logistics organization, access to credit for equipment, etc.).

6. A viable and robust business plan

(no recommended actions)

7. Keep environmental impact low

In the Po Valley the concentrations of PM10 exceed the limits set for 4 consecutive days. Italy was convicted of infringement by the EU Commission.

For that reason, the Agreement was signed between the regions of the Po Valley and the Ministry of the Ecological Transition for the improvement of air quality. This agreement provides for a series of limitations both for the use and for the installation of woody biomass heat generators in the households. There are restrictions in case of situations of accumulation of pollutants in the atmosphere. The first level of temporary measures is activated in the municipalities concerned on a provincial basis. These measures, as far as heating systems are concerned, include a ban on the use of domestic heat generators fed by woody biomass (in the presence of an alternative heating system) with performance below class 3, and with a maximum limit of 19 °C for average temperatures inside.

FIPER's action will be aimed at raising awareness among the general public and local and / or national administrators that the peculiarity of bioenergy compared to other renewable sources is given by the environmental service that is carried out in the supply chain of biomass of agricultural and forestry origin. In the woody biomass-energy supply chain, the first environmental impact is given by the prevention of hydrogeological risks, starting with forest maintenance and management activated through the launch of biomass district heating plants.

Secondly, it is a priority action of FIPER to highlight to public opinion and institutions that the emission impact of the use of biomass for energy purposes depends on the technology and abatement systems used.

In fact, biomass district heating plants are equipped with high-performance emission abatement systems, which also allow the use of lower quality woody biomass. Compared to dust, biomass district heating systems allow a significant improvement in emission indices compared to domestic devices (boilers / stoves). For example, a medium-sized plant (about 5 MW) compared to the use of biomass household devices makes it possible to avoid emissions of about 10 tons of dust on an annual basis.

Furthermore, the impact in terms of greenhouse gases and CO₂ produced by methane gas is often underestimated or overshadowed, while the issue of dust is always at the fore.

FIPER's commitment is to demonstrate "data in hand" that in municipalities equipped with biomass district heating, CO₂ savings of about 90% are recorded compared to the initial situation. These plants are equipped with highly performing abatement systems, such as bag filters or electrostatic filters. The use of biomass is carbon neutral; this means that compared to the use of fossil fuels (methane gas and / or heating oil) the CO₂ produced is equal almost to zero.

- Sensitize local institutions and the general public so that the environmental service provided by the biomass-energy supply chain to the community is recognized in economic and social terms.
- Promote low-emission biomass heat production and distribution systems (district heating) equipped with high-performance abatement systems.
- Inform the public and institutions correctly about the difference in overall environmental impact (ecosystem services, CO₂ savings, fine dust) between the use of biomass and methane gas (fossil).
- Activate and consolidate the network with UNCEM (National Union of Mountain Municipalities) so that in the internal areas the local administrators promote the biomass-energy supply chain to activate interventions for the prevention of hydrogeological risks and sustainable forest management.

8. Quality of biofuel and efficient system management and operation

(no recommended actions)

3 EU-level analysis

This section summarizes the outcomes of expert reviews and consultations focusing on the leading needs and challenges of EU - level stakeholders in the bioenergy sector. A number of working group sessions took place among BECoop partners: CBS, IEECP and White Research. Conclusions further integrate the input of BECoop Advisory Board and are classified into a number of categories based on their thematic nature. **Intervention areas and recommended actions to address points raised are proposed in turn, incorporated as suggestions under the respective needs' and challenges' analyses.**

3.1 Identified needs

On the **political front**, there is a clear pressure on public authorities to develop greener and more democratic heating solutions. This was highlighted as a clear need at the EU level, in terms of the transnational co-ordination of local public authorities which can facilitate new energy communities. **Actions** to address the situation could include the issuance of a general policy briefing, regarding bioenergy communities, targeted at EU level actors but also aiming for subsequent regional and local level actors. The briefing can include lessons learned from previous schemes, and policy recommendations for the future – including actions that can be implemented at the country level. Intervening at EU level provides an opportunity to introduce the issue to the public debate, through the gathering of examples, transfer of knowledge and building political impetus directed at relevant networks of municipalities.

In terms of **legal needs**, the stability in the legal framework was identified as a top priority. It was emphasized that there are many policy incompatibilities among EU, national and regional levels regarding bioenergy, with the legal framework being deeply dependent on policies at the national scale. Experts pointed to the need for concrete and targeted policy making across the EU. In terms of **actions**, this could be facilitated by information campaigns to policy makers in Brussels, in order to raise awareness of the problem. Incompatibilities need to be pinpointed and brought to a European debate, to foreground the need for EU action to speed-up a fair decision-making framework in all EU countries. The promotion of bioenergy communities at the regional level can also be aided by joint working with Bioenergy Europe & RESCoop.eu, while briefing and informing policy makers in order to create stable frameworks.

With regard to **economic needs**, the local supply and availability of biomass resources is of particular importance, especially with regard to access to abundant and raw biomass. The sustainability aspect of this is crucial, especially in terms of demonstrating that biomass can be sustainably handled. It has been identified that there is currently a debate at the scale of the EU, involving arguments that biomass utilization is against carbon sequestration, or against forest sustainability. Here, it was highlighted that biomass should be promoted as a sustainable resource. Moreover, promoting bioenergy communities should be underpinned by emphasizing the value and the good contribution that biomass can bring to citizens. A possible **action** would be to prepare a briefing – involving relevant information and data – that will help counter arguments that biomass is not sustainable. Another action at the EU level can be an interchange of visions between *Bioenergy Europe* and *RESCoops*. This may trigger actions to transfer concrete actions and ideas to the country level.

Another **economic** need was the requirement to local return on investment. The requirement for identifying evidence of the benefits community bioenergy is highly pertinent here. It hence becomes important to communicate how successful case studies can increase the level of certainty and confidence in terms of uptake and investment in bioenergy communities. Citizen **action** can be

facilitated by building confidence in 1) the energy community model as a whole; 2) its economic viability; 3) the performance and governance of the new systems. Outputs and lessons learnt and evidence gathered by BECoop can facilitate the work of civil society organizations and national authorities through effective knowledge transfer.

In terms of **social** needs, raising awareness among energy communities and the general public (in terms of the benefits of bioenergy) is paramount. Given that bioenergy can be implemented better at the local level, and in terms of relevant **actions**, the EU and national civic organizations require a project-by-project approach, supported by *RESCoop*, *Bioenergy Europe* and other allies. Evidence on models to combat energy poverty through energy community actions can also be part of the initiative to approach these organizations.

With regard to **environmental** needs, it is of crucial importance to show that bioenergy is feasible and sustainable. The rise of an environmentally friendly Europe – and a more climate neutral Europe – involves opening debates around the role of biomass in the energy system, and in relation to wider environmental services and rural landscape management more generally. This is an issue to be clarified in the advocacy work of the project. Building connections at the EU and regional level entails engendering a scientifically-informed understanding of the benefits that bioheat (and energy communities) can bring. An **action** plan could be the monitoring of the environmental impacts of newly implemented bioenergy communities and using data from previously successful cases. The preparation of arguments surrounding the sustainability issues regarding bioenergy communities is also of relevance here.

As for **technical** needs, the importance of maintaining active research and development work was emphasized. In terms of **actions**, this entails the continuous development of technology, and the improvement of technological efficiency. However, bioenergy should not be promoted only at technical level: social science specialists can be good allies to help detect critical factors, forms, ideas and models for expanding the energy community model. Complementary work is needed to learn from practice and pilots that are already underway.

3.2 Identified challenges

Political challenges include changes in the traditional method of running municipalities, in order to implement new ways of generating, using and managing energy at the local level through the cooperation. A further challenge is the need for engaging local administration and government, to commit to long-term bioenergy project development. This involves the use of existing examples to communicate to local administrations that bioenergy communities are possible. In terms of **actions**, it becomes important to inform relevant actors – through EU level initiatives - that bioenergy can be feasible and can bring significant benefits to local communities. Another action is to detect lighthouse cases, document them, and use them to bring evidence to policy makers in EU, and networks of municipalities: *the Covenant of Mayors*, *Climate Alliance*, *Cities for Climate – Eurocities*, or *the Council of European Municipalities and Regions (CEMR)*. The creation of information and action packages that can be used as reference points by local authorities and general public is also essential. At the EU level, a set of actions can be addressed towards organizations that bring together local public entities.

Legal and administrative challenges involve issues of energy market integration and the legal status of energy community formation by citizens, which have otherwise rarely been aware of the issue. EU bodies, along with *Bioenergy Europe* and *RESCoop*, can collaborate to change the existing situation. **Acting** to address these challenges, with barriers being already detected in several countries, involves approaching different civil organisations working at the EU level, to open the space for creating bioheat

prosumers. This can be done in partnership with *Bioenergy Europe*, *RESCoop.eu*, NGOs and energy associations.

Economic challenges involve the achievement of a sustainable and clear business model for all actors in the value chain. Information campaigns for EU organizations are a key potential **action** in this regard, allowing relevant actors to become aware of the new bioenergy community market. This can be communicated to potential interested business actors – suppliers, installers and engineers – who can become engaged with new business models. Another relevant line of work are dissemination activities towards EU organizations: to understand new energy models based on energy cooperatives or communities is a new form of energy management, but also as a niche for business. Installers, ESCOs and suppliers – for whom energy communities are new clients – can be made aware and more confident on how to establish new partnerships. These EU-wide recommendations can be transferred across the governance hierarchy to national-level bodies, where energy communities in particular can gain new knowledge about the bioenergy model.

Social challenges involve the engagement of citizens from vulnerable communities and increasing the role of knowledge about energy communities. In terms of **actions**, *Bioenergy Europe* along with *RESCoop.eu* can communicate this to the general public. A stronger focus on interacting with relevant H2020 projects is warranted here, in order to tackle energy poverty and detect best practice examples to address energy inequalities through community action. Such projects could be approached so as to generate knowledge transfer with respect to energy community activities based on bioheat, as one of the potential actions for reducing energy poverty. Common workshops and knowledge transfer to RESCoop national associates can also be helpful in this regard.

3.3 Intervention areas

Intervention areas and recommended actions to address points raised were incorporated as suggestions under the respective needs' and challenges' sections.

As is apparent from the aforementioned analyses, all proposed actions at EU-level pertain to the intervention area of **raising awareness** among European citizens and briefing policymakers at a supra-national level. To achieve this, a number of European organisations have been identified as allies or intermediates: *Bioenergy Europe* and *RESCoop.eu* are the clearest allies for promoting the uptake of bioenergy and the promotion of energy communities, but also *the Covenant of Mayors*, *Climate Alliance*, *Cities for Climate – Eurocities*, and *the Council of European Municipalities and Regions (CEMR)* are highlighted.

4 Conclusions

All regional pilot areas were able to identify a set of actions that broadly belonged to 8 intervention areas:

- Raise awareness regarding bioenergy and regarding Energy Communities
- Collaborate with local administrations and lawmakers
- Nurturing local leadership
- Socio-economic benefits for all
- The basics: local resource availability
- A viable and robust business plan
- Keep environmental impact low
- Quality of biofuel and efficient system management and operation

Some pilot regions defined specific actions assigned to different stakeholder groups, others considered the actions from a regional standpoint. Some regions did not have actions in all intervention areas, because there were no critical needs or challenges that required an intervention of such nature.

The REScoops partners in the consortium (Spain: GoiEner; Greece: ESEK) performed their pilot-level Needs and Challenges analysis and the definition of the ensuing interventions from a REScoop point of view in a more detailed and exhaustive manner than those developed on behalf (and from the perspective) of the other stakeholders. However, the project partners will support all stakeholders in their interventions to promote bioenergy.

Although many interventions are region-specific, there are some **common elements**:

- greater awareness and understanding must be created of both the potential of bioenergy as a sustainable local resource and of energy communities as a novel instrument to empower citizens in the energy transition.
- The collaboration with local (in particular rural) municipalities is also of critical importance.
- And lastly, all economic actors require legal clarity and stability in order to develop their businesses.

Regional differences are related to:

- the abundance and type of biomass available (forest or agricultural) and the access rights to it (e.g., allotments, as is the case in some areas of Spain)
- the perception or even legislation of biomass as a sustainable or environmentally friendly source of energy (Italy, Greece, EU)
- the negative associations about cooperativism, often because of past experiences (Poland, Greece).
- the strong influence of the gas and fossil fuel lobby is an important issue in Italy and Spain (in particular the Basque Country).

The reader is invited to interpret the specificities of each pilot region and consult with local actors in order to decide which needs and challenges apply to his or her region of interest. As a result, similar interventions can be planned in other regions wishing to replicate the results of this project.

Annexes

Annex I: Needs and Challenges picklist

In order to aid all partners with its initial PESTLE analysis and to guarantee coherence of the study across the different pilots, a list of suggested needs and challenges was compiled by a panel of experts from the project. This was the starting point for the Round 1 analysis, as explained in section 1.3 about the methodology of this study.

Suggested NEEDS

ECOLOGICAL NEEDS:

- Sustainable biomass resources management
- Meet local environmental standards (air quality, GHG emissions, monitoring)

POLITICAL NEEDS:

- Local/Region authorities interest in favour of greener and more democratic heating solutions.
- Interest in exploitation of local resources (Sovereignty km 0 energy generation)

LEGAL / ADMINISTRATIVE NEEDS:

- Legal framework favourable to EnerComs (less bureaucracy), shared renewable energy distributed systems and transposition of European directives.
- Legal framework favourable to Bioenergy
- Stability in the legal framework
- Transposition of common agricultural policy (CAP)

TECHNICAL NEEDS

- Technology that meets air quality and efficiency standards
- Reliable and efficiently designed/maintained heating distribution systems including thermo/mechanical systems for supplying biomass
- Ensure biofuel good quality
- Local infrastructure/ logistics related to bioenergy production (supply of biomass, storage areas etc.)

ECONOMICAL NEEDS

- Local supply/availability of Biomass resources: abundant and economic raw biomass (supply).
- Variety of financial instruments and aids.
- Balanced supply (biomass) and demand (heat) (minimum BE heat demand for BE use. users).
- Be competitive enough against rest of heat solutions

SOCIAL NEEDS:

- Raise awareness Bioenergy potential/benefits
- Awareness Energy Communities potential benefits.
- The help of motivated citizens(volunteers) willing to spread the concepts.

- Good examples in local area to be followed

Suggested CHALLENGES:

ECOLOGICAL CHALLENGES:

- Decrease life cycle GHG and air quality impacts of BE
- Convince habitants to take care about the environment.
- Ensure a sustainable management of resources

POLITICAL CHALLENGES:

- Changes in the traditional way of running municipalities in order to implement new ways of generating, using and managing energy at the local level through cooperation.
- Engage the local administration/government to commit to long-term BE project development.

LEGAL / ADMINISTRATIVE CHALLENGES:

- Administrative and procedural barriers (energy market integration, legal status, grant application etc.)
- Clarification of legal status of energy communities to market heat
- Handle uncertainty regarding BE regulatory framework

TECHNICAL CHALLENGES:

- Ensure an optimal fuel quality (humidity, homogeneity and energy density)
- Tackle difficulties regarding biomass final transportation, storage and management
- Address seasonality and agro-climatology dependence to obtain certain biomass.
- Achieve most efficient dimensioning of the system (optimal integration of heat demand and production, energy management)

ECONOMICAL CHALLENGES:

- Economic viability, investment risk (high initial investment, lack of demand)
- Achieve biomass based thermal kWh price stability
- Convince sufficient number of people to switch from fossil fuels to BE
- Achieve a sustainable and clear business model for all actors in the value chain
- Local representation of all type of stakeholders along the value chain

SOCIAL CHALLENGES:

- Increase low social cohesion, voluntary movements and perception of common goods for collective actions / cooperatives
- Improve social poor perceptions about bioenergy benefits
- Increase Low level of knowledge about EnerCom
- Motivation to use more environmentally friendly solutions such as biomass
- Change mind-set regarding payback periods
- Engage/reach citizens from vulnerable communities
- Products environmental responsibility
- Open minded to change traditional practices

Annex II: Stakeholder groups analysed

The same expert group that proposed the initial needs and challenges picklist, also defined the following list of 12 stakeholders relevant for the setting up of bioenergy communities. The regional pilot partners were asked to consider needs and challenges from the point of view of each of these stakeholders, as explained in section 1.3.

- Biomass owners
- Biomass management companies
- Equipment manufacturers (Pellets, biogas, woodchips production plants, Biomass based boilers, DH plants, Cogeneration plants)
- ESCO and installers
- REScoops
- Citizens/General Public
- Authorities/Municipalities
- Policymakers
- Energy/Biomass Associations
- NGOs
- Investors
- Research centres /universities

Annex III: Example – notes from the Polish working group needs/challenges assessment

Awareness of bioenergy and energy communities

#	Polish pilot needs	Polish pilot challenges
1.	Increasing public attendance in information and educational meetings.	<p>Reaching the participants via various information channels – traditional mail, Internet portals, leaflets, brochures, e-mail, media (radio, television), articles in the press.</p> <p>Meetings will have to take place at different times of the day.</p> <p>Establishing contact with village leaders, town council members, residents of housing communities, housing cooperatives and their representatives.</p>
2.	Raising public awareness.	<p>Run educational and information activities, informing the public about the current air quality and transferring knowledge about the benefits of establishing cooperatives and energy communities.</p> <p>Establish and keep contact with stakeholders (residents, local governments and social environment).</p>
3.	Spread the knowledge in the local community.	Transmission of reliable, documented and scientific knowledge in the field of bioenergy, air quality, energy cooperatives and a just energy transition, but in a way which is easily accessible to the residents.
4.	Increase participants' willingness to attend meetings.	<p>Use of incentives by the providing ready-to-use educational material.</p> <p>The transfer of knowledge in a non-specialized language appeals more easily to residents, which will increase trust and a better understanding of the subject.</p> <p>Make wider use of consultations - local meetings with representatives of various industries and social groups.</p>
5.	Development of educational materials, taking into account renewable energy sources.	Easy access to reliable knowledge. A tab is going to be prepared on the OBS web site, with bioenergy educational materials - updated every two/three weeks.

Local administration and legislators

#	Polish pilot needs	OBS (Challenges):
1.	Increasing the interest of local authorities - mayors, town council members, heads of communes and poviats and village leaders.	Organize awareness raising meetings on bioenergy, air quality, energy cooperatives and a just energy transition, fight with energy poverty. Greater involvement of local authorities in the idea of the project. Start a discussion on the possibility of mutual cooperation.
2.	Changes in legal acts.	The legal system in Poland currently does not favour energy cooperatives and has many restrictions in the context of their development – high threshold values and the inability to sell energy. There are no detailed legal regulations as to how an energy cooperative would account for the energy produced. Lack of stabilization of legal regulations which causes chaos in the sector and the accounts for inability to create a long-term and safe plan for investing in green energy for entrepreneurs.
3.	RED II directive implementation.	Lack of implementation of the RED II directive.
4.	Change in the definition of an energy cooperative in accordance with the RES Act.	RES Act is at the moment in the process of being amended. Current statutory regulations make it difficult to set up an energy cooperative, thus excluding entities from the support system

Nurturing Local Leadership:

#	Polish pilot needs	Polish pilot challenges
1.	Presenting good implementations.	Presenting good practices and good cases of implementation. The stakeholders can benefit from the model examples implemented by the best, e.g. Germany, Denmark, the Netherlands. Promoting and sharing the knowledge with others by experienced entities that operate in the RES field. Implementation of good management practices.
2.	Presenting good practices.	
3.	Involvement of activists.	Partnership discussions to convince stakeholders to the idea of creating energy communities. Cooperation with local communities.

Socio-economic benefits for all

#	Polish pilot needs	Polish pilot challenges
1.	Legal and economic consulting.	Starting the education process.
2.	Convincing the local community by investors to join RES related projects.	Presenting the financial benefits and benefits of energy independence in the region.
3.	Democratizing energy.	Dissemination of knowledge about rising energy prices, and thus rising costs of living in general – increasing energy poverty. Opportunity to improve energy safety and energy independence.

Availability of local resources

#	Polish pilot needs	Polish pilot challenges
1.	Securing an access to sustainable and competitive energy at affordable prices for the citizens and businesses.	Developing a short supply chain. Creating a market for the biomass producers. Production of biomass supports the sustainable development of agriculture.
2.	Monitoring changes in raw material prices.	Monitoring changes in the prices of raw materials that are related to the use of biomass for energy production
3.	Estimation of the potential of biomass in the region with the possibility of its use for heating.	Estimation of the amount of biomass available.

A profitable and solid business plan

#	Polish pilot needs	Polish pilot challenges
1.	Financial support system.	Launching funding for the implementation of investments and similar projects so that more energy cooperatives will be set up in Poland – as a strong point of the business plan. Presentation of new ways of earning money for farmers.
2.	Exclusion of lobbying.	Presenting of the possibilities of excluding lobbying.
3.	Estimating investment risk.	Presentation of weaknesses. Presentation of strengths.

The electricity sector will need very large investment outlays in the near future. This is, among others, the consequence of the ageing of existing power plants and transmission installations. Financial incentives - support instruments - grants/loan system.

Easy access to available technologies. Later on this will be the basis for future investments.

Keep environmental impact low

#	Polish pilot needs	Polish pilot challenges
1.	Improving air quality – a low-carbon economy.	Changing the heating method.
2.	Closed economy.	Use of waste as a raw material for energy production.
3.	The need to preserve biodiversity.	Conducting investments with the least negative impact on the environment.

Quality of biofuels and logistics

#	Polish pilot needs	Polish pilot challenges
1.	Self-sufficiency in the region.	Developing good and effective supply chain standards.
2.	Exploring and exploiting the potential of the region.	Developing a system of being close to an implemented project.
3.	Ensuring the availability of raw material.	Developing and ensuring the availability of raw material throughout the year – talks with biomass suppliers about cooperation in supplying each other with raw material.
4.	Exclusion of unfair practices in the marketing of not certified pellets.	Education of residents in the field of recognizing good quality fuel. Greater control over biofuels. Increasing the responsibility of producers for their products.