

STRATEGIC BIOENERGY GOALS OF THE BIOVILL TARGET VILLAGES



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Further information about the BioVill project on: www.biovill.eu

Picture of the front page:

The picture shows a discussion between BioVill stakeholders and Mr Karl Totter of Bioenergie Mureck (Austria). Mr Totter presented the visions and goals of Mureck and inspired the BioVill partners and stakeholders to formulate their own strategies. (Picture Source: D. Rutz)



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1 Introduction

1.1 The BioVill project

BioVill is a three years project supported by the European Union's Horizon 2020 research and innovation programme with a budget of around 1.99 Mio EUR. The project started in March 2016 and is implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH in collaboration with 8 partners from the BioVill target partner countries Croatia, Macedonia, Romania, Serbia and Slovenia, as well as from Germany and Austria.

Many South East European countries have high biomass potentials, but they are often not or only inefficiently used for local energy supply and regional economic development. Thus, the overall objective of the BioVill project is to support the development of regional bioenergy concepts and the establishment of bioenergy villages in Croatia, Macedonia, Romania, Serbia and Slovenia. This will be achieved by identifying suitable biomass value chains according to local and regional needs and transferring existing experiences in Austria, Germany and other European countries to the South-Eastern European partners. Thereby the market uptake of domestic bioenergy supply chains will be increased and the role of locally produced biomass as a main source of energy supply and added value for the local and regional economy will be strengthened.

Core activities of the BioVill project include national and local framework analyses, technological and economic assessments of local bioenergy value chains, development of the institutional set-up and energy management concepts for the potential Bioenergy villages as well as capacity building on financing schemes and business models. As a key factor of success the BioVill project uses a multi stakeholder approach fostering the involvement and active participation of the citizens and all relevant stakeholders in the planning and implementation process.

Major results of the BioVill project will be the initiation of at least five bioenergy villages in the target partner countries up to the investment stage for physical infrastructure, the raise of public acceptance and awareness of a sustainable bioenergy production and its commercial opportunities as well as increased capacities of users and key actors in business and legislation to sustainably manage bioenergy villages and to enact national and EU legislation. Altogether the BioVill project will contribute to the expansion and sustainability of the bioenergy markets in the European Union.

1.2 Scope of the task/deliverable

A first step in the set-up of a bioenergy village is the formulation of a common vision and strategic goals for the village. They need to be elaborated and discussed by the local actors and written down so that reference can be made during the bioenergy village development process. The vision and the strategic goals are furthermore related to initial local action plans which describe the next steps to be made in the sectors of power supply, heat supply, and transport.

The visions, strategic bioenergy goals, and action plans for the BioVill target villages were elaborated by the local working group members and by the BioVill partners. Input from working group meetings and from the public survey from each target village were used to formulate the strategic goals.

The present report summarizes the visions, strategic bioenergy goals, and action plans for the BioVill target villages. However, it must be highlighted that these strategical elements are subject to continuous development and discussions and will be revised continuously.

2 Dole pri Litiji, Slovenija

Strategic bioenergy goals of Dole pri Litiji were discussed and formulated during the first working group meeting, which was held at the premises of the primary school in Dole pri Litiji, on 14th of February 2017.

Fifteen members of the working group participated in the meeting; one member of the BioVill advisory board, the Deputy Major of the municipality of Litija, a representative of the regional energy agency, the owner of the local sawmill, the head of the local committee for development, the president of the local fire fighters, and the head of the branch school. Furthermore, representatives of the Slovenian Forest Service, of the Slovenian Forestry Institute, of the local sports association and of the “Land of charcoal” association participated, as well as engaged farmers, forest owners and residents. Two members excused them for their absence.

The working group meeting was opened by the head of the local committee for development, Irena Bostič, who welcomed the participants and presented the programme of the meeting. Nike Krajnc from the Slovenian Forestry Institute briefly presented the purpose of the meeting and introduced some starting points to open the discussion on the formulation of strategic bioenergy goals for the development of the village. The consensus on the formulation of the strategic goals was reached smoothly and quickly, as they were discussed at the first working group meeting and already comprised a large part of the ideas and vision that sprung up from the local community.

It was concluded that within two weeks a core of working group will assemble again and will set the dimensions of the new fire station and boiler room, which are the priority and the most defined goals in the development strategy of the village. Then, they will meet with the mayor, who will at that time already have the final information regarding the construction site. They set the year 2017 as a deadline for the preparation of the construction plan and of the construction of the fire station with the district heating boiler room. The regional energy agency offered help with applying for subsidies and dimensioning of the district heating system and the boiler room. The deadline for the operational start-up of the system is set for the year 2019. It was agreed that the working group will meet again in the middle of March 2017 and discuss the work done and set plans for next steps.

Members of the working group, who participated at the excursion to the Best Practice Examples in Austria and Germany, are bringing new ideas for the development of Dole. So, it is expected that some strategic goals might be revised.

2.1 Current bioenergy use in the village

The local community Dole pri Litiji covers an area of approximately 55 km² of rugged terrain at an average altitude of 700 m. Agriculture and forestry are the two most important and widespread activities in the local community of Dole pri Litiji. However, due to the specific location of the local community of Dole, intensive and sufficient farming is hardly possible and there are several factors limiting higher productivity. More than 60% of all agricultural areas are on steep slopes. Furthermore, the small and fragmented farms typically have only sizes of 2 to 5 ha. In addition, small and medium-sized farms are disappearing.

About 3,300 ha (60%) of the local community is covered by forest. Fragmented forest parcels have the most negative impact on forest management. An average owner has 6 ha of forest, which is fragmented in separate plots.

By far, the most important renewable source in the local community is wood biomass. Forest owners are fairly well equipped with adapted forest tractors, as well as with tractors with semi-trailers for transport of wood and chips. Positively, there is no pressure on forest in terms of land use change and deforestation. Also, no illegal logging was identified. In Dole pri Litiji, about 65% of buildings are heated using wood biomass. In the surroundings, there are several sawmills, some of them also own wood chippers. To summarize, there is a great potential for the village to become self-sufficient in energy supply for heating. On the other hand, the local community depends 100% on the import of electricity and motor fuel. Currently, there is no export of locally produced energy.

The majority of boilers in the households are obsolete and therefore, burning biomass causes pollution with particle dust emissions and low efficiency. Additionally, liquid manure produced at surrounding stockbreeding farms contaminates the environment and the groundwater.

The road infrastructure is in poor conditions and the level of education in the community is low. This is the reason for the lack of business skills and experience. The lack of jobs in Dole, combined with other negative conditions, leads to increased migrations. Most of the inhabitants travel to larger towns to work. Young people are also moving to cities if they get an opportunity to study or work there.

2.2 Vision of the village

In the local community Dole pri Litiji a strong local initiative exists to promote the development of the village. The residents are keen to make changes and to push the development of tourism and to strengthen the activities in the village. However they want to keep their traditions alive.

They plan to rebuild the village infrastructure (optic internet, sewerage, electricity) and to build a new wooden fire station which shall include a charcoal museum. As part of the renovation of infrastructure, there is also a plan to set up a biomass district heating system.

The development will be based on three main sections: (1) the development of “Charcoal Land”, (2) activation of the touristic information point and (3) establishment of a bioenergy self-sufficient village. To start the development of the village, it is first necessary to restore the infrastructure in the villages, to build a museum of charcoal as part of the new fire station, to build a common biomass boiler, and to start the process of energy independence. The increased use of renewable energy sources will be based on a smaller district heating system for heating larger buildings in the centre of the village and surrounding individual houses. In the next step, they want to focus towards self-sufficiency in electricity by setting up a windmill, a small biogas plant and a cogeneration plant.

The vision of the village is summarized in the slogan:

"The first energy self-sufficient village in Charcoal Land, where tradition goes hand in hand with the future."

2.3 Strategic bioenergy goals in the village

Table 1: Strategic bioenergy goals in the BioVill target village Dole pri Litiji, Slovenia

| Current situation / Challenge | Strategic goals | Sub-goals and short description |
|---|---|--|
| Charcoal production in Dole pri Litiji has a long tradition. Many different activities were organized in the past and several projects implemented. | Goal 1: Charcoal museum | Goal 1.1: Construction of new wooden fire station Goal 1.2: Opening of the Charcoal museum in the building of new fire station |
| | Goal 2: Renovation of local infrastructure | Goal 2.1: Reconstruction of local infrastructure (water supply, sewerage, broadband internet, heating system, ...) is the basis for the further development of the village. |
| The surroundings of Dole pri Litiji is mostly covered by forests (70% of the area). About 35% of | Goal 3: Most of the heat demand will be covered from the | Goal 3.1: Construction of woodchip boiler for heating the village centre Goal 3.2: |

| Current situation / Challenge | Strategic goals | Sub-goals and short description |
|--|---|---|
| households are heated by using fossil fuels. Most of the forests are private and represent an important income for their owners. | locally available renewable source (wood, sun) | Connection of individual households to the district heating system Goal 3.3: Promotion of modern wood based heating systems in combination with solar systems for more remote individual houses |
| | Goal 4: Involvement of forest owners and other local wood suppliers | Goal 4.1: Supply all the necessary wood from the surrounding forests |
| The surrounding area has several stockbreeding farms. Liquid manure contaminates the environment and the groundwater. | Goal 5: Production of electricity and heat from biogas | Goal 5.1: Setting up a small biogas plant, which will use manure from the surrounding farms Goal 5.2: Transmitting the produced electricity to the electricity grid Goal 5.3: Usage of produced heat for the district heating system or for other purposes, as e.g. drying of hay or fruits. |
| | Goal 6: Involvement of local farmers in the process of electricity and heat production | Goal 6.1: The supply of manure for biogas and the use of produced fertilizer on the surrounding fields. |
| Dole pri Litiji is currently 100% dependent on the import of electricity | Goal 7: Energy independency of the village | Goal 7.1: Installation of a windmill Goal 7.2: Production of electricity from biogas Goal 7.3 Biomass cogeneration |
| Dole pri Litiji is located in the countryside where the nature is still well preserved. However, there are problems with polluted drinking water and particulate matter emissions from obsolete boilers. | Goal 8: Improve the quality of the environment | Goal 8.1: Construction of the biogas plant will decrease the contamination caused by unused manure and improve the status of groundwater. Goal 8.2: Replacement of obsolete boilers will improve the air quality |

| Current situation / Challenge | Strategic goals | Sub-goals and short description |
|-------------------------------|---|---|
| | Goal 9: Reduction of pollution caused by transport | Goal 9.1: Use of biogas in transport |

2.4 Local bioenergy action plan

Table 2: Local bioenergy action plans and bioenergy goals in the BioVill target village Dole pri Litiji, Slovenia

| Action area | Current situation/ challenges | Actions | Action plan | | | Contribution to the strategic goal (No.) |
|-------------|--|--|---|--|---|--|
| | | | 2020 | 2030 | 2050 | |
| Heating | Buildings in Dole pri Litiji are heated individually, 35% of them are using fossil fuels. The surroundings of Dole pri Litiji is mostly covered by forests (70% of the area). Most of the forests are private and represent an important income for their owners. | Setting up a small district heating grid system. Supporting the replacement of old and inefficient boilers with modern biomass based heating systems. Local forest owners and farmers will supply all the necessary wood from the surrounding forests. | Building a new fire station with a biomass boiler room. Setting up a legal form of organization Start of operation of district heating system Connection of buildings with high heat demand (zone 1) to the district heating system. | Connection of individual households (zone 2) to the district heating. Implementation of individual heating solution for household, not appropriate to connect to the district heating system. | All buildings in the local community are heated using renewable energy sources. | 1, 2, 3, 4, 5, 6, 8 |

| Action area | Current situation/ challenges | Actions | Action plan | | | Contribution to the strategic goal (No.) |
|------------------|--|--|--|--|---|--|
| | | | 2020 | 2030 | 2050 | |
| Power generation | <p>The surrounding area has several stockbreeding farms. Liquid manure contaminates environment and groundwater.</p> <p>Dole pri Litiji is currently 100% dependent on imported electricity.</p> | <p>Setting up a small biogas plant for production of electricity and heat.</p> <p>Setting up a wood based cogeneration unit.</p> <p>Installation of a windmill.</p> <p>Involvement of local farmers and forest owners in the process of electricity and heat production.</p> | <p>Investigate the administrative and technological requirements for setting up a biogas plant and windmill.</p> <p>Involve stock farmers in the process of decision making.</p> | <p>Building a small biogas plant.</p> <p>Installation of a windmill.</p> <p>Building a wood cogeneration unit.</p> | <p>All buildings in the local community are provided by locally generated electricity from RES.</p> | 3, 4,5, 6, 7, 8 |
| Transport | <p>Dole pri Litiji is currently 100 % dependent on the supply of imported motor fuel.</p> <p>Problems with polluted drinking water and particulate matter emissions.</p> | <p>Construction of a biogas plant to decrease the contamination caused by manure and thereby improving the status of the groundwater.</p> <p>Use of biogas and biodiesel for transport.</p> | <p>Stirring up an interest in the local community for using biofuels.</p> <p>Investigate the requirement for setting up a biogas plant and/or biodiesel plant.</p> | <p>First working vehicle to run on biogas.</p> | <p>All working vehicles in local community run on biofuels.</p> | 8, 9 |

3 Estelnic, Romania

The elaboration of Estelnic's strategy was carried out with local stakeholders. We held two meetings to identify the local strategic goals that we want to achieve during the next few years. Both meetings were organized together with the bioenergy village Ghelinița. The first one was held in Balványos on 7th February 2017, while the second one on 9th March 2017, in Sfântu Gheorghe.

In Estelnic, the working group is made up of nine persons: Attila Varga village manager; Ferenc Domokos mayor; István Fülöp local school director and member of local council; PhD. Tihamér Sebestyén vicepresident of Youth Association Tg. Secuiesc area and researcher, Imola Bodó notary; Béla Kakucs priest at Franciscan Monastery church; Zoltán Jancsó president of the local Forest Owners Association; Árpád Domokos entrepreneur and owner of local energy willow plantations; Balázs Salamon director of Angustia Leader Association.

During the second meeting, the Green Energy Association organized a company visit day. Thanks to the organizer, Sándor Bartha vice-president of GEA, the working groups visited several locally implemented projects about solid-biomass collecting, chipping and heating technologies. These projects were realized at Sfântu Gheorghe, one of them at the local waste management centre, the other one at a private greenhouse plant and a third one at a meat processing plant. After the study visit the working groups have focused on the bioenergy village strategy.

Despite the fact that in Ghelinița there are numerous SMEs in the wood sector while in Estelnic this sector is not present, the situation in both villages is very similar. Therefore the local stakeholders have the similar interests: first to ensure the biomass based heat supply in the public institutions and after that to realize a local heating system. Because both villages have more or less the same strategic goals, they worked together to achieve a well-defined strategy. After the study tours in Germany and Austria, the local stakeholders formulated several ideas on starting local bioenergy businesses. Therefore, they quickly reached consensus on the strategic bioenergy goals.

Both villages would like to invest in new heating systems for local public institutions, while they plan that they will increase the collaboration with local sawmill owners to ensure the woodchips input for heating systems. The municipality of Ghelinița wants to purchase a wood chipper, and as a first step, to organize an open day for local citizens and entrepreneurs together with GEA, to demonstrate the whole concept of a bioenergy village. The revision of the bioenergy village strategy will be at the end of 2018.

3.1 Current bioenergy use in the village

Estelnic is situated in the North-Eastern part of the Covasna County, at the foot of the Eastern Carpathians. The local community covers an area of 91.31 km² at an average altitude of 600 m. Small scale agriculture and forestry are the two most important and widespread activities. The small farms typically have sizes of only 2 to 5 ha, and a few farms with 10-50 ha exist.

About 5,900 ha (55%) of the local community is covered with grassland and the second biggest area in Estelnic is covered with forest (40%). The forest is uninterrupted in the mountain region, thus the forest asset is still protected. The local Forest Owners Association has been established with the aim of a sustainable forest management. Since it is surrounded by forests, Estelnic has a very high local dendromass potential (e.g. wood-waste, sawdust, etc.). According to the EU criterion, Estelnic is categorised as less favoured area (LFA). Insufficient employment/lack of workplaces and difficulties in marketing the agricultural products are the main local socio-economic obstacles. The local cultural life is poorly organized and there is a deficit in community activities, also because of difficulties in the integration of the Roma population. In addition a shortage of well-educated human resources and a deficit in expertise/know-how exists due to migration to urban areas or abroad. Roads and public infrastructure are poorly developed (Sebestyén, 2015).

Firewood is the most significant source of heating energy in rural Romania, and the majority of the people use it for heating and cooking. Furthermore, small-scale industries, e.g. agro processing, food industry, timber processing and wood drying, are also using firewood for heating. The firewood is mostly harvested from the local forest. Most of the households in Estelnic are using outdated classical wood stoves with a low heating efficiency. Regarding the current state of emissions in the energy sector in Estelnic, there are no chimneys with particular filters and the CO₂ emission was never monitored.

Firewood expenses have increased three times since 2005 and it is expected to increase more in the next period and their availability to decrease. Deforestation and illegal logging still exists in Estelnic, however, in the last years it is decreasing. There is no statistical estimation about this issue, but it refers also to small scale private households.

In Estelnic, on the local market a lot of firewood is offered which can be used in stoves or firewood boilers as ecological fuel. But no briquette and pellet production exists. The forest management and local wood industry is also poorly developed. Actually in Estelnic there is no relevant wood processing. Wood logging is organized by a company from a neighbouring area, the log is transported out of the municipality and a large quantity of wood waste, like branches etc. remain unused in the forests.

In order to ensure the feedstock for biomass heating, farmers in Estelnic municipality are currently cultivating about 50 ha of energy willow as short rotation coppice (SRC) on degraded land. The stems are harvested every three or four years using a self-propelled forage harvester that cuts and chips the stems. A future extension of the willow plantation to 100-150 ha would supply the local public buildings heating needs. Larger willow plantation would make use of unused lands and help to avoid (or considerably reduces) unsustainable wood logging caused by the increasing need for cheap firewood.

In Estelnic, a new biomass heating system based on woodchips was established recently to supply the mayor's building, the cultural centre and Angustia Leader Association (local action group consisting of 12 communes). This supports the local forest economy and provides a technological and economic basis to further develop the local bioenergy value chain. The mayor, the local council and various stakeholders have already contributed a lot and are willing to further support the development. Currently the biggest challenge is to find financing schemes, investment fund and to build viable business models for the implementation of the bioenergy village concept in Estelnic.

Regarding the electricity supply, in Estelnic there are no local power generation facilities. Public sector, private households and industrial consumers are connected to the national grid. From this point of view, the expenses for electricity are lost for the region.

From 2010 on, the Romanian "Green House Programme" subsidized with approximately 1,350 € per household residential solar and thermal systems and also a small proportion of biomass systems. However, it was stopped in 2016 when the total sum of the financial support on national level reached only 15 million €. The beneficiaries are mostly from rural areas where electricity or thermal energy supply by the national grid is not possible or cost effective. Therefore, off-grid PV systems are only common in remote areas which are still not supplied by an electrical grid.

The energy for transportation in Estelnic is based 100% on fossil fuel, originating partly from domestic resources but the major part comes from abroad.

3.2 Vision of the village

The vision of *the village is "Estelnic pilot of green applications"*. In Estelnic a small scale biomass heating system for local public organizations already exists. Thus, the municipality is already a best practice example in using forest resources and implementing bottom up initiatives.

According to the results of the survey with the local inhabitants, they are open for the Bioenergy Village project and for local development. On the other hand, Estelnic realised that through the know-how transfer and the international cooperation, a sustainable development for its less favoured rural community could be achieved, while the local human and natural potential could be exploited.

Economic growth, through activating local bioenergy potential, has a positive impact not only on the target community, but also on the surrounding communes. Small businesses contribute to local bioenergy value chain by bringing growth and innovation to the community in which the business is established. Small businesses also help to stimulate economic growth by providing employment opportunities to vulnerable groups and people who may not be employable by larger corporations.

The local stakeholders have to be able to provide an innovative and dynamic development process based on local endowments to achieve a safe and decentralised energy supply.

According to the working group conclusions, the main objectives are the following: the local future policies should focus and develop the basic economic infrastructure, create new local business opportunities for

bioenergy sources, keep the monetary value from local businesses and service expenses in the region. The vision of Estelnic is to become step by step a self-sufficient energy village based on local biomass potential. Increasing the local economy by developing local value chains is crucial for the citizens. Furthermore, to create new revenue possibilities especially for young people, for agricultural by-products, forest wood wastes and other renewable energy resources. To reduce the outmigration, especially of young people, from the village is one of the most important local policies.

This commune will demonstrate that by know-how transfer and by focusing on the local human and natural potential, the bottom up based development of a less favoured rural community is going to be successful. The improvements will have a positive impact not only on the target community, but also on surrounding communes.

3.3 Strategic bioenergy goals in the village

Table 3: Strategic bioenergy goals in the BioVill target village Estelnic, Romania

| Current situation / Challenge | Strategic goals | Sub-goals and short description |
|--|---|---|
| <p>100% of the heating demand in the village is based on local firewood and sawdust, wood waste, fired by out dated classical wood stoves</p> <p>The estimated heating expenses in the village is 60,000 €/year for 403 households, however, there is a significant illegal wood harvesting.</p> <p>There is a small heating system for few local public institutions.</p> <p>100% of the electricity demand in the village is based on national supply systems, the expenses are lost for the region.</p> <p>The amount of money flowing out from Estelnic per year is ca. 200,000 €</p> <p>100% of the energy for transportation is based on fossil fuels from abroad, the amount of money flowing out from Estelnic is 387,000 €/year</p> | <p>Goal 1: Keep the monetary value from energy expenses in the region</p> | <p>Goal 1.1: Create new business opportunities (installations, demand for wood chips and wood waste) of local SMEs (installers, manufacturers, chimney sweepers)</p> <p>Goal 1.2: Provide local biomass trade centre and deposit opportunities for inhabitants for household woody waste (branches, wreaths, Christmas tree, etc.), and for biomass producers (farmers, forest owners)</p> <p>Goal 1.3: Develop a local or regional biomass value chain, include forest and sawmill owners, and timber producers, forest owners association, etc.</p> <p>Goal 1.4: Reduce the dependency of imported woods, electricity and fuel.</p> |
| <p>100% of the heating demand in the village is based on firewood and classical wood stoves, firewood boilers, etc. with low efficiency and no environmentally friendly technologies.</p> <p>There is no power generation</p> | <p>Goal 2: Increase the energy efficiency in the heating and power sector, achieve the energy self sufficiency of the village</p> | <p>Goal 2.1: Increase the social awareness about energy efficiency in daily energy consumption (Buildings refurbishing, smart measuring, energy saving, etc.)</p> <p>Goal 2.2: Demonstrate new purposes, efficient technologies, workshops.</p> <p>Goal 2.3: The local woody waste should not be burnt on site,</p> |

| Current situation / Challenge | Strategic goals | Sub-goals and short description |
|--|--|--|
| | | instead have to be chipped and used as fuel for the heating of local public buildings. Goal 2.4: Provide information about national or local subsidy opportunities, like Green House Program, Green House Plus, etc. |
| The official unemployment rate is currently very low, only 6%. However, many people appear in official statistics as employed as they have some informal income. In practice, many of them do not have a regular job. Thus, unemployment is a big challenge for the local economy. | Goal 3: Increase the local employment opportunities, create new jobs | Goal 3.1: Involve the local vulnerable social groups, unqualified workforce to collect the wood waste, branches from public areas, river basin, grass land Goal 3.2: Create temporary or permanent job for local inhabitants for transportation, wood chipping, wood waste deposit distribution Goal 3.3: Create local service and maintenance for biomass boilers and other additional facilities |
| The awareness about energy efficiency and environmental protection is low in Estelnic | Goal 4: Increase the local social awareness about: energy efficiency, renewable energy use, environmental protection Reduce the carbon and other emissions (particulate matter, etc.) of the village | Goal 4.1: Install new energy efficient heating systems, while the old ones have to be replaced in public and private buildings Goal 4.2: Install particulate matter emissions filters - controlling for wood boiler systems Goal 4.3: Introducing new issue for local school program, like environment awareness, bioenergy cycle, energy saving Goal 4.4: The members of the BioVill working group have to undertake active role to shaping the local mentality and to increase the local awareness Goal 4.5: The bioenergy village concept has to be included in the Local Development Strategy and its strategic steps that are required for Estelnic to achieve the local energy transition and the "Bioenergy Village" to be successful. |
| According to the dynamic of the population, we are faced with a big challenge: we have to mitigate the negative effects of ageing | Goal 5: Reduce the emigrate, especially of young people, from the village | Goal 5.1: Develop the local economy through bioenergy value chain, set up the local bioenergy market and new start-ups. Goal 5.2: |

| Current situation / Challenge | Strategic goals | Sub-goals and short description |
|-------------------------------|-----------------|---|
| | | <p>Create new revenue possibilities especially for young people in energy sector, e.g. energy willow plantation on the degraded lands to supply the local heating demand, the surplus could be sell on the region biomass market</p> <p>Goal 5.3:</p> <p>Create a business-friendly environment at local and regional level</p> |

3.4 Local bioenergy action plans for Estelnic

Table 4: Local bioenergy action plans and bioenergy goals in the BioVill target village Estelnic, Romania

| Action area | Current situation/ challenges | Actions | Action plan | | | Contribution to the strategic goal (No.) |
|-------------|---|--|---|--|--|---|
| | | | 2020 | 2030 | 2050 | |
| Heating | <p>Efficiency/ insulation status of the buildings are poor, very few public institutions are refurbished. However private households are getting to be insulated. The average heat demand of the buildings is 227 kWh per m² and year.</p> <p>There is no heating system based on fossil heating oil or on lignite briquettes.</p> | <p>Increase the energy efficiency:</p> <p>Replace traditional, inefficient firewood based boilers with modern biomass based boilers, thus, creating new business opportunities</p> | <p>50% classical stove and firewood boiler replaced with biomass boilers in public institutions</p> | <p>100% classical stoves replaced with high efficient biomass boilers in public institutions and 50% classical stoves replaced with high efficient heating technology in the whole village</p> | <p>Using 100% energy efficient technology for heating in the whole village</p> | <p>1.4</p> <p>2.1</p> <p>2.2</p> <p>2.3</p> <p>3.3</p> <p>4.1</p> |
| | | <p>Keep the monetary value from energy expenses in the region: Set up small district</p> | <p>Installing a small district heating at Franciscan Monastery, Local Medical Centre,</p> | <p>Develop several small heating systems at local public institutions and companies</p> | <p>Develop a local district heating in the centre of villages</p> | <p>1.1</p> <p>1.3</p> <p>1.2</p> <p>2.2</p> <p>3.3</p> |

| Action area | Current situation/ challenges | Actions | Action plan | | | Contribution to the strategic goal (No.) |
|-------------------------|--|---|---|---|--|---|
| | | | 2020 | 2030 | 2050 | |
| | | heating system and woody biomass collection center at Estelnic in the local school and additional buildings | Schoolhouse Setting place for woody waste collection centre | | | 3.2 5.1 |
| | | Increase the local social awareness about: renewable energy use, environmental protection | Increasing the local awareness about renewable energies Provide information about local and national subsidies Involve the local inhabitants in bioenergy action activities | At household level, 50% of heating systems contains and use renewable energy sources, | Using 100% renewable energy for local heating supply | 2.2 4.1 4.2 2.4 3.2 4.3 4.4 |
| | | Increase the local employment opportunities, create new jobs, mitigate the emigration | Involve the local active population to develop the local biomass market | Create a local social enterprise to involve local vulnerable social groups, unqualified workforce to collect the wood waste | Keep the social enterprise, develop the corporate social responsibility mentality at local companies | 3.1 3.2 3.3 5.2 |
| Power generation | There is no power generation activity. However, the electricity bills are going to be more and | Provide information and technical support for local | Demonstrative projects for power generation | 10% of power supply from local power generation | 70 % of power supply from local power generation | 2.1 2.2 2.3 |

| Action area | Current situation/ challenges | Actions | Action plan | | | Contribution to the strategic goal (No.) |
|------------------|--|---|---|-------------------|-------------------|--|
| | | | 2020 | 2030 | 2050 | |
| | <p>more expensive for the private households but also for the companies.</p> <p>The technology for power generation is available. However, in Romania, there is no adequate support for energy transition. Therefore the first investment is still too much for a reasonable payback period, while the energy market is vulnerable and uncertain. The average power demand per person is 600 kWh/year.</p> | <p>stakeholders/ inhabitants to get national subsidies for power generation. Support the small scale PV solar panel installation for households</p> | | | | <p>5.2</p> <p>4.5</p> <p>5.3</p> |
| Transport | <p>There is no biofuel generation possibility. For a biorefinery the villages have no “know how” and facilities, while the domestic fuel prices are still cheap, the biodiesel or bio ethanol prices are still not competitive.</p> | <p>Through international research and development programs we can realize several researches about bio fuel production</p> | <p>Research for biofuel production</p> <p>Electric charging station</p> | Not yet clarified | Not yet clarified | <p>1.1</p> <p>1.4</p> |

4 Ghelintă, Romania

The elaboration of Ghelintă's Bioenergy Village Strategy was carried out with local stakeholders in Sfântu Gheorghe, Romania. The BioVill working group from Ghelintă held two meetings with the aim to define the local strategic goals that they want to achieve during the next 10 years. Both meetings were organized together with the bioenergy village Estelnic. The first was held in Balványos on 7th February 2017 and we evaluated the questionnaire survey result which has been carried out in the end of 2016. The second one was on 9th March 2017, in Sfântu Gheorghe where the strategy has been formulated and agreed.

Our strategic objectives are long-term, continuous strategic areas that help us connect to our vision, namely to energy self-sufficiency. The working group selected the key activities that Ghelintă needs to perform in order to achieve its vision.

The members of Ghelintă working group are Mr. József Cseh mayor, Botond Ilyés deputy-mayor, István Fejér councilor, Attila Csákány manager of land register office, István Bereczki priest, Zsuzsanna Kovács school director, László Tamás president of Local Forest Owner Association, Csaba Szakács entrepreneur, Csaba Cseh councilor, Szilárd Márkos councilor and PhD. Tihamér Sebestyén vice president of Youth Association Tg. Secuiesc area.

During the last six months, thanks to the German and Austrian partners, it was a great opportunity to visit the best practice examples and facilitating exchange with already successfully running bioenergy villages. The first BioVill study tour was organized in South-West Germany from Oct. 17-20, 2016. The group visited four different bioenergy villages in the region around Singen: St Peter, Büsingen, Bonndorf and Möggingen. The mayor from Ghelintă village participated in the study tour. The second BioVill study tour was organized in Austria from 25-27th January, 2017. The delegation visited five different renewable energy complexes in Bruck an der Leitha, Güssing, Mureck and Hartberg. The participants from Romania were local mayors, members of local councils of Estelnic and Ghelintă bioenergy villages.

The working group has visited several companies in Sfântu Gheorghe who have installed solid biomass based heating systems. Mr. Sándor Bartha vice president of GEA, gave guidance on how to collect the public wood waste in the town, about the chipping process and the automated heating systems. The local implemented projects with solid-biomass collecting, chipping and burning to heating have been also presented. These projects were realized in Sfântu Gheorghe, one of them at the local waste management centre, the other one at private greenhouse plant and the third one at the local meat processing plant. After the tour the working groups focused on discussing the bioenergy village strategy.

The main goals for the villages (Estelnic and Ghelintă) will be mostly the same, hence the stakeholders worked together to achieve a well thought out strategy. After the study tours in Germany and Austria the local stakeholders already formulated several ideas on starting local bioenergy businesses, therefore they quickly reached consensus on the strategic bioenergy goals.

Firstly, Ghelintă would like to invest in a new biomass heating system for the Local Council's building as a demo purpose. In the next years, the Local Council is planning to increase the collaboration with the local sawmill owners to ensure the woodchips input for the heating systems which will be installed step by step to each public institution. The decision makers from Ghelintă want to purchase a wood chipper in 2017 and they would like to organize together with GEA an open day for citizens and entrepreneurs to demonstrate the whole concept of the bioenergy village. According to the working group decision, the revision of bioenergy village strategy will be in the end of 2018.

The local working group set several short-term goals for this year, for instance Ghelintă local council wants to realize a project investing for a tractor and for a wood chipper, while in Ghelintă, there is a need to find a place to deposit the local wood waste coming from the cleaning public green areas, backyards, households etc. The concept is that on this place the local inhabitants can deposit for free their burnable wood waste, while yearly two-three times this raw material is going to be chipped to ensure the feedstock for the local biomass boilers.

4.1 Current bioenergy use in the village

Firewood is the most significant source of heating energy in Ghelintă, while the municipality is not connected to the natural gas grid. The people use the firewood for heating and cooking, a very few households use gas tanks (LPG) for cooking, but in Ghelintă nobody uses heating oil, coal or other fossil fuels. Furthermore, in Ghelintă, there are more than 28 sawmills and several logging groups working local and regional level. The sawmill SMEs

process the round logs for primary wood products, for timber processing and wood drying using firewood to produce heating. Even though Ghelinta is famous for its logging history, there is no added value in wood processing, like furniture, parquet or paper industry.

As firewood was cheap until the last years, the major part of the consumers used firewood for heating, while thermal stoves and furnaces have a lower efficiency about 10-15% (Grîu, 2014)¹. The out dated classical wood stoves could supply the heating needs, because the firewood is mostly harvested from local forest. However, in the last years the price of wood has increased continuously and more and more households want to invest money for a higher energy efficient biomass boiler or firewood boiler. In this case, the working group is fully convinced that the local bioenergy market is going to be stronger and stronger. In the same time, the illegal cutting is going to be more and more difficult and dangerous; the black market is permanently investigated from local and national forest inspectorates and police.

Considering all these aspects, the bioenergy village has a great future for citizens. The working group is committed to provide a sustainable local forest management and smart management for local woody waste. An important aspect in the use of wooden biomass to produce heat is that the biomass is an ecological material with lower CO₂ emission in the burning process.

Regarding the current state of emissions in the energy sector in Ghelinta, there are no chimneys with particular filters and the CO₂ emission was never monitored.

According to the local stakeholders, the exploitation of firewood has to be reduced, while for heating poor quality wood waste has to be used.

The main objective, together with the Estelnic municipality, is to highlight the most efficient solid biomass fuel to produce thermal energy for the public institutions, housing and the cost for this energy. Fossil fuels have high costs and the firewood expenses have increased three times since 2005 and it is expected to increase more in the next period and their availability to decrease. Deforestation and illegal logging still exists, however, in the last years it is decreasing.

The extended mountain pastures in Ghelinta reaches few hundred hectares which is cleaned year by year. From these areas a voluminous amount of branches and smaller trees could be harvested. From this raw material, the heating demand of public institutions could be supplied. Even though there are several sawmills, the sawdust goes out from the region to the bigger wood processing factories.

The forest management is not sustainable and is poorly developed. After loggings a huge quantity of wood waste, branches, etc. remains in the forests. According to the new forest regulations, after the logging process the company is obliged to clean the logging site from wood waste and branches. From these materials woodchips, pellets, briquettes can be produced for local using but also for export.

Regarding the local employment, in Ghelinta several SMEs exist, mostly interested in wood processing, services and tourism. Therefore, currently the lack of jobs is not the biggest problem. According to the local socio-economic survey carried out during spring 2016, the following factors are considered as obstacles in the development of the village: low incomes; difficulties in the wood exploitation, the price of round log is increasing; low quality of the local agricultural lands. The poor strategies to overcome natural risks in agriculture produce uncertain incomes for farmers. This kind of problems appears in literature also. The local cultural life is poor organized and there is a deficit in community; in addition a shortage of valuable human resources due to migration to urban areas or abroad; furthermore deficit in expertise/know-how; as well the poor condition of the roads, the public infrastructure and facilities; difficulties in the integration of the Roma population (Havadi & Sebestyen, 2016)².

According to the European nomenclature, Ghelinta is considered in less favoured areas (LFAs) are characterized by diversity of environmental conditions and can be defined according to place and space specificities. Ghelinta

¹ GRÎU RARIANA and LUNGULEASA AUREL (2014): Economics consideration on wooden biomass consumption, International Conference of Scientific paper afases, Brasov, 22-24 May 2014.

² Kinga Xénia HAVADI-NAGY & Tihamér-Tibor SEBESTYÉN (2016): Entrepreneurship and activation of local potential for rural development. Lemnia and Sâncraiu – two case studies from Romania, in Territorial Identity and Development, pp. 7-22, DOI: 10.23740/TID120161

is 70 km away from the nearest metropolitan zone, which leads to high transport costs. Moreover, this region of Romania is affected by poor physical infrastructure, missing local capital, while the community generally has a traditional social network.

According to the latest statistical database in Ghelinița, the population dynamic is positive. This favourable situation gives the power to build new development strategy for bioenergy sector. The demographic structure of Ghelinița is stable, however, the migration to the cities and abroad is also considerable.

In Ghelinița, there are more than 200 ha degraded and low quality land which are suitable for energy forest plantations. In the neighbouring municipalities, there are already a few hundred hectare of energy willow plantations. The agro-climatic parameters are good for such a plantation in Ghelinița. In principle, these species have been experimented in order to serve as primary energy source.

150 ha of energy willow plantations can supply the local public buildings heating needs. If the local investors are interested in larger plantations, this can justify the investments such as pelletizing factories – which will provide export activities.

Even though that a biomass potential exists and there are several SMEs in wood processing, no initiatives have been existed before to develop the bioenergy value chains.

The working group recently recognized that the technological and economic environment is given for local bioenergy market and value chain. Therefore the local human and material capacities have to be developed to achieve the above mentioned goals.

Due to the active participation of the mayor, the local council, several SMEs and decision makers, the bioenergy value chain development is possible.

Regarding the electricity supply in Ghelinița, there are no local power generation facilities. The settlement, the public lighting, the private households and the industrial consumers are connected to the national grid. From this point of view, the expenses represent losses for the municipality, only for private households of approximately 300,000 € per year, while the local industrial electricity consumption is much bigger. The concept to install a new CHP plant in Ghelinița is accepted, however, there is no investor for it, because the national energy policy does not provide new power plants to connect to the national grid, while the subsidies for electricity generation from renewable energies are also stopped in Romania.

The global radiation potential in Ghelinița is 1,285 kWh/m²/year (SEBESTYEN, 2016). In our region the installed PV projects are already connected to the national grid, mostly installed on land surface with different characteristics. Off-grid solar PV systems or solar heating systems have many application opportunities in household energy supply: water pumping, operation of kitchen equipment, heating, etc. It is assumed that the decentralized PV applications are to be installed at roof-tops. The potential of off-grid PV system is, therefore, practically the search for households in „roof reach area”, namely in rural villages. This pathway to use solar energy is very popular in Ghelinița, because the equipment cost is decreasing while the usefulness is more and more evident.

The energy for transportation is based 100% on fossil fuel, one part of comes from domestic resources and the bigger part comes from abroad. Actually there are no initiatives for the biorefinery.

4.2 Vision of the village

According to the results of the questionnaire survey, the local citizens are open for a Bioenergy Village project and for local development. Ghelinița municipality has a lot of solid biomass and a strong local entrepreneurship in wood exploiting. However, after the exploiting, there is no added value wood producing, the wood goes out from municipality as raw material. During the wood exploiting remains a huge amount of wood waste, the vision of Ghelinița to be used for local energy supply.

The BioVill project enables the know-how transfer and international cooperation for bioenergy development. Thus, Ghelinița gets more and more knowledge about smart wood management for energy production.

Economic growth through activating the local bioenergy potential has a positive impact, not only on the target community, but also on the surrounding communes. Small businesses in the wood sector contribute to the local bioenergy value chain by bringing growth and innovation to the community in which the business is established.

Small local businesses also help to stimulate the sustainable economic growth by providing employment opportunities to vulnerable groups and people who may not be employable by larger corporations.

The local stakeholders are able to provide an innovative and dynamic development process, based on local endowments to achieve a safe and decentralised energy supply.

According to the conclusions of the working group, the main objectives are following: the local future policies should focus on sustainable use of wood waste, to develop added value for wood processing, develop the basic economic infrastructure, create new local business opportunities for bioenergy sources, and keep the monetary value from local businesses and service expenses in the region. The main goal of Ghelinița is to achieve that the heating at the public institutions to be produced from local wood waste comes from local public areas, sawmills, forest management. For a longer period the concept is to achieve heating and power energy self-sufficiency based on local renewable energy potentials. Increasing the local economy due to develop local added value chains is crucial for the citizens. Furthermore, the aim is to create new revenue possibilities especially for young people, for agricultural by-products, forest wood wastes and other renewable energy resources. To reduce the exodus, especially of young people, from the village is one of the most important local policies. Regarding the environmental protection, Ghelinița is able to achieve to mitigate the GHG emission, to keep clean the public areas, orchards, mountain pastures and forests.

The vision of the village summarized that Ghelinița would like to produce and consume its energy locally, it's slogan is: **"Let's energize Ghelinița locally!"**

4.3 Strategic bioenergy goals in the village

Table 5: Strategic bioenergy goals in the BioVill target village Ghelintă, Romania

| Current situation / Challenge | Strategic goals | Sub-goals and short description |
|--|---|---|
| <p>100% of the heating demand in the village is based on local firewood and on few sawdust boilers, but most of the households heat with outdated classical wood stoves</p> <p>100% of the electricity demand in the village is based on the national supply system, the expenses of more than 500,000 €/year are lost for the region.</p> <p>100% of the energy for transportation is based on fossil fuel, comes from abroad. The expenses of more than 1.52 million €/year are lost for the region.</p> | <p>Goal 1: Keep the monetary value from energy expenses in the region</p> | <p>Goal 1.1: Create new business opportunities (installations, demand for wood chips and wood waste) of local SMEs (installers, manufacturers, chimney sweepers)</p> <p>Create new start-ups for local energy supply</p> <p>Goal 1.2: Provide revenue opportunities for local biomass producers (farmers, forest owners)</p> <p>Goal 1.3: Develop local or regional biomass value chain, include forest and sawmill owners, and timber producers, local forest owners association, etc.</p> <p>Goal 1.4: Reduce the dependency of imported woods, electricity and fuel.</p> |
| <p>100% of the heating demand in the village is based on firewood and classical wood stoves, firewood boilers, etc.</p> <p>There is no power generation</p> | <p>Goal 2: Increase the energy efficiency in the heating and power sector, achieve the energy self-sufficiency of the village</p> | <p>Goal 2.1: Increase the social awareness about energy efficiency in daily energy consumption (Buildings refurbishing, smart measuring, energy saving, etc.)</p> <p>Goal 2.2: Demonstrate new energy efficient technologies, wood chipper, demonstrative workshops</p> <p>Goal 2.3: Provide information about national or local subsidy opportunities for citizens, like Green House Program, Green House Plus, etc.</p> <p>Goal 2.4: Invest for demonstration wood chipper, set up an arranged place for woody waste deposit, install a wood chips based biomass boiler for a public building</p> |
| <p>The official unemployment rate</p> | <p>Goal 3:</p> | <p>Goal 3.1:</p> |

| Current situation / Challenge | Strategic goals | Sub-goals and short description |
|--|--|---|
| <p>is currently very low, only 6%. However, many people appear in official statistics as employed as they have some informal income. In practice, many of them do not have a regular job. Thus, unemployment is a big challenge for the local economy.</p> | <p>Increase the local employment opportunities</p> | <p>Involve the local vulnerable social groups, unqualified workforce to collect the wood waste, branches from public areas, river basin, grass land; Social enterprise for wood waste collecting.</p> <p>Goal 3.2: Create temporary or permanent job for local inhabitants for transportation, wood chipping, wood waste deposit distribution</p> <p>Goal 3.3: Create local service and maintenance for biomass boilers and other additional facilities</p> |
| <p>Currently, the local inhabitants do not know about biomass value chain. The public awareness about renewable energy use is at low level.</p> <p>Due to the traditional mentality the environment friendly attitude is given, but there is no holistic information about energy self-sufficiency, bioenergy concept, biomass value chain, etc.</p> | <p>Goal 4: Increase the awareness about renewable energy use. Develop the environment friendly attitude in villages, mitigate the emissions</p> <p>Reduce the carbon and other emissions (particulate matter, etc.) of the village</p> | <p>Goal 4.1: Introducing new issue for local school program, like environment awareness, bioenergy cycle, energy saving</p> <p>Goal 4.2: The members of BioVill working group have to undertake active role to shaping the local mentality and to increase the local awareness.</p> <p>Goal 4.3: The bioenergy village concept has to be included in the Local Development Strategy and its strategic steps that are required for Ghelinta to achieve the local energy transition and the "Bioenergy Village" to be successful.</p> <p>Goal 4.4: Organizing open days, awareness campaign for citizens, public debate, presentations, etc.</p> <p>Goal 4.5: The bioenergy village has to be promoted in different media.</p> <p>Goal 4.6: Install new energy efficient heating system, while the old ones have to be replaced.</p> <p>Goal 4.7: Install particulate matter emissions filters - controlling for wood boiler systems.</p> |
| <p>According to the dynamic of population, we are faced with a big challenge: we have to mitigate the negative effects of ageing.</p> | <p>Goal 5: Reduce the exodus, especially of young people, from the villager</p> | <p>Goal 5.1: Develop the local economy through a bioenergy value chain and set up the local bioenergy market.</p> <p>Goal 5.2: Create new revenue possibilities, especially for young people in energy sector.</p> <p>Goal 5.3:</p> |

| Current situation / Challenge | Strategic goals | Sub-goals and short description |
|-------------------------------|-----------------|---|
| | | Create a business-friendly environment at local and regional level. |

4.4 Local bioenergy action plans

Table 6: Local bioenergy action plans and bioenergy goals in the BioVill target village Ghelinta, Romania

| Action area | Current situation/ challenges | Actions | Action plan | | | Contribution to the strategic goal (No.) |
|-------------|---|--|---|---|---|--|
| | | | 2020 | 2030 | 2050 | |
| Heating | Efficiency/insulation status of the buildings is poor. There are no public buildings which are already refurbished. However private households are getting to be insulated. The average heat demand of the public buildings is 300 kWh per m ² and year. However, there is a small scale oil exploitation, there is no heating system based on fossil heating oil or coal, lignite briquettes, etc. | Replace traditional and inefficient stoves based on firewood with energy efficient biomass based boilers | The classical stove and firewood boiler from public buildings has to be replaced with biomass boilers | 100% classical stoves replaced with high efficient biomass boilers at the public institutions and 50% classical stoves replaced with high efficient heating technology in the whole village | Use 100% energy efficient technology for heating in the whole village | 1.4 2.1 2.2 2.3 3.3 4.1 |
| | | Set up small district heating system at Ghelinta in the local school and additional buildings | Installing a small district heating at Ghelinta' School | Develop several small heating systems at local public institutions and companies | Develop a local district heating in the centre of villages | 1.1 1.3 2.2 3.3 |
| | | Support the replacement of old and inefficient boilers with modern | Increase the local awareness about renewable | At household level, 50% of heating systems contains and | Use 100% renewable energy for local heating supply | 2.2 4.1 4.2 |

| Action area | Current situation/ challenges | Actions | Action plan | | | Contribution to the strategic goal (No.) |
|------------------|--|---|---|---|--|---|
| | | | 2020 | 2030 | 2050 | |
| | | biomass systems (biomass, solar) | energies. Provide information about local and national subsidies | use renewable energy sources | | |
| Power generation | <p>There is no power generation activity; however, the electricity bill is going to be more expensive for the private households and also for the companies.</p> <p>The technology for power generation is available. However, in Romania, there is no adequate energy policy for it. Therefore, the initial investment is still too much for a reasonable payback period, while the energy market is vulnerable and uncertain. The local average power demand per person is 600 kWh per year.</p> | Provide information and technical support for local stakeholders, inhabitants to get national subsidies for off-grid power generation. Support the small scale PV solar panel installation for households | <p>Demonstration projects for power generation</p> <p>The municipality would like to realize a local PV plant to supply the public lighting and public institutions power needs</p> | 10% of power supply from local power generation | 50 % of power supply from local power generation | <p>2.1</p> <p>2.2</p> <p>2.3</p> <p>5.2</p> |
| Transport | There is no biofuel generation possibility. For a biorefinery, the village do not have “know how” and facilities, while the domestic fuel prices are still too cheap that biodiesel or bio ethanol production can be competitive. There is no big cow farm or pig farm for biogas production, the average farm size is 2.65 ha, therefore it is | Through international research and development programs we can realize several researches about bio fuel production | Research for biofuel production | Not yet clarified | Not yet clarified | |

| Action area | Current situation/ challenges | Actions | Action plan | | | Contribution to the strategic goal (No.) |
|-------------|--|---------|-------------|------|------|--|
| | | | 2020 | 2030 | 2050 | |
| | impossible to collect a huge amount of waste material for a biogas fermentation or bio refinery. However the climate is suitable for oil plants, while the wastewater treatment station is not realized yet. | | | | | |

5 Kichevo, Macedonia

The key stakeholders for the process of formulating strategic bioenergy goals are the Council and the Mayor of the Municipality of Kichevo along with the administration represented by Tino Aleksov, adviser for energy efficiency and public lighting. The goals have been defined with technical support from SDEWES-Skopje and its representatives (Natasha Markovska, Ljupcho Dimov, Vasil Bozhikaliev and Ilija Sazdovski). Representatives from the local public forestry enterprise and the local sawmill have been consulted as well.

After many discussions among the experts, a consensus has been reached without any obstacles.

When looking into the near future, plans have been made to include more stakeholders from the target village (Regional office of the Economic Chamber of Macedonia, NGOs) to revisit the goals and amend if needed. Realistically, these actions are expected to take place after the second year of the project. At the same time, the proposals for biomass heating system are going to be finalized as well as a concrete individual financing and business model for the target village is going to be developed.

5.1 Current bioenergy use in the village

The existing biomass feedstock in Kichevo consists of forest biomass, stockbreeding residues, and municipal solid waste. A sawmill is located close to Kichevo, that has already been working for five years. The local sawmill and the local public forestry enterprise “Lopushnik” are considered to be very important stakeholders in this project, particularly for the establishment of a local biomass supply chain. At the moment, firewood is being predominantly used as fuel source for heating in the municipality³.

The local economy in Kichevo/in the region stagnates. The main feature of the economy in the region is the Mining and Energy Plant “REK Oslomej”. “REK Oslomej” is the second biggest thermal power plant regarding the installed capacity in the country which once accounted for approximately 10% of the total domestic production of electricity. It consists of one block with a total installed capacity of 125 MW, which started operating in 1980. This thermal power plant currently uses the remaining quantities from local lignite mine Oslomej - West (Kicevo Basin) as a primary fuel. Furthermore, the public administration is the “main employer” in Kichevo after closing the big capacities, the iron mine “Tajmishte” and the factory “Tane Caleski”. There are also small and medium-sized enterprises for trade and production. Foreign donations from relatives living and working out of Macedonia are another income for the families living in Kichevo.

The prospective bioenergy village in Kichevo is located at a densely-populated area which includes residential buildings and public buildings (kindergarten, elementary school, high school and boarding school), all of them on 0.5 km² area. This area has around 3,000 citizens and as many students.

A survey providing first feedback from citizens on their visions and ideas with regards to the bioenergy village concept was performed in October/November 2016⁴.

The major findings showed the following:

- 72% of respondents use firewood as a heating source, 21% have electric heating, 7% use fuel oil
- 67% of respondents are satisfied with their current way of heating
- 53% of respondents pay less than 50 Euros per month for heating
- 80% of respondents will likely change their current way of heating
- 75% of respondents expressed high interest in sustainable and efficient biomass heating
- 61% of respondents are willing to connect their house to a district heating system
- 89% of respondents think that obtaining heating energy from biomass is more environmentally acceptable than the current way of heating
- 82% of respondents welcome the idea of establishment of a bioenergy village
- 63% of respondents are willing to participate in project activities

³ BioVill: D2.7 Report on local and regional framework conditions in the target communities, www.biovill.eu

⁴ BioVill: D3.6 Report on survey with citizens on their visions and ideas, www.biovill.eu

- Other results indicated the following:
- 37% of answers to a question (with multiple answers possible) addressing the expectations for district heating system based on biomass were given to the reduction of costs, 24% to the combination of space heating and hot water, 10% to the operation of the system on renewables, 9% to the citizens' ownership of the system
- 73% of answers to a question (with multiple answers possible) addressing the most promising bioenergy source being available in larger quantities in the region pointed out firewood, 15% pellets, 8% briquettes
- 37% of answers to a question (with multiple answers possible) addressing the main objectives and drivers when establishing a bioenergy village supported the reduction of heating costs, 31% the decrease of CO₂ emissions, 15% the creation of jobs and financial benefits
- 26% of answers to a question (with multiple answers possible) addressing the main reasons of weak usage of biomass as an energy source were allocated to the lack of information and knowledge, 19% to the lack of technologies, 19% to the lack of financial mechanisms
- 45% of additional comments to an open question addressing the potential stakeholders responsible for the prospective bioenergy village referred to the local authorities, 21% to the local population and 13% to the national authorities.

The main issues in Kichevo and Macedonia in general are the low prices of firewood and electricity. According to the State Statistical office, approximately 62% use firewood and wood of fruit trees and other plant residues for heating, whilst approximately 29% use electricity⁵.

The illegal logging is an important issue, too. Despite the significant biomass potential, the problem with the illegal logging leads towards non sustainability of wooden biomass, contributing to land degradation and potential floods. Furthermore, the high level of energy consumption per capita and the high level of environmental pollution (air pollution and waste disposal problems) are evident.⁶

On the other side, the main challenge is how to convince people to connect to a district/micro heating grid or to replace their currently used in-house technologies (boilers, ovens) with more efficient ones and to switch the fuels (from crude oil and firewood to woodchips, pellets, briquettes), especially when they pay less than 50 Euros per month which is around one fourth of the minimum net monthly wage in the country. In this case, one has to deal with energy poverty and energy vulnerability.

The energy poverty and energy vulnerability are relatively new terms in Macedonia, though can be seen on a regular basis. Results from two case studies of districts in the capital within the EVALUATE project demonstrated that households are spending 15-30% or more of income on energy costs⁷. It is estimated that 50-61% of the households are being affected by the energy poverty⁸. Consequently, the energy poverty has to be reduced, and one way could be by building district heating infrastructure or allowing natural persons to have personal income tax deductions in case they invest in energy efficiency or renewable energy. In fact, as the feed-in tariffs are for companies only, support for using renewables in households has to be made by tax reductions, subsidies and similar. The country similarly as the EU has to integrate energy poverty policies when adopting and implementing the EU energy and climate acquis. Truth to be told, the existing energy poverty policy only delays the problem by offering minimal financial support and does not try to solve it.

There are not any data available with reference to CO₂ emissions in Kichevo, nonetheless, as every other municipality in Macedonia, Kichevo is inevitably taking part into the national goal set with the Macedonian Intendent National Determined Contribution (MK INDC) towards the United Nations Framework Convention on Climate Change (UNFCCC) that aims at 30% (36% at higher level of ambition) reduction of CO₂ emissions at a country level compared to business as usual.

⁵ <http://www.stat.gov.mk/Publikacii/6.4.15.03.pdf>

⁶ D2.7 Report on local and regional framework conditions in the target communities

⁷ <https://urban-energy.org/2015/09/21/energy-poverty-in-macedonia-workshop-report/>

⁸ http://www.analyticamk.org/images/Files/Commentary/2016/comm1606-en_bd3cd.pdf

5.2 Vision of the village

The chosen location for setting up the bioenergy village is a settlement in the centre of Kichevo. This settlement is called “Lozhilnica” (in Macedonian language), which means heating station, in English language.

Its overall objective is to develop a concept for a district heating system that can be divided in three phases:

- 1) The first phase comprises public buildings under responsibility of the municipality that are easier to reach – kindergarten (“Olga Miceska”), elementary school (“Kuzman Josifoski – Pitu”), high school (“Mirko Mileski”, “Drita”) and boarding school (“Mirko Mileski”, “Drita”);
- 2) The second phase includes residential buildings that already have central heating piping system (blocks of flats called “Lameli”);
- 3) The third phase foresees other residential buildings.

The second and/or the third phase can be also transformed into proposals for a micro grid and in-house boilers/ovens envisaged in the project implementation, though this is not resolved yet.

Other aspects underpinning the overall objective involve:

- Overcoming the heating problems in the settlement, especially in the public buildings, by utilization of renewable energy sources and implementation of energy efficiency measures;
- Exploiting the local biomass resources and creating a local supply chain;
- Strengthening the local economy by keeping the finances in the region and creating new jobs;
- Investigating the possibilities for financing the realization of such system and selecting the most suitable financing and business model;
- Mitigating the pollution by decreasing the emissions of noxious gases.

Finally, the above-mentioned aspects correlate with Kichevo’s slogan for becoming a bioenergy village that summarizes the vision of the village: **“Our village – Clean village – Biovillage”**.

5.3 Strategic bioenergy goals in the village

A concrete list of strategic energy goals in the village is presented in Table 7.

Table 7: Strategic bioenergy goals in the BioVill target village in Kichevo, Macedonia

| Current situation / Challenge | Strategic goals | Sub-goals and short description |
|--|--|---|
| Problems with providing adequate heating conditions in the public buildings. Inefficient usage of fuel for heating in households. | Goal 1: Overcoming the heating problems in the settlement, especially in public buildings | Goal 1.1: Utilization of renewable energy sources (RES) Goal 1.2: Implementation of energy efficiency measures |
| Low level of awareness of the local stakeholders for the potential of waste biomass. | Goal 2: Exploiting the local biomass resources | Goal 2.1: Promotion of RES to local stakeholders Goal 2.2: Creation of a local supply chain |
| High level of unemployment in | Goal 3: Strengthening the | Goal 3.1: |

| Current situation / Challenge | Strategic goals | Sub-goals and short description |
|--|---|--|
| Kichevo, and high level of migration. | local economy | Keeping the finances in the region Goal 3.2: Creating new jobs |
| Non-existent modern system for district heating and high expenses for heating of the public buildings. | Goal 4: Investigating the possibilities for financing the realization of district heating system | Goal 4.1: Involving the local citizens in the development of the district heating system Goal 4.2: Selecting the most suitable financing and business model |
| Kichevo is one of the most polluted cities in Macedonia. | Goal 5: Mitigating the pollution | Goal 5.1: Decreasing the emissions of noxious gases |

5.4 Local bioenergy action plans

The local bioenergy action plans and their contribution to the strategic goals are elaborated in Table 8.

Table 8: Local bioenergy action plans and bioenergy goals in the BioVill target village in Kichevo, Macedonia

| Action area | Current situation/ challenges | Actions | Action plan | | | Contribution to the strategic goal (No.) |
|-------------|---|--|--|--|--|--|
| | | | 2020 | 2025 | 2030 | |
| Heating | Needed installed capacities of boilers: 480 kW (high school), 198 kW (elementary school), 186 kW (kindergarten, with a possibility for a 30% decrease if windows are replaced and roof insulation is placed), 144 kW (boarding school) Total: 1,008 kW Solution: 2 boilers with installed capacity of 500 kW situated in the high school backyard Annual woodchips demand: 250-270 t (750-850 m ³ wood) Boiler house: 10x20m (to fit the boilers from the first, second and the third phase) | Training of local SMEs and other stakeholders in bioenergy technologies | Planned project trainings, workshops and other activities 2017/2018/2019 | Upon local SMEs and other stakeholders request | Upon local SMEs and other stakeholders request | 2, 3 |
| | | Support the replacement of old and inefficient boilers/ovens with modern technologies (biomass, solar) | Establishment of a local information point and pool of local companies working in the field of renewable energy as well as local info days | Upon local SMEs and stakeholders request | Upon local SMEs and other stakeholders request | 1, 2, 3, 5 |
| | | Replacement of fossil fuels with bioenergy | Beginning of implementation of phase 1* | Beginning of implementation of phase 2** | Beginning of implementation of phase 3*** | all goals |
| | | Set up small | Beginning of | Beginning of | Beginning of | all goals |

| Action area | Current situation/ challenges | Actions | Action plan | | | Contribution to the strategic goal (No.) |
|-------------|--|---|-----------------------------------|------------------------------------|-------------------------------------|--|
| | | | 2020 | 2025 | 2030 | |
| | <p>Old boilers remain as a backup.</p> <p>Additionally, placement of an underground buffer storage with minimum 20,000 litres due to combination with the existing solar collectors on the high school sport hall roof.</p> <p>In order to avoid implementation procedures deriving from the Energy Regulatory Commission, the installed capacity of boilers will be kept under 1MW (for equal or higher than that permission for construction and operation is needed).</p> | <p>district heating system, if it is techno-economical viable</p> | <p>implementation of phase 1*</p> | <p>implementation of phase 2**</p> | <p>implementation of phase 3***</p> | |

*District heating network for 4 public buildings: kindergarten, elementary school, high school and boarding school

**Expanding the network to the building complex "Lameli"

***Involvement of other residential buildings

6 Kostojevići, Serbia

The elaboration of the strategic goals for the future bioenergy village of Kostojevići took place during the two days event in the Municipality of Bajina Bašta and in the village itself on 27-28 February 2017. The two day event consisted of presentation of the project to interested stakeholders, setting up of bio-village working group and discussion with the citizens and business representatives from Kostojevići.

The main stakeholders gathering took place in the assembly hall of the Municipality of Bajina Bašta. The stakeholder group included representatives of the following institutions, organizations and individuals:

- Municipality of Bajina Bašta
- Local Community of Kostojevići
- Public Utility “Tara National Park”
- Public Utility “BB Term”
- Green Council of Bajina Bašta
- Health Care Centre of Bajina Bašta
- Power Distribution Company in Bajina Bašta
- Regional Development Agency “Zlatibor”

All participants in this meeting agreed to become a part of the bioenergy village Kostojevići working group. This notion was later formalized in the form of the Decision of the SCTM Secretary General on forming of Bioenergy Village Kostojević Working Group.

The Decision foresees that the Working Group is the forum for discussing the topics and issues of the consequence to setting up of bioenergy village Kostojevići as well as the mechanism for steering the project activities. The decision also stipulates that for its operation the Working Group will have the support of the BioVill Project i.e. SCTM Secretariat staff and the engaged experts. Finally, it is foreseen that the Working Group will continue its work even after the termination of the BioVill Project.

After the presentation of the BioVill Project its goals and activities that will support reaching them the discussion on specific issues related to the actual situation in Bajina Bašta and Kostojevići regarding energy usage, biomass potentials and existing value chains took place. The discussion led to the formulation of draft challenges and strategic objectives for the Bioenergy village Kostojevići. These findings were later discussed with the citizens and business representatives from Kostojevići during the info session on the second day of the event.

The challenges, strategic objectives and sub-objectives are presented and elaborated in the text that follows. The Working Group also agreed that the strategic objectives will be revised regular after more substantive analytical work in the field has been done.

6.1 Current bioenergy use in the village

Kostojevići is a unique case in Serbia since it is the only village that has a functional district heating system consisting of two 750 kW crude oil burning boilers and approximately 3 km of network. The system itself has been operational since 2007 and currently has several drawbacks. First of all it is using imported fossil fuel although the village is set in the area rich in forests and agricultural land. Furthermore, measurements of the emissions from the boiler room done by the environmental inspection from Municipality of Bajina Bašta show that concentrations of CO₂, nitrate oxides (NO_x) and particles are over the allowed limits, thus, posing major health and environmental risks for the local population. Secondly, the system is operated by the Public Utility Company from Bajina Bašta which is billing the service, based on square meter of heated area and not on the amount of heat delivered. This fact combined with fairly expensive energy source (crude oil is currently more affordable than in the past but still more expensive than other sources especially biomass) resulted in high monthly bills and subsequently in disconnection of some users from the system. All this poses serious threats to the system in the future which will, if nothing changes, continue to accumulate losses. Furthermore, there are 40 users currently connected to the system although it was designed for at least 80 making the boilers oversized and therefore, inefficient. According to the National Typology of Residential Buildings, most of the houses in the village fall under category E with average heat demand between 190-320 kWh/m².

Besides the 40 connected users, the rest of the households in the village of Kostojevići are predominantly using fire wood for heating purposes. In the village there are also several private businesses which need heat and electricity for their operations. Currently, within the village limits, there are three refrigerating plants, two small sawmills, one distillery, one furniture producer, three bakeries, and one gas station. All these facilities extensively use heat and electricity for their business operations. Heat is provided by inefficient burning of wood biomass and waste wood and organic materials from the processes. Electricity is being taken from the grid.

Forests in the village of Kostojevići accounts for 2.5 % (725 ha) of all forests in Bajina Basta municipality with an average volume of 136.2 m³/ha and an average increment of 3.8 m³/ha. These are mostly privately owned forests. In the two mentioned sawmills there are wood processing residues of about 140 m³ / year and about 25 t / year of sawdust. Other potential biomass resources are agricultural residues. Each year the village generates about 200 t residues from corn and approximately 100 t of raspberry residue per season. The company RB Global, which produces Stara Sokolova brandy, currently generates about 2-3 t of pits of apricots and 200-300 t of fermented fruit mash.

Most of the citizens of Kostojevići are living from agricultural production with corn and raspberries currently being the most popular crops. There are several public institutions in the village like school, primary health care centre and post office and in addition to already mentioned small businesses there are several small grocery shops and a bar. Still one of the biggest problems of Kostojevići is the aging population and the migration towards bigger economic centres.

6.2 Vision of the village

The vision of the village is: Kostojevići is economically developed, healthy, vibrant, energy self-sufficient and a village with the future based on smart and efficient use of bioenergy and other renewable sources.

The vision of the village is summarized in the slogan:

“Kostojevići: Village for the Future”

6.3 Strategic bioenergy goals in the village

Table 9: Strategic bioenergy goals in the BioVill target village of Kostojevići, Serbia

| Current situation / Challenge | Strategic goals | Sub-goals and short description |
|--|---|--|
| Existing local heating system is fuelled by imported fossil fuels, resulting in loss of the added value for the local community and the region | Goal 1: Keep the monetary value from energy expenses in the community and the region | Goal 1.1: Create revenue opportunities for local biomass producers (farmers, forest owners) Goal 1.2: Reduce monthly spending for heat of the district heating users Goal 1.3: Reduce the dependency on imported energy |
| Existing local heating system is, by burning crude oil, posing significant environmental and health risks for the local community | Goal 2: Reduce harmful emissions of the village | Goal 2.1: Reduce health risks in the community Goal 2.2: Reduce risk to the local agriculture production |

| Current situation / Challenge | Strategic goals | Sub-goals and short description |
|--|---|--|
| Households and business that are inefficiently using fire wood and agricultural residues for heat generation | Goal 3: Increase the number of connections to the district heating system | Goal 3.1: Reduce the heating costs and increase the profitability of the local heating system Goal 3.2: Reduce heat demand of the households Goal 3.3: Reduce energy poverty in the community |
| Ageing population and migration | Goal 4: Create employment opportunities and reduce migrations of young people from the village | Goal 4.1: Introduce local citizens in energy value chains |
| Local population is currently dependant on decisions taken in the municipality and not fully aware of potentials of the renewable energies | Goal 5: Local community takes over ownership of the bioenergy village process | Goal 5.1: Local businesses and citizens are ready to invest in renewable energy conversion Goal 5.2: Promote Kostojevići locally and regionally as a leader in bioenergy sustainability |

6.4 Local bioenergy action plans

Table 10: Local bioenergy action plans and bioenergy goals in the BioVill target village of Kostojevići, Serbia

| Action area | Current situation/ challenges | Actions | Action plan | | | Contribution to the strategic goal (No.) |
|-------------|--|---|------------------------------------|------------------------------------|------|--|
| | | | 2020 | 2030 | 2050 | |
| Heating | 2 oil boilers of 750 kW capacity are installed and in operation since 10 years. According to the National Typology of Residential buildings most of the houses in | Replacement of fossil fuels with locally available biomass in the district heating system | 100% fossil fuels replaced | | | 1, 2, 3 and 4 |
| | | Connection of new domestic | Number of connections increased to | Number of connections increased to | | 3 and 4 |

| Action area | Current situation/ challenges | Actions | Action plan | | | Contribution to the strategic goal (No.) | |
|------------------|---|--|--|--|---|--|---------------|
| | | | 2020 | 2030 | 2050 | | |
| | <p>the Village fall under category E with average heat demand between 190-320 kWh/m².</p> <p>Current billing is based on area of heated space</p> <p>CO₂, NO_x and particles are over the allowed limits</p> <p>Biomass is currently inefficiently used</p> | users to the district heating system | 50 | 80 | | | |
| | | Introduction of consumption based billing | 10 % of users are billed based on real consumption | 50 % of users are billed based on real consumption | 100 % of users are billed based on real consumption | 1 | |
| | | Connection of business users to the district heating system | At least two business users connected to district heating system | | | | 2, 3, 4 and 5 |
| | | Introduction of more efficient boilers or stoves for individual households | 10% of households improved efficiency of their heating systems | 50% of households improved efficiency of their heating systems | 100% of households improved efficiency of their heating systems | | 3 and 4 |
| | | Improvement of the insulation of the buildings | 10% of households improved insulation | 50% of households improved insulation | 100% of households improved insulation | | 3 and 4 |
| | | | | | | | |
| Power generation | | Introduction of small CHP generators with business in the Village | At least one CHP generator installed | At least three CHP generator installed | | 1 and 5 | |

7 Lekenik, Croatia

The strategic bioenergy goals of Lekenik were formulated during the first working group meeting after collecting the citizens' feedback on the information day in the municipality of Lekenik. The first working group meeting was held in the premises of SOS Children's Village Lekenik, on 8th March 2017. The meeting was attended by the 9 participants who are also the key stakeholders in the process of formulation of strategic bioenergy goals. Present were the mayor of the municipality of Lekenik, the head administrator of elementary school Lekenik, the head of the SOS Children's Village, the head of the public utility and employees of the municipality. REGEA has also participated in the decision-making process and provided expertise and technical assistance in setting up the main goals and conclusions. The working group developed the following list of issues which are considered and discussed during the working group meeting. Some of the main issues were as follows:

- How to secure and provide financing of project documentation and biomass plant in the municipality of Lekenik?
- Possibilities for providing incentives or renewable energy credits for households near the boiler room to connect to a district heating network;
- Encouraging good forestry practice on the ground;
- Public outreach – the greater public involvement, the more successful process will be.

Members of the working group stated concerns regarding the problems with financing the bioenergy project in Croatia. Currently in Croatia, there are no specific strategies focused exclusively on the promotion of bioenergy or financial mechanisms which are supporting such projects. The adoption of the legislative package and formulation of strategies which will open the possibilities of financing the bioenergy projects is expected in the near future.

Working group members reached the consensus quickly and with plans to include the Lekenik forestry and wood based producers in the decision-making process. Unfortunately, they were unable to participate on the first information day and the working group meeting, but they will be able to update the current goals due to their plans, vision and positioning in the process of implementing of district heating system in the municipality, especially plans connected to the possibilities of providing wood biomass or cutting and selling wood. The goals will be revised in the next few months.

7.1 Current bioenergy use in the village

The Municipality of Lekenik is covered with forests, in total 9,062 hectares, where the common oak is mainly in the lowland areas (valleys) and beech in the mountainous areas. Exploitation of forests, which are mostly state-owned, is very pronounced. Wood is mostly exploited for heating (firewood), but it is also used as a building material and material for making furniture. Private forests are exploited by their owners, with the necessary consent and control of the Croatian Forests (Forest Office Lekenik), mainly for the heating (firewood). The municipality has a great potential in the production of wood biomass.

Near the centre of the village an educational, cultural, social and sports complex is located. In this complex the following institutions are located: Mladost Lekenik Elementary school, Lekenik Kindergarten, Community centre, Public Reading Room and Library Lekenik, Football Club Lekenik and SOS Children's Village Lekenik. For the energetic planning of the complex, it is necessary to consider the whole complex as a unit due to the proximity of the different buildings. This opens the possibility for installing an efficient central biomass plant with only small losses of heat transfer. The public buildings of the complex currently consist of small, individual central heating systems which are older than 20 years old and are based on fuel oil or gas.

Agriculture is partly developed and inhabitants commute daily to Zagreb where they are employed in the private or public sectors. The manufacturing sector in Lekenik consists of several economic entities in the fields of furniture manufacturing, saw wood, and CNC technology. The service sector is only partly developed.

Biomass is currently used in a very little amount. Organic household waste is managed in the traditional way (composting, i.e. conversion into fertilizer) or it is being disposed by the system of public collection and disposal of municipal waste. Agricultural biomass has traditionally been recovered and converted into fertilizer for fertilizing farmland or simply treated as municipal waste. Forest biomass is managed by the Croatian forests, because most forests are state property, whereas private forest owners use their forests for the exploitation of

firewood, whereby no significant amounts of biomass remain. In the village, there is a small number of business-, construction-, wiring- and similar sectors that could perform a minor or finishing work.

The average unemployment rate in Lekenik is 19.8%. Owing the fact that the inhabitants are mostly employed in Zagreb, a high number of working residents commute daily from Lekenik to Zagreb for work.

The improvement of the energy system in the village will create benefits for the inhabitants of the municipality through the increased quality of life, environment preservation and energy and money savings. Furthermore, the manufacturing sector will be activated, even agriculture through the investments in the production of biomass or cultivation of energy crops.

In the village Lekenik exact information and data on energy consumption are lacking, but they are currently analysed by the BioVill project for assessing the opportunities to set-up biomass based CHP plants on woodchip and small district heating networks.

7.2 Vision of the village

The main objective of Lekenik is a shift of energy sources from fossil energy sources to the renewables for public buildings. In the future, the village aims to completely replace its fossil energy use for heating and electricity through bioenergy. Its overall objective is the implementation of a district heating system.

Considering that about 45% of the county's surface is covered with forests and a common interest is expressed in strengthening the domestic economy, the implementation of a district heating system has been recognized as the most important measure of regional development. Making use of own biomass energy resources can reduce energy costs and the money spent for this energy stays within the local economy.

The district heating project aims to supply the public buildings with heat and in a second phase to also connect private households in the vicinity. All public buildings which are going to be connected to a district heating network are currently using fuel oil or liquefied petroleum gas. A preliminary analysis based on comparing the actual price of the current energy source and wood chips as a future energy source shows that this project is justified from an economic aspect. The implementation of a district heating system has many positive effects, such as the creation of new jobs, protecting the environment and increasing the competitiveness of forestry and wood based industries.

The slogan for becoming the bioenergy village:

“We use energy from our environment – let us become BioVill!”

7.3 Strategic bioenergy goals in the village

Table 11: Strategic bioenergy goals in the BioVill target village Lekenik, Croatia

| Current situation / Challenge | Strategic goals | Sub-goals and short description |
|---|---|---|
| Existing heating systems in public buildings are small central heating systems based on fuel oil or gas and private households mostly use inefficiently firewood. | Goal 1: Supply all public buildings with heating energy from RES | Goal 1.1: Implementation of a district heating on renewable resources Goal 1.2: Construction of a central woodchip boiler Goal 1.3: Use the wood from the surrounding / local and regional forests |
| Public buildings in Lekenik depend on imported energy | Goal 2: Increase the energy self-sufficiency of the | Goal 2.1: Reduce the dependency of imported energy sources by |

| Current situation / Challenge | Strategic goals | Sub-goals and short description |
|---|--|--|
| sources. | village | construction of a CHP Goal 2.2: Construction of a biomass cogeneration plant (CHP) |
| The biomass is currently hardly used or isn't used at all. | Goal 3: Strengthening the local and regional economic development | Goal 3.1: Provide revenue opportunities for local wood producers (forest owners) Goal 3.2: Reduce energy costs and keep the money spent for energy within the local economy |
| The unemployment rate in the municipality of Lekenik is currently 19.8%. | Goal 4: Increase the local employment opportunities | Goal 4.1: Ensuring employment and creation of new jobs Goal 4.2: Investments in the production of biomass or cultivation of energy crops (preservation of arable land areas in a way of using them for cultivation of energy crops) |
| Fossil fuels, currently used as source for heating in the public buildings, are responsible for high emissions of CO ₂ . | Goal 5: Reduce the carbon emissions of the village | Goal 5.1: Reducing air pollution with use of biomass Goal 5.2: Increasing of quality of life and environment preservation |

7.4 Local bioenergy action plans

Table 12: Local bioenergy action plans and bioenergy goals in the BioVill target village Lekenik, Croatia

| Action area | Current situation/ challenges | Actions | Action plan | | | Contribution to the strategic goal (No.) |
|-------------|---|--|--|--|--|--|
| | | | 2020 | 2030 | 2050 | |
| Heating | Public buildings in Lekenik have small central heating boilers on fuel oil or gas which are installed 20 years ago. | Set up district heating system on renewables | Construction of a biomass based heating plant and heating grid | | | 1,2,3,4,5 |
| | Average annual heat demand of the public buildings (Mladost Lekenik Elementary | Replacement of fossil fuels with biomass as | Fossil fuels are replaced with biomass, but only for the | Firewood and fossil fuels used in private households | Firewood and fossil fuels used in private households | 1,2,3,4,5 |

| Action area | Current situation/ challenges | Actions | Action plan | | | Contribution to the strategic goal (No.) |
|------------------|---|---|---|---|--|--|
| | | | 2020 | 2030 | 2050 | |
| | school, Lekenik Kindergarten, Community centre, Public Reading Room and Library Lekenik, Football Club Lekenik and SOS Children's Village Lekenik) is approximately 1,400,000 kWh/a The average annual heat demand includes 39,000 l of fuel oil and 76,000 l of LPG | an energy source for heating the public buildings | heating needs of public buildings – 1st phase | near the boiler room are replaced with biomass – 2nd phase | are replaced with biomass; they are either connected to a district heating system or have a small in-house biomass boiler/oven – 3rd phase | |
| | | Support the replacement of old and inefficient boilers with modern biomass systems | Education programs for private building owners | Incentives or energy credits for private households to connect to a district heating network | Incentives or energy credits for either to connect to a district heating network or buy and install small in-house boiler/oven | 2,5 |
| | | Use wood from local and regional forest owners | Supporting the local wood producers and local farmers; encouraging good forestry practice on the ground | At least one local producer and distributor of biomass | Construction of a small biomass logistic and trade centre for the local and regional needs (BLTC) | 1,3,4 |
| Power generation | | Educations and trainings of citizens on possibilities of producing electricity within the village | Solar panels on private households (also possible for heat generation) | Construction of a biomass power plant (or upgrading of biomass heating plant); All public buildings are | All building, public and private, are supplied with electricity, either with electricity produced in CHP or by | 1,2,3 |

| Action area | Current situation/ challenges | Actions | Action plan | | | Contribution to the strategic goal (No.) |
|-------------|----------------------------------|---------|-------------|---|-----------------------|---|
| | | | 2020 | 2030 | 2050 | |
| | | | | supplied with electricity produced in cogeneratio n plant (CHP) | using solar energy | |

8 Perušić, Croatia

The first stakeholder working group meeting was held in the Municipality of Perušić, on 27 February 2017 with the purpose of introducing all relevant project stakeholders to each other and for them to get a better overview of BioVill project aims and upcoming activities. The working group had an attendance of 12 participants, which included 9 participants from the area of Municipality of Perušić and 3 participants from North-west Croatia Regional Energy Agency (REGEA).

Table 13: The working group in the Perušić municipality

| First and last name | Function | Organization/company |
|---------------------|--|---------------------------|
| Ivica Turić | Mayor | Municipality of Perušić |
| Mihael Kurteš | Head for the development and implementation of projects financed from EU funds | Municipality of Perušić |
| Nada Marjanović | Project manager of EU funds | Municipality of Perušić |
| Snježana Milković | Principal | Elementary school Perušić |
| Marko Župan | Technical director | Viševica – Energo d.o.o. |
| Marica Fajdić | Principal | Kindergarten Pahuljica |
| Dragan Milković | Manager | Forestry Perušić |
| Marjan Kolak | Representative | |
| Marija Štimac | Resident | |

Source: REGEA

The group is comprised of a wide range of stakeholders in the private, public and non-profit sectors working to advance sustainable biomass utilization in village Perušić. Therefore, the meeting was opened by the Mayor of the Municipality, Ivica Turić. At the beginning of the meeting the mapping of utilized energy sources for heating was introduced to all present stakeholders. The Mayor informed all stakeholders, the first step toward success is taken; municipality left a certain amount in the budget for documentation of district heating system powered by a cogeneration plant on forest biomass through the domestic company, Viševica Energo Ltd.⁹ that has left over heat. With that leftover heat from wood processing industry, parts of the municipality will be supplied with heat energy. All stakeholders agreed that highly efficient cogeneration and district heating systems will have a significant potential for primary energy savings in Perušić. When elaborating the strategic goals, primarily the following aspects were taken into account: strengthening of the energy and agricultural sector, support for the transition towards an economy based on low CO₂ emissions in all sectors, protecting the environment and promoting resource efficiency, and promoting sustainable transport. The working group considers that the strategic goals set out in the meeting will individually enhance the district heating market in the region. However, the working group wishes to emphasise that their value will be greater in combination. Taken together long-term strategic plans, national standards for socio-economic cost-benefit analysis, defined technical standards, clear enabling powers for infrastructure, increased access to biomass heat and effective customer protection will provide a clear and supportive context and framework for the development of district heating projects which is largely missing at present in village Perušić. The implementation of district heating network was also generally discussed since the biggest obstacles to the implementation of such system at local and national level are the long lasting procedures in obtaining legal documentation and lack of financial mechanism. According to this fact, local governments have legislative and purchasing power that they can use to implement change in their own operations and in the wider community. As a matter of fact, they play a multiple role as decision makers, planning authorities, managers of municipal infrastructure, and role models for citizens and businesses. With such capacity, local governments can become beacons for change in their region or country, demonstrating the effectiveness of policies and local action. And as early leaders among local governments take initiative, others can follow and improve upon the early efforts, replicating and implementing good practice and successful examples. Decision was made to invite potential investors, development banks and national energy funds to the second working group

⁹ Viševica Energo Ltd is a company dealing with wood processing has a need for thermal energy for the purpose of drying and steaming timber, its own heating and the drying of pellets.

workshop in order to examine the true bankability of these measures. State and local communities should work together in promoting renewable energy and rational use of all forms of energy while fostering local and regional cooperation through mutual exchange of knowledge and experience.

The meeting were incredibly enlightening for the participating stakeholders from the village and they learned very much about the obstacles to achieve improved and more widespread energy services throughout the village Perušić. A major barrier to expanded energy services, however, and something that was a common theme throughout stakeholder meetings is that Perušić and Lika-Senj County currently lacks a clear and long-term energy framework. Therefore, it is important that sector ministers and industry leaders and national level come together to outline their future energy needs. Without input from leaders from all sectors within Perušić, any energy vision would be incomplete. Finally all stakeholders concluded that exchange of energy data between energy utilities and local authorities that are busy assessing local greenhouse gas (GHG) emissions and planning action to address this through energy savings, energy efficiency and the use of renewable energy should be fostered and encouraged, also provide guidance for further problem solving regarding local energy, by means of which the heating in region will become even cheaper and ecologically acceptable. For June 2017, a follow-up working group meeting on certain subdomain of discussed issues is planned.

8.1 Current bioenergy use in the village

Forest land covers 19,469 ha or 51% of the area of the municipality. In this area natural (wild) and planted forests (plantations) occur. Areas under natural forests are far greater, and plantations participate with minimal surfaces. Within the total area of forest land, forest areas account for about 80% while non-productive and barren land accounts to approximately 20% of the land. Agricultural land (arable land, meadows, pasture) covers an area of 17,601 ha or 46% of the entire area of the municipality. Within the overall structure of agricultural land, farmland land, as well as the more quality part, makes up 18% of the surface of 6,698 ha, while arable land as part of the highest quality part participates only with 9% or 3,448 ha. It is quite clear that the land from the economic point of view can relate to natural resources, which cover adequate natural conditions for agricultural activity. Within the total area of the Perušić municipality with a size of 38,294 ha, the agricultural and forest land of different categories participate with an area of 33,093 ha and makes up 86.4% of the municipality area. Due to such participation, it can be concluded that the forest and agricultural land are a very important resource for the development of the municipality.

The Perušić municipality issued a Waste Management Plan for the period 2012-2020. Currently the municipality of Perušić is missing a number of strategic documents regarding energy plans for the planning period 2014-2020.

In the Municipality of Perušić 600 people were employed in 2011, of which 366 men and 234 women. The largest number is employed by an employer 88%, and self-employed is 11%.¹⁰

Perušić has a significant potential of biomass for energy production because it is located in a region with a long tradition of the local community to use the local wood resources. Firewood is the most significant source of heating energy in households of village Perušić. Existing climate conditions, meaning the long winters, request a significant amount of energy and a reliable source, but on the other hand, also cause higher heating costs. Households are heated by old firewood stoves, only few of them have central system but radiators don't have thermostatic valves so heating regulation is poor. Main cause of huge heat losses is the non-existence of wall and floor insulation. Currently, public buildings are heated by gas, electricity and wood stoves. Since many elderly people live in Perušić, the inhabitants find it difficult to cut the firewood by oneself. Thus, they are interested in a centralised heating system based on biomass district heating plant, which would offer them a higher comfort. With their own wood resources they would be able to compensate the monthly instalments for the new heating system, and in that way also encourage the local economy.

The average unemployment rate in Perušić is 17.3%.¹¹ It is currently not possible to give exact data on energy consumption at local level, but data can be provided at regional level. The county adopted a strategic energy

¹⁰ Croatian Bureau of Statistics (2011.), *The Census of Population, Households and Dwellings*, Available at: http://www.dzs.hr/Hrv_Eng/publication/2012/SI-1468.pdf [March 17 2017]

¹¹ Croatian Beureau of Statistic (2015), *Statistical Yearbook of the Republic of Croatia*, Available at: http://www.dzs.hr/Hrv_Eng/ljetopis/2015/sljh2015.pdf [March 17 2017]

document “The Programme of effective energy use in the final consumption in Lika-Senj County for the period 2017-2019”. According to the Programme, the total immediate energy consumption in the administrative area of the Lika-Senj county during 2013 amounted to 910,858 MWh, where the largest energy consumption was in the household sector (59%), led by the consumption of fuel wood, followed by the transport sector with 19%, the service sector with 15% and the lowest energy consumption in the industrial sector (7%).¹² In regards to the type of energy, the overall largest consumption was firewood and the smallest was remote heating. In the strategy it is emphasized, as a great potential, a large number of high-quality forest areas which provide excellent basis for the development of timber industry and for production of energy from renewable sources. The development of this document shows the willingness and intention to make changes in the field of sustainable development, so future for developing these kinds of projects definitely looks brighter.

¹² The Programme of effective energy use in the final consumption in Lika-Senj County for the period 2017-2019, Available at: <http://www.licko-senjska.hr/webdemo/wp-content/uploads/2016/12/Materijal-za-to%C4%8Dku-19-prilog-1..pdf> [March 17 2017]

8.2 Vision of the village

Village Perušić shall strive to be a community that bridges the gap between the traditional fossil-fuel economy and the evolving sustainable bioenergy economy. The working group identified 3 potential future goals for the energy network in the village:

1. **Construction of transport and communal infrastructure and energetics** - In the planning period up to 2020 the Perušić Municipality places emphasis on transport infrastructure. They intend to construct, reconstruct or repair uncategorized roads and access roads. With this, the municipality intends to provide better transport links within the municipality and also ensure the further development of settlements with the construction of access roads. Energy infrastructure is an important part of the development of the Perušić Municipality. The current hydropower plant Senj should be upgraded with the new accumulation lake in the Kosinj valley with a hydropower plant of 30 MW, a new 13.5 km long drainage tunnel and the new power plant Senj 2 with 350 MW. Another important part is thermal energy. In terms of ensuring sufficient quantities of thermal energy, it is planned to construct district heating network through Perušić and build a cogeneration plant on biomass in partnership with Viševica Energo ltd. with constant power in the amount of 2 MW all year, which will relieve the electricity network in the area and open the opportunity for large investors to open their plants which will ultimately result in the industrial and economic development of the entire part of the region
2. **Environment protection** - As part of these measures people and institutions will be informed and encouraged to participate in the refurbishment of non-residential and residential buildings to increase energy efficiency as well as in the production of renewable electricity. This measure includes the replacement of the heating system, as well as the development of biomass, hydro and solar resources. It will also include the use of electric or hybrid cars.
3. **Increasing the quality of life** – This includes the development of urban infrastructure, low running costs and consumption of primary energy, reduction of CO₂ emissions, the development of social services (education, sport, recreation, health and social programs, culture and the development of institutions in the Perušić Municipality including strengthening the capacity of the municipal administration and tourist boards and the strengthening of civil society).

Consideration was given to several visions that appear below:

- Proposal 1: Perušić Municipality is a municipality that attracts with its preservation, high living standards and a range of options for starting a business.
- Proposal 2: Perušić Municipality attracts young families by providing them employment in logistics companies and offering good living conditions.
- Proposal 3: Perušić Municipality is a municipality inhabited by young families attracted to developed economies, preserved environment and excellent benefits for families.

All three definitions of the visions that somewhat outline how the Perušić Municipality has been conceived in the next two decades, but none completely corresponded. A vision was requested that would cover all of the above. Finally, it was concluded that the vision that best reflects the desired future of Perušić is as follows:

Perušić Municipality is a small municipality of higher living standards, sustainable economy and all facilities that make life pleasant, inhabited by a young population that is educated, entrepreneurial and lives in an almost untouched environment.

8.3 Strategic bioenergy goals in the village

Table 14: Strategic bioenergy goals in the BioVill target village Perušić, Croatia

| Current situation / Challenge | Strategic goals | Sub-goals and short description |
|--|--|--|
| Existing heating systems in public buildings are small central heating systems on fuel oil or gas and private households mostly use firewood; but inefficiently. | Goal 1: Supply all public buildings with heating energy from RES | Goal 1.1: Implementation of a district heating on renewable resources Goal 1.2: Construction of a cogeneration plant on biomass Goal 1.3: Use the wood from the surrounding / local and regional forests |
| Public buildings in Perušić depend on the imported energy sources | Goal 2: Increase the energy self-sufficiency of the village | Goal 2.1: Reduce the dependency of imported energy sources |
| Renovate the Elementary school of Perušić which is in poor condition with regard to energy efficiency | Goal 3: replacement of energy sources for heating, reconstruction of the existing heating system or the transfer to the cogeneration on biomass of the nearby wood industry; improving the thermal insulation of the elementary school through the replacement of windows, increasing thermal protection of the outer coat, floor, ceiling and/or the roof of the unheated space; | Goal 3.1: School is connected to the biomass district heating plant district (CHP) Goal 3.2: Security of energy supply and savings costs (expected energy savings would amount to 1,013 MWh/year, while the expected reduction of CO ₂ emissions would be 269 t/year). |
| The biomass is currently hardly used or is not used at all | Goal 4: Strengthening the local and regional economic development | Goal 4.1: Provide revenue opportunities for local wood producers (forest owners) Goal 4.2: Reduce energy costs and keep the money spent for energy within the local economy |

| Current situation / Challenge | Strategic goals | Sub-goals and short description |
|---|---|--|
| The unemployment rate in the municipality of Perušić is currently 17.3% | Goal 5: Increase the local employment opportunities | Goal 5.1: Ensuring employment and creation of new jobs Goal 5.2: Investments in the production of biomass or cultivation of energy crops (preservation of arable land areas in a way of using them for cultivation of energy crops) |
| Fossil fuels, currently used as source for heating in the public buildings, are responsible for high emissions of CO ₂ | Goal 6: Reduce the carbon emissions of the village | Goal 6.1: Reducing air pollution with use of biomass Goal 6.2: Protection of citizens' health and environment preservation, improvement of local conditions for higher quality of life |
| Inefficient waste management | Goal 7: Rehabilitate and improve the system of communal waste management, reduce the pollution and improve wellbeing of citizens | Goal 7.1. Build a recycling yard and implement measures for waste management Goal 7.2. Transformation of village Perušić into more ecologically sustainable village, promoting green technologies and create demand for green products and services |

8.4 Local bioenergy action plans

Table 15: Local bioenergy action plans and bioenergy goals in the BioVill target village Perušić, Croatia

| Action area | Current situation/ challenges | Actions | Action plan | | | Contribution to the strategic goal (No.) |
|-------------|---|--|---|---|---|--|
| | | | 2020 | 2030 | 2050 | |
| Heating | Public buildings in Perušić have small central heating boilers on fuel oil or LPG which are installed 20-25 years ago. For the public buildings (Ambulance Perušić, Elementary school, Forestry, | Set up district heating system on renewables | Construction of a biomass based cogeneration plant with a heating capacity of 2 MW and heating grid | | | 1,2,3,4,5,6,7 |
| | | Replacement of fossil fuels with | Fossil fuels are replaced with biomass, but only for the | Firewood and fossil fuels used in private | Firewood and fossil fuels used in private | 1,2,3,4,5,6 |

| Action area | Current situation/ challenges | Actions | Action plan | | | Contribution to the strategic goal (No.) |
|------------------|--|--|---|---|---|---|
| | | | 2020 | 2030 | 2050 | |
| | municipal building, building of Post, Commercial building - Kukčevka, building of Bakery, Culture centre, Kindergarten, residential building etc.) the average of annual heat demand includes 105.665,00 litres of fuel oil and 320,00 m ³ of wood logs combined with electricity heating | biomass as an energy source for heating the public buildings | heating needs of 11 public buildings | households are replaced with biomass; they are ca 200 users connected to a district heating system - | households are replaced with biomass; the whole village is connected to a district heating system | |
| | | Support the replacement of old and inefficient boilers with modern biomass systems | Education programs for private building owners | Incentives or energy credits for private households to connect to a district heating network | Incentives or energy credits for either to connect to a district heating network or buy and install small in-house boiler/oven | 2,6 |
| | | Use wood from local and regional forest owners | Supporting the local wood producers and local farmers; encouraging good forestry practice on the ground | At least one local producer and distributor of biomass | Construction of a small biomass logistic and trade centre for the local and regional needs (BLTC) | 1,3,4 |
| Power generation | | Education and trainings of citizens on possibilities of producing electricity within the village | Solar panels on private households (also possible for heat generation) | Construction of a biomass power plant (or upgrading of biomass heating plant); All public buildings are | All building, public and private, are supplied with electricity, either with electricity produced in CHP or by using solar energy | 1,2,3,4 |

| Action area | Current situation/ challenges | Actions | Action plan | | | Contribution to the strategic goal (No.) |
|-------------|----------------------------------|---------|-------------|--|------|---|
| | | | 2020 | 2030 | 2050 | |
| | | | | supplied with electricity produced in cogenerat ion plant (CHP) | | |