

## SUMMARY OF BUSINESS MODELS IN BIOVILL TARGET VILLAGES

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## Abbreviations and acronyms

AEA	Österreichische Energieagentur Austrian Energy Agency (Austria)
BLTC	Biomass trade and logistic centre
CHP	Combined heat and power
CO <sub>2</sub>	carbon dioxide
DH	District Heating
DHS	District heating system
EBRD	European Bank for Reconstruction and Development
EE	Energy Efficiency
EEA	European Economic Area
EIB	European Investment Bank
EP	Electricity producer
EPC	Energy Performance Contracting
EPEEF	Environmental Protection and Energy Efficiency Fund)
ERDF	European Regional Development Fund
ESC	Energy Supply Contracting
ESCO	Energy Service Company
ESCOROM Ltd.	Romanian ESCO
EU	European Union
EUR	Euro
excl.	excluded
GEA	Asociatia Green Energy (Romania)
GIS	Gozdarski Institut Slovenije (Slovenia)
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (Germany)
Ha	Hectare
ICS	Intelligent Climate Solutions
KEA	Klimaschutz- und Energieagentur Baden-Württemberg (Germany)
kW	Kilowatt
kWel	Kilowatt Electrical Capacity
kWth	Kilowatt per hour thermal energy )
Ltd.	Limited company
m	meter
m <sup>3</sup>	cubic meter
MBDP	Macedonian Bank for Development Promotion
Mio.	Million
MKD	Macedonian Denar
MW	Megawatt
MWh	Megawatt hour
MW/h	Megawatt per hour
ORC	Organic Rankine Cycle
PIMO	Public Investment Management Office

POIM	Operational Program for Big Infrastructures (in Romania)
PUC	Public Utility Company
REGEA	Regionalna Energetska Agencija Sjeverozapadne Hrvatske (Croatia)
RES	Renewable sources of energy
SC	Steering Committee
SDEWES-Skopje	International Centre for Sustainable Development of Energy, Water and Environment Systems - Macedonian Section (Macedonia)
SKGO	Stalna Konferencija Gradova i Opstina (Serbia)
SME	Small and Medium-sized Enterprise
VAT	Value Added Tax
WeBSEFF	Western Balkans Sustainable Energy Financing Facility
WIP	Wirtschaft und Infrastruktur GmbH & Co Planungs- KG (Germany)

## 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 million Euro. 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 these potentials 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 and the rest of Europe.

#### 1.1.1. Scope of the task/deliverable

This report is a summary of the BioVill deliverable 5.5 – Individual Reports on the business models in the target villages. It documents the current stage of the business model development in all seven target villages and highlights further developments, decisions and key points of discussions in the single target villages. It describes the possible biomass value chain in the villages, the necessary investments, relevant economic issues and financing options and the planned ownership and operating models. Furthermore, important contractual issues are included in the report.

The report summarizes all actions and decisions that were undertaken until April 2018. However, the process of compiling and establishing the business models in the bioenergy village is still ongoing and not finished yet. Therefore, reports 5.5. will be updated and the final business models will be described at the end of the project.

## 2. Business model in the target villages

### 2.1. Biomass value chain

Dole pri Litiji: The municipality is surrounded with forests that can be used for the bioenergy value chain. Wood is the most available local resource of bioenergy. Currently, more than half of buildings in Dole are heated using local wood, mostly log wood. A local entrepreneur will probably supply the wood chips for the biomass heating system. Moreover the regional wood-based industry in the municipality can provide additional biomass. Also cooperative is feasible which will deliver wood chips to the DHS. Wood chips will be delivered to DHS by local supplier. It is not decided yet who will be a supplier, this depends on the investor and if an idea of establishment of local cooperative will be realised.

The working group in Dole plans that the heat consumers who supply biomass from their own forest have to pay reduced heat costs.

Kostojevići: The Public Company National Park Tara (hereafter NP Tara) will supply the required biomass at least at the beginning of the biomass DH plant operation. The expected woodchips price is calculated (15 EUR/m<sup>3</sup>). Additionally, a preliminary contract was already set up with local biomass producers in Kostojevići – entrepreneurs who log and sell wood for heating to bigger cities. Some of current and future DH system users are also ready to provide wood to the heating station. Thus, the heat costs of the local forest owners who will consume heat from the DHS will be partly covered from the biomass remuneration.

Since a wood chipper does currently not exist, it is planned that PUC BB Term - the public utility - will buy a wood chipper and will be in charge of the woodchips production on the location close to biomass DH plant.

BB Term will prepare and adopt procedures for calculation of the supplied biomass and the delivered heat: The weight of the taken biomass will be measured, the water content will be determined on the basis of the sample and accompanying documents, the origin of the biomass and the compliance with the applicable technical standards in Serbia will be provided by the supplier. Based on the mathematical formula and on basis of the biomass weight and the water content, the energy content (lower heating value) of the delivered biomass will be calculated and on this basis payment will be made to suppliers.

Lekenik: Several wood processing industries in the region around Lekenik can supply a significant amount of wood residues for the planned biomass system. It is also possible to engage Hrvatske šume Ltd. - the Forest office of Lekenik that cooperates with existing or new companies that care for cutting and selling the firewood from the forests. The representatives of the municipal administration of Lekenik would like to support all the local entrepreneurs of the wood industry as well as the local forest owners.

Stakeholders in Lekenik plan the establishment of a local/regional Biomass Trade and Logistic Center that will be the source for biomass supply to the central biomass district heating plant of the DHS and another decentral biomass projects in the region. It is foreseen that either the municipality / the public utility or a local entrepreneur / a group of local entrepreneurs will be the investor of the Biomass Trade and Logistic Center from the municipality's territory. The final decision depends on the availability of grants that are necessary for the funding of the Biomass Trade and Logistic Center. Without subsidies neither the municipality nor the private investor are able to invest in the establishment of a BLTC. In any case, a successful operation of the BLTC needs stable long-term contracts with the biomass suppliers in order to ensure the availability of the biomass raw material and thus to ensure the ongoing and sustainable operation of the BLTC.

Perušić: The forest owners mostly produce wood fuel for their own consumption or for the local market. Also, a fair number of citizens own a part of surrounding forests. Additionally, three local sawmills produce wood fuel from their side products. One of them, Viševica, processes large capacities of wood to impregnate wood products and has a high heat demand for drying and steaming the timber. Viševica plans to expand the production, thus the energy demand of this company will significantly increase. Beside the utilization of heat, Viševica will be in charge of supplying the DHS with excess heat produced in its facilities.

Moreover, several local service companies exist in Perušić that offer their workforce and machinery for wood-based services such as chopping, chipping and transportation, thus new value chains based on wood fuels will be created based on the existing infrastructure and the local wood sources. In future, small amounts of wood can

be bundled and offered to the heating plant operator. Smaller biomass supplier can either receive heat for lower costs or directly get paid for the delivery of the biomass.

Kichevo: Potential woodchip suppliers are the Regional Forest Service “Lopushnik” and the forest concessionaire “Grande Tini”. Currently, the annual harvest of wood in Kichevo’s forests is around 40,000 m<sup>3</sup>, whereof 35,000 m<sup>3</sup> for heating and 5,000 m<sup>3</sup>/y. for material use. Additionally, there are forest residues that ranges between 2,000 – 5,000 m<sup>3</sup>/y and can be used as woodchips (app. 10,000 m<sup>3</sup>/y). This amount is sufficient to cover the fuel demand of the planned three-phase DHS project.

The additional advantage of using the forest residues is the obligation of disposing them in order to leave a minimum of biological material in the forests.

It is planned that the municipality will purchase the technical equipment (mobile wood chipper and a transportation truck) that is necessary for producing the woodchips. The woodchip price was determined on basis of the official price list<sup>1</sup> given by the Public Enterprise Macedonian Forests, but the municipal administration will negotiate the price before signing the biomass supply contract.

Estelnic: During 2017, a biomass deposit center has been constructed. The capacity of the biomass center is around 3,300 m<sup>3</sup>. The owner of this biomass center, a local company, has around 40 ha energy willow plantation close to the target village. The owner of the energy willow plantation provides woodchips for the micro biomass heating system at the Mayoralty since 2015. Additionally, the local Forest Owner Association can provide wood residuals that can be converted in woodchips too. The Forest Owner Association is planning to purchase a new wood chipper. Therefore, the local biomass value chain is already established in Estelnic. Existing biomass resources can cover the demand of the planned woodchips based DHS. The amount of harvestable woodchips from the energy willow plantations reaches 1,600 t/y. The owner of the energy willow plantation can ensure woodchips not only for the future DHS but for the local textile factory as well.

The municipality also owns 10 ha energy willow plantation, the first harvest is planned in 2019. The municipality of Estelnic has already purchased the woodchip producer equipment. Residues from local sawmills can also be used for the biomass plant. Besides that, the municipality will produce woodchips from landscape and public mountain pasture cleaning activities.

Ghelinta: During 2018 a biomass deposit center will be established by the Local Council of Ghelinta to collect the available amount of wood residuals in the municipality. In Ghelinta, there are no energy crop plantations like in Estelnic, but on the other hand, there are four Forest Owner Associations with more than 6,000 ha forests and more than twenty sawmills. These sawmills are ready to provide wood residuals in order to produce woodchips to cover the fuel demand for the planned DH system. From the beginning of 2000, several DHS companies from the region and other wood processing companies already collect wood residuals from the sawmills in Ghelinta. Thus, the local biomass production is already well developed and in the near future it is possible to cover the fuel needs for the planned woodchips based DHS in Ghelinta as well.

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<sup>1</sup> [http://www.mkdsumi.com.mk/admin/documents/cenovnik\\_.pdf](http://www.mkdsumi.com.mk/admin/documents/cenovnik_.pdf) (Last accessed: 1.3.2018)

The planned biomass, the selected biomass supplier and the current biomass price are compiled in table 1:

Bioenergy village	Biomass	Biomass supplier	Biomass price €/MWh incl. VAT
Dole pri Litiji	Woodchips from forest and wood residuals	local entrepreneur and wood-based industry, DHS-users (cooperative)	17.9
Kostojevici	Woodchips from forest	National Park Tara, local entrepreneurs, DHS-users	15
Lekenik	Woodchips from sawdust, off-cuts, trims and shavings	wood processing industries, Hrvatske šume Ltd., Forest office Lekenik, forest owners and foresters	15,8
Perušić	Woodchips from forest and woos residuals	Private forest owners, sawmills, local service companies, Hrvatske šume Ltd.	15,8
Kichevo	Woodchips / pellets as back up mode	Regional Forest Service "Lopushnik" and forest concessionaire "Grande Tini"	14.8-24.6
Estelnic	Woodchips from the willow plantation	Local biomass deposit center	13-15
Ghelinta	Woodchips from forests and wood residuals	four Forest Owner Associations, twenty sawmills	13-15

Table 1: Kind of biomass, selected biomass supplier and calculated biomass price in bioenergy village concepts

**Dole pri Litiji:** The boiler room is planned to be built as part of new community building with the fire station and the charcoal museum. The planned wood chip boiler (400 kW) plus a peak load boiler will supply heat via the DHS to the main public buildings and to the households in the central part of the village.

**Kostojevici:** Besides the currently connected school, the ambulance and 26 households, representatives of business sector (bakery, restaurants, offices, warehouses, etc.) and another 19 households expressed a strong interest for connecting to DHS. Additionally to the already existing oil boiler a biomass boiler will be installed. The existing DHS will be used and extended if necessary.

**Lekenik:** Currently, it is planned to implement a biomass district heating system that supplies 18 public and private buildings. The heat will be produced with woodchip boilers combined with a peak load boiler. In remote areas where the grid connection is not economic, old in-house heating systems are planned to replace with modern biomass based systems.

**Perušić:** A cogeneration plant will probably be installed since the supplied heat will be used to expand the production capacity of the sawmill Viševica as well as delivered to the DHS. The company Viševica has already implemented a pellets production site and plans to use the remaining wood waste for onsite combined heat and power generation. In addition, the cogeneration plant will supply electricity to the public grid. The DHS will connect finally 202 public and private consumers. At the beginning, it is foreseen to connect eleven public and private buildings (Ambulance Perušić, Elementary school, Forestry, the municipal building, the building of Post, one Commercial building - Kukčevka, the building of Bakery, the Culture center, Kindergarten, residential buildings etc.) and to connect further buildings in different phases.

**Kichevo:** The project is structured in three phases. The first phase foresees two biomass boilers (2 x 500 kW) that supply the heat via a new DHS to four public buildings. Two biomass modes of the biomass boiler are planned - the woodchip mode as a primary mode and the pellet mode as a backup mode. Furthermore, the DHS will be

completely installed for all three phases, thus the pipeline will be ready for connecting seven older residential buildings with 240 households (second phase) and two new residential buildings with 40 households (the third phase).

Estelnic: A woodchip based DHS is planned that will supply heat to several public buildings such as the mayoralty, the culture center, the office of Angustia Leader Group Association, the kindergarten, the elementary school, etc. In a second step, private companies and individual households shall also be connected to the DHS. According to the financing requirements, an adaptation of the DHS concept is foreseen (look at 2.2.)

Ghelinta: It is foreseen that twelve public buildings will be connected to the DHS in the first phase. In the second phase, three blocks of flats and several small stores going to be connected from 2021. Later on, up to 25 households are planned to connect to the heating network in the village center, which are close to the future DHS in Ghelinta. According to the location of the public institutions, it is foreseen to install a new biomass heating plant (400 kWth + 2x 250 kWth.) and to construct an app. 1,500 m long DHS. According to the financing requirements, an adaptation of the DHS concept is also foreseen in Ghelinta (see chapter 2.2.)

Table 2 gives an overview about the number of connected buildings on the DHS, the number of decentral biomass heated buildings and the planned technical systems.

Bioenergy village	Connected buildings	Decentral buildings	Technical system
Dole pri Litiji	17 consumers	-	Wood chip boiler 400 kW / DHS
Kostojevici	24 households, school , ambulance and at least 4 companies	-	Wood chip boiler combined with the existing fuel boiler and the existing DHS
Lekenik	18 buildings	replacing old in-house heating systems with heat supplied by modern biomass based systems in remote areas	Wood chip boiler
Perušić	202 consumers	-	CHP
Kichevo	First Phase: 4 public buildings Second phase : 7 residential buildings (240 households) Third phase: two new buildings (40 households)	-	two biomass boilers
Estelnic	First phase: Mayoralty, Culture Center, the Office of Angustia Leader Group Association, Kindergarten, Elementary School, Franciscan Monastery and Local Medical Second phase: private businesses and individual households		biomass heating plant and new DHS
Ghelinta	First phase: 12 public institutions Second phase: 3 Blocks of Flats and several small stores Third phase: up to 25 households	Mayoralty	biomass heating plant and new DHS

Table 2: Number of connected buildings, number of decentral biomass heated buildings and planned technical systems in bioenergy village concepts

## 2.2. Investments, economic issues and financing options

Dole pri Litiji: The total investment costs for the new biomass- based DHS are app. 415,000 EUR (excl. VAT). The installation of the DHS will be carried out together with other infrastructure measures (road renovation, electricity, internet...) in order to reduce costs. Currently a slightly different route of the DHS is planned as originally agreed. Therefore, the survey with the inhabitants was repeated in order to ensure right calculation of heating capacity and the size of the pipelines. The survey will be followed by re-calculations of the project, in particular of the heat price. All calculations will be presented to the citizens, probably in June 2018.

The Slovenian Ministry for Infrastructure has an open call for the subsidy for the period 2016 – 2020. The municipality will apply for the subsidy that could cover 55% of the investment costs. Eligible costs for the grant are partly costs of the boiler house, boiler costs and installation in boiler house, and costs of the pipelines.

The municipality Litija will be the investor of DHS (boiler room and pipelines) whereas an investor for the boiler will be selected later. The total investment costs that should be covered by the investor are estimated on 175,000 € (from which 55% grant is foreseen). Two potential investors are already found, the private company EVJ d.o.o. which already takes care of the heating system in a primary school in Dole and the entrepreneur Lavrič who owns a local sawmill, produces woodchips and is already involved in the development of the village.

The municipality plans to prepare all project documentations and to collect all necessary permits before the end of 2018 and to start with the construction works at the beginning of 2019.

Kostojevići: The supplement of the biomass boilers in the heating station in Kostojevići is planned and one of existing heavy fuel boilers will be used to cover the peak load. The investment costs for supplement of biomass boilers are calculated on 280,000 Euro excl. VAT. The Public Investment Management Office (hereafter PIMO)<sup>2</sup> could finance 100% of the necessary investments as non-refundable grant. Main precondition for getting funds is that a project of reconstruction (school building) is included, thus the technical documentation has to describe all planned construction and efficiency measures in accordance to Law on Planning and Construction.

With this subsidy, the complete economic calculation of the DH system has to be adapted, since the subsidy will significantly improve the profitability of the project. The Biomass DH system heat generation costs are calculated in this case to 39.7 EUR/MWh. The expected subsidy would open space for further decrease of the heat price that could be an additional motivation factor for more households that like to connect on the DHS.

Currently, only the technical documentation as basis for the grant application has to be financed. The estimated costs of the technical documentation are 8,000 EUR.

Lekenik: The total investment costs for the biomass district heating system in Lekenik are app. 600.000 EUR excl. VAT. The majority of the investment costs are related to the biomass boiler and the heating grid. An announcement of a future call regarding the energy reconstruction of family houses was published by the Ministry of Construction and Physical Planning. The call will focus on private persons that plan to install small-scale heating systems in their households. Currently, the techno-economical assessment was carried out on basis of subsidies for the municipality that cover 15% of the eligible investment costs. The financing of the remaining investment costs is based on 30% equity from municipal funds and 70% from a credit line. However, the calculated DH price of 85 EUR/MWh is relatively high and the financial sources of the municipality are limited, therefore the municipality as the main investor needs more subsidies in order to reduce the investment costs and thus the heat price. It was decided that the only real option to achieve the necessary investments is using subsidies and defining the municipality as the main investor. Potential subsidies could be provided via the Operational Programme for Rural Development, the Operational Programme for Competitiveness and the Cohesion or EEA/Norwegian financial mechanism. Regarding the beginning of negotiations between Ministry of Regional Development and EU Funds of the Republic of Croatia and EEA and Norway Grants for the use of the Norwegian Financial Mechanisms, RE-GEA together with Sisak-Moslavina county already sent a letter of interest in March 2017 for financing district heating projects in Croatia.

Perušić: The private company Viševica estimates the investment costs for the planned CHP of app. 12.5 Mio. EURO excl. VAT. The investment includes costs for housing of the CHP plant, the biomass storage and for in-house heat utilization facilities as well as the connection to the DHS. Subsidies are not available yet, but possible programs are the same as mentioned for Lekenik.

<sup>2</sup> <http://www.obnova.gov.rs/english>

Viševica wants to build a new production building in which the CHP should be installed. The company is still waiting for its permission. By the end of 2018, Viševica will start implementing the CHP, but it will probably not be finished by the end of the BioVill project.

HEP Toplinarstvo, a public owned sister company of the national power company, will cooperate with a national utility company which owns the electricity grid. The next step is to receive the permission for electricity production, a land permit and a building occupancy permit.

Kichevo: The overall investment costs for the first phase are estimated on 700,000 EUR excl. VAT, whereof app. 30% will be covered from the municipality and the remaining 70% from a third party (financial institution and/or private partner).

The company REHAU in Skopje is interested in the development of the DHS and ICS (Intelligent Climate Solutions) Group was consulted for the design of the heating plant. The offers and calculations made by these companies will be compared with the analysis carried out in the BioVill project, thus the calculation will probably be adapted. Besides the pipeline for the second phase which will already be built in the first phase, the district heating plant will be dimensioned that it can cover the requirements of the future second and third phase of the project. Therefore, the costs for the district heating plant and the network increase the initial investment for the first phase, but will drastically decrease the future costs in the following phases. Thus a more competitive heating price can be offered for interested building owners of the second and third stage of the project.

Different financing institutions, international programmes and credit lines were analyzed and as a result the working group has decided to focus on the funding by the World Bank. The representative office in Macedonia is willing to take the first phase into consideration for possible co-financing in the near future. The World Bank usually opens calls aimed at financing projects through the Ministry of Finance or an intermediary bank, such as the MBDP. One credit line<sup>3</sup> for financing renewable energy sources projects available through the MBDP and the commercial banks supports projects in the amount of up to 3 Mio EUR, with a repayment period of up to 12 years and a grace period of up to 2 years, and a fixed interest rate for the final borrower of up to 6% p.a. Another decision was to keep in mind the credit line WeBSEFF II by the EBRD, offered through the commercial banks, that provides loans of up to 2.5 Mio EUR for the municipal sector, including a grant in the amount of 10-15% of the loan based on the estimated energy savings and CO<sub>2</sub> emission reductions generated by the project. The interest rates are market based and determined by the commercial banks, while the repayment period is up to 15 years with an opportunity for a grace period depending on the investment. Required guarantees can be mortgage on real estate, equipment pledge and other instruments eligible for the banks.

In the next weeks the working group will negotiate with the World Bank, check the conditions of possible credit lines and possible grants. Then the design of the heating network by REHAU and of the heating plant by the ICS Group will be included in the application for the project's first phase and send to the World Bank.

Estelnic: The total investment costs calculated in the pre-feasibility study are 967,843 €, excl. VAT. Currently, a specific call, namely POIM 6.1 "Increase the energy production from less exploited renewable energy resources (biomass, biogas, geothermal)" was identified, that supports the modernization, extension or the establishment of new biomass based DHS in Romania. The working group in Estelnic is very interested to elaborate the documentation for the project submission. It is planned, that the project submission to the POIM 6.1. programme will be finished by the end of 2018. The subsidy program offers at least 60% and a maximum of 98% financial subsidy of the eligible investment costs for local municipalities or public companies that provide heating services in their town, but only for municipalities or public companies with non-profit approach. The subsidy program covers the costs for the construction of the biomass plant, the biomass boiler installation, the heat distribution system and the pump station. The program can also cover the costs for the development of a local heating network up to 20% of the total budget of the project. The remaining 80% of the DHS costs have to be covered from the municipality.

The municipality is willing to finance the feasibility study and the project documentation (20,000 Euro) that are necessary for the application in the POIM programme. In the case that the municipality of Estelnic will not receive the investment subsidy from the national support program for the planned DHS, an alternative solution is to install small separate biomass boilers in 2018 at the Medical Center, in 2019 in the Franciscan monastery and the new Kindergarten and in 2020 at the school. The financial resources for these small individual heating systems are foreseen from local budget and from national refurbishment programs in case of Franciscan Monastery.

<sup>3</sup> <http://www.mbdp.com.mk/index.php/en/lending/energy#renewable-sources> (Last Accessed: 21.3.2018)

Ghelinta: The estimated investment costs for the heating plant and the DHS are app. 705,000 €, excl. VAT. In order to realize this investments the above mentioned “POIM 6.1” programme will be used, too. The development agency, which collects the project proposals, so far has received only 4 applications. Thus, Ghelinta has a very promising chance to receive the financial support for its bioenergy project. According to the POIM 6.1 call, the municipality of Ghelinta can receive up to 98% subsidies for heating services in public buildings. Therefore, the municipality has to elaborate the feasibility study focusing only on the local public institutions during 2018. The Local Council of Ghelinta already included the costs for the feasibility study in the local budget. This update will be carried out by the ESCOROM Company.

Since the programme only covers the costs of the DHS up to 20% of the total budget, the Biovill working group in Ghelinta decided to install several small biomass boilers in the bigger public buildings and to connect the closest ones. In the beginning of 2018, a Romanian ESCO company has been invited for preparing the project documentation for the submission that will be finished in the end of 2018.

Table 3 gives an overview about the calculated investment costs and the eligible financing and grant programmes:

Bioenergy village	Necessary investments (EUR excl. VAT)	Funding and Grant programmes
Dole pri Litiji	415,000 (updated calculation is planned)	55% subsidies from a call of the The Slovenian Ministry for Infrastructure
Kostojevici	280,000	100% from Public Investment Management Office PIMO
Lekenik	600,000	Possible subsidies from the Operational Programme for Rural Development, Operational Programme for Competitiveness and Cohesion or EEA/Norwegian financial mechanism.
Perušić	12,500,000	
Kichevo	700,000	Credit lines offered from World Bank and WebSEFF II by the EBRD
Estelnic	967,843	60-98 % from POIM 6.1 Programme (only for heating plant)
Ghelinta	705,000	

Table 3: Calculated investment costs and eligible funding an grant programmes

### 2.3. Ownership and operating model

Dole pri Litiji: The municipality of Litija will take the leading role in implementation of the project and will be the main investor in the community building in which the boiler room will be implemented. Additionally, the municipality will be in charge of reconstruction of all local infrastructures (sewage, optic internet, electricity) and will invest in the ground construction of the pipelines within the infrastructure renovation. Thus the municipality will be the owner of the land, of the DH pipe lines and in the first phase of project implementation it will be also an owner of the new building. The boiler room will be available for a long-term rent to the investor who will be responsible to finance the boiler and all needed installations inside the boiler house. The investor will also be responsible for the operation of the system and will sell the heat to end consumers. It is not decided yet who will be the investor, two companies mentioned in 2.2. are eligible.

Kostojevići: On basis of 100% grants from the PIMO programme and with support of the municipality of Bajina Bašta (project documentation etc.), the ownership structure would remain the same as it is now. That means that the municipality of Bajina Bašta and PUC BB Term will be the owner of complete DH system in Kostojevići. BB Term would also remain the DH system operator responsible for maintenance, accounting, etc. Meters that measure the produced energy from the boilers are installed in the boiler room. But it is planned to switch the accounting of the delivered heat from square meter to kilowatt-hour. Therefore, meters have to be installed in all heat transfer stations in the buildings. This is still a point of discussion in the working group. The procedure for procurement of the equipment and works required for the construction of a biomass plant will be implemented by BB Term in accordance with the laws of the Republic of Serbia (public procurement procedures).

The involvement of citizens in bioenergy project is expected on the biomass supply side. The owners of the local forests already expressed interest to provide biomass for DH system operation.

Lekenik: The municipality will be the owner of the planned biomass based district heating system. The municipality will set up a special municipal company for managing and operating the boilers and the district heating system. The company will produce energy for heating and sell it to all users connected to the heating system.

Perušić: It is planned that the municipality will be in charge of the heating grid and the local sawmill operator for the energy production. The CHP plant will be 100% owned by the company Viševica. The company's ambition is to be the leader in the processing of waste wood into biofuel. Viševica's main objective is to supply the electricity from the biomass based CHP to the grid (remuneration based on feed-in tariffs) and to use the heat for drying the pellets or wood logs in the factory and for supplying to the DHS. Thus, Viševica will be accountable for the maintenance of the CHP and the sufficient amount of wood waste or other biomass material.

Kichevo: The local working group analyzed two possible options that are relevant for funding the investments, operating the plants and the DHS and selling the heat: The municipality is responsible /establishment of a public enterprise or a public-private partnership. Finally, the group decided that the municipality should be accountable for the complete management of the system in the first phase of the project. In the future, the municipality can found a public enterprise that will take over the management of the system and connect additional buildings on the network. Thus, the municipality will be the owner of the technical equipment as well as the operator of the boilers and networks. Available technical experts who currently care for the individual heating systems in the buildings will get additional trainings that they should be able to maintain the prospective district heating system as well. Besides that, one or two additional engineers can be transferred from another sector in the municipality and can form a subsector responsible for the operation of the plant.

Estelnic: Since the municipality is the only eligible entity in the village who can apply for the above mentioned national support program, and since no private company is interested to invest in a new biomass based DHS in Estelnic, the future boiler house and the DHS will be owned by the municipality.

The municipality will also organize the operation and management of the DH system. ErPek Ind Ltd, the local biomass boiler producer and biomass distribution company will provide the relevant knowledge and will train the responsible staff of the municipality before the operation of the DHS starts. The maintenance will be provided by professional companies from the region.

During 2018, the local council will elaborate the building permits for the biomass heating plant, will request necessary permits from Water Agency of Covasna and from the Environment Directorate of Covasna County and will prepare a topographic plan for the DH network.

Ghelinta: Also in Ghelinta, no private investor could be identified, who is willing to invest in the planned boilers and networks. Therefore, the municipality will invest in the plants and apply for subsidies from the national support program. Then, the municipality will be the owner of the central plant and the DHS. The operation will be ensured by the municipality, which will create at least two new jobs for the operation of the heating service. The company ErPek Ltd., a local biomass boiler producer dealing with biomass, will provide a training to the responsible staff of the municipality before the operation of the DHS or the boilers in the buildings starts. A subcontracted professional company from the region will provide maintenance services for the DHS. Moreover, several companies exist in the closest town that have good experiences in heating systems and are capable and interested in providing maintenance services.

The local businesses in Ghelinta are very ambitious since they are very willing to change their heating system from traditional firewood to modern biomass based technologies. In the last two years, four local businesses like a bakery, an event hall, a guest house and a sawmill have switched to biomass and implemented a biomass boiler.

Bioenergy village	Ownership on the technical plants	Operator
Dole pri Litiji	DHS and boiler room: municipality Boiler: private investor	Private investor
Kostojevici	BB Therm (public utility)	BB Therm (public utility)
Lekenik	municipality	municipality
Perušić	DHS: municipality CHP: company Viševica	Company Viševica
Kichevo	First phase: Municipality Future phases: probably public utility	First phase: Municipality Future phases: probably public utility
Estelnic	First phase: Municipality Second phase: stores and other institutions Third phase: households and block of flat in the village center	First phase: Municipality Future phases: municipality and private investors
Ghelinta	First phase: local public institutions and businesses Second phase: local businesses from village center Third phase: households and blocks of flats in the village center	First phase: Municipality Future phases: municipality and private investors

Table 4: Ownership and Operator of the technical plants

## 2.4 Contractual issues

The contractual issues are quite similar in the bioenergy villages. However, there are some differences between contractual requirements and regulations in the single villages.

Since the projects are still in the preparation phase, recalculations have to be done and more clarifications regarding costs, heat prices, timelines and others have to be communicated, the contractual issues are mostly not a key topic in the villages now. Nevertheless, some project groups already discussed some of the key regulations in the necessary contracts that are described below.

Table 5 shows an overview about the relevant contracts that have to be set up in the single villages.

Bioenergy village	Biomass supply contract <sup>4</sup>	Preliminary heat supply contract	Heat supply contract	Electricity supply contract	Rental contract	Maintenance contract
Dole pri Litiji	Investor/biomass supplier (e.g. cooperative)		Investor/public + private building owners	-	Municipality/investor (boiler room)	N.A.
Kostojevici	BBTherm/biomass suppliers		BBTherm/public + private building owners	-	-	N.A.
Lekenik	Municipality/biomass suppliers	Municipality/private consumers	Municipality/private consumers	-	-	N.A.
Perušić	Viševica/Hrvatske šume and local forest owners	Viševica/municipality/consumers	Viševica/municipality/consumers	Viševica/Hep Toplinarstvo <sup>5</sup> (PPP)		N.A.
Kichevo	Municipality/bio-mass suppliers		Municipality/Private consumers			Municipality/professional companies
Estelnic	Municipality/bio-mass suppliers		Municipality/public and private consumers			professional company
Ghelinta	Municipality/bio-mass suppliers		Municipality/public and private consumers			professional company

Table 5: Planned contracts in the bioenergy villages

### Biomass supply contracts

Main contents of the biomass supply contracts will be the price of the woodchips accounted per m<sup>3</sup>, the necessary amount of woodchips resp. heat and the quality requirements in all bioenergy villages. Some of them already determined some specific parameters of the contract: The working group in Kichevo plans a 10 years long biomass supply contract and BB Therm in Kostojevici wants at least a 5 years contract to ensure a stable biomass supply and the financial security for both contract partners.

<sup>4</sup> In projects that needs a peak load boiler also contracts for the fossil fuels are necessary.

<sup>5</sup> HEP Toplinarstvo, a publicly owned sister company of the national power company, HEP group, which is by far the biggest district heating operator in Croatia with the share of about 85 % of district heating supply.

### Preliminary heat supply contract

The municipalities in Lekenik, Perušić and Dole pri Litiji plan preliminary heat contracts with all customers in order to reduce the risk but also to make the overall project economically feasible. Preliminary contracts with the end consumers are not foreseen in the other projects but heat supply contracts will be agreed with the connected private consumers. Only public buildings will be connected in the first phases of the projects in Kichevo, Estelnic and Ghelinta, in these villages the preliminary contracts are not needed since the municipality is the investor, building owner, operator and consumer.

### Heat supply contract

Main contents of the heat supply contract are the necessary amount of heat (kWh/y), the heat price (mostly as fixed price in Euro/y and as consumption based price in Euro/ kWh), the maintenance of the system, regulations regarding heat supply disruptions, price adaptation clauses and additional tasks for both contract partners. The contracts will be agreed either the municipality or the private investor with the end consumers.

In villages, where the biomass also comes from private forest owners who are also DHS heat consumers, these private consumers will have the opportunity to pay their heat costs partially/totally with their own wood resources (planned in Dole pri Litiji and Kostojevici). In Dole, nearly all households own forest land, that why they have interest in selling wood from their forests to planned DHS. The system of available wood biomass supply to DHS will be agreed with investor in next step. Since in the existing DHS in Kostojevici the heat is accounted per square meter, meters have to be installed in the connected buildings. Thus, the accounting can be carried on basis of the real consumed heat in the buildings. This accounting system is foreseen for all other new DHS in the bioenergy villages too.

Ten-years contracts for delivery of heat energy will be set up in Dole, Kostojevici, Lekenik and Perušić. Stakeholders in the other villages also focus on longer supply contracts in order to reduce the risk of disconnecting.

### Rental contract

A rental contract for the boiler room has to be worked out in Dole, since the municipality will be the owner of the building / boiler room and will rent it to the selected private investor. The contract will comprise the fee, the responsibilities for both sites and the interfaces. It will probably be signed for a longer time.

### Electricity supply contract

An electricity supply contract is only necessary in Perušić: The company Viševica as an electricity producer will sign the contract with HEP Toplinarstvo, the national utility company, for feed-in-tariffs remuneration and electricity supply. The contract will probably be signed for a period of 14 years. However, this contract defines feed-in premiums that subsidize electricity input from highly efficient cogeneration. Therefore, subsidies on basis of the feed-in premiums are still uncertain yet. Selling of electricity on the electricity market is also an important income, thus Viševica can recover a third of the expenses over the years with these revenue streams.

### Maintenance contract

Some municipalities that will be the investor and operator are not able to maintain the technical devices professionally. Therefore, an experienced company will be involved and a maintenance contract will be agreed in Kichevo, Estelnic and Ghelinta. In Estelnic and Ghelinta, there is a local biomass boiler producer who provides long-term maintenance service as well.

Investors who will be responsible for operation of the system in Dole will have to arrange a contract for maintenance of the DHS, if it will not have his own available personnel. This will be the responsibility of the investor, that why the solution will be known as soon as the investor will be selected in the other villages.

### Transfer agreements

A transfer agreement will probably be necessary in Perušić and in Dole pri Litiji, since both municipalities will finance the DHS and transfer the grid including all obligations such as maintenance to the heat supplier, the company Viševica (Perušić) or the selected investor (Dole pri Litiji). However, the ownership on the grid will stay

by the municipalities therefore the main content of the agreement will be the transfer of the right to use the DHS to the private investor.

### 3. Summary

The following charts give an overview about the planned business models in the single bioenergy villages. However, the development of the concepts is still in progress therefore the reports 5.5. will be updated at the end of the BIOVILL project.

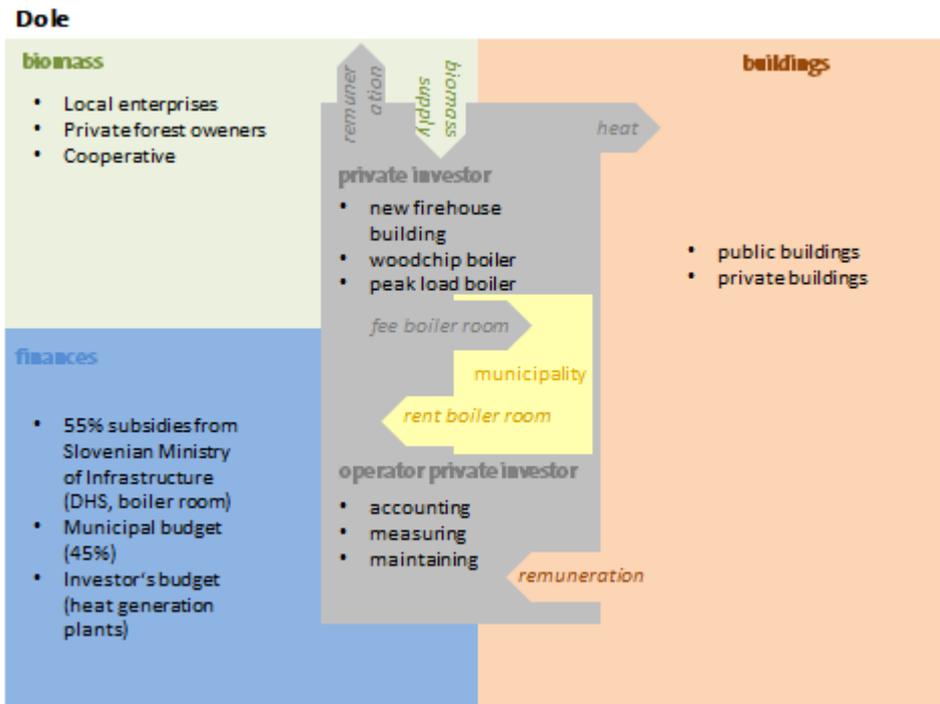


Figure 1: Business model in Dole pri Litiji

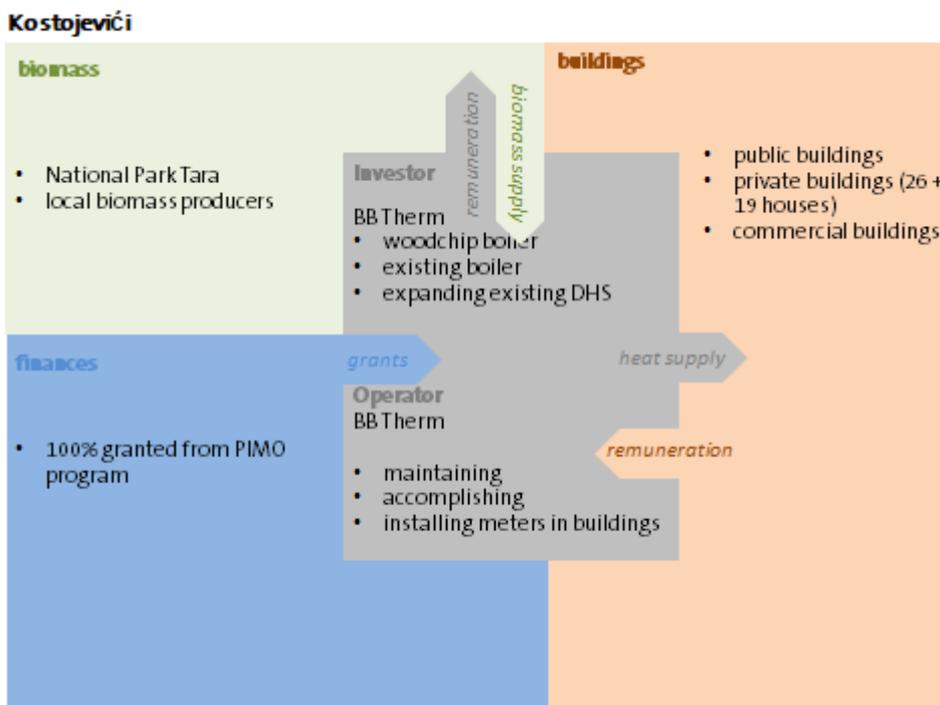


Figure 2: Business model in Kostojevići

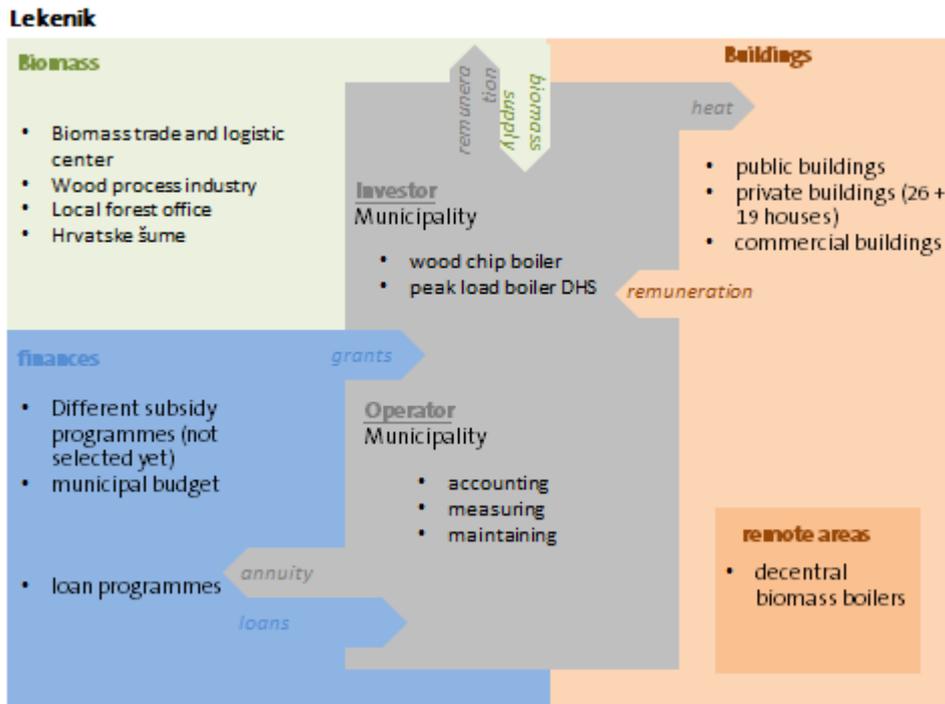


Figure 3: Business model in Lekenik

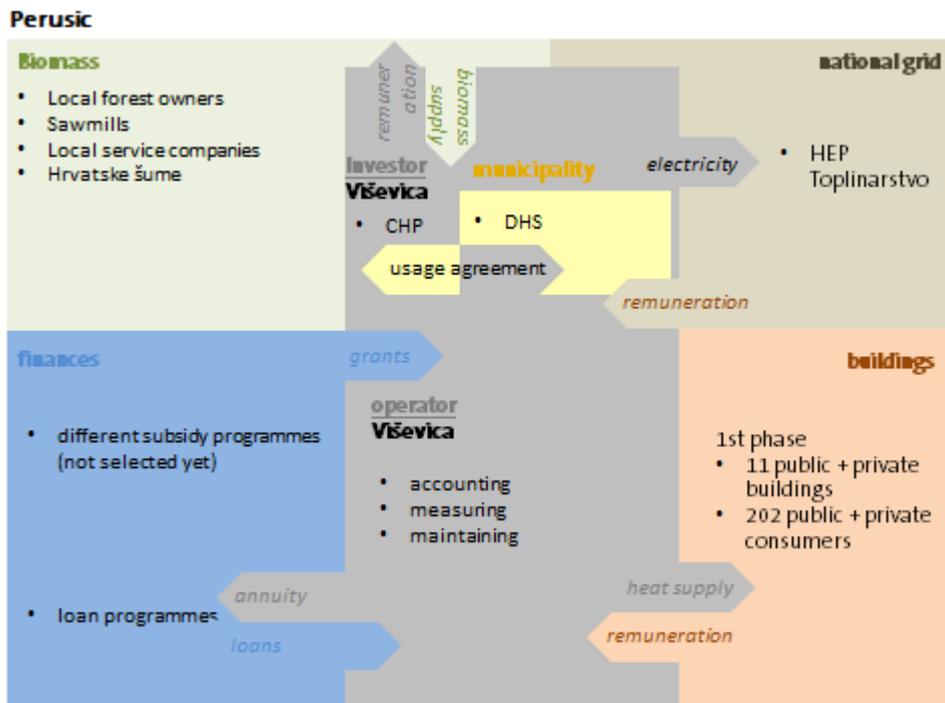


Figure 4: Business model in Perušić

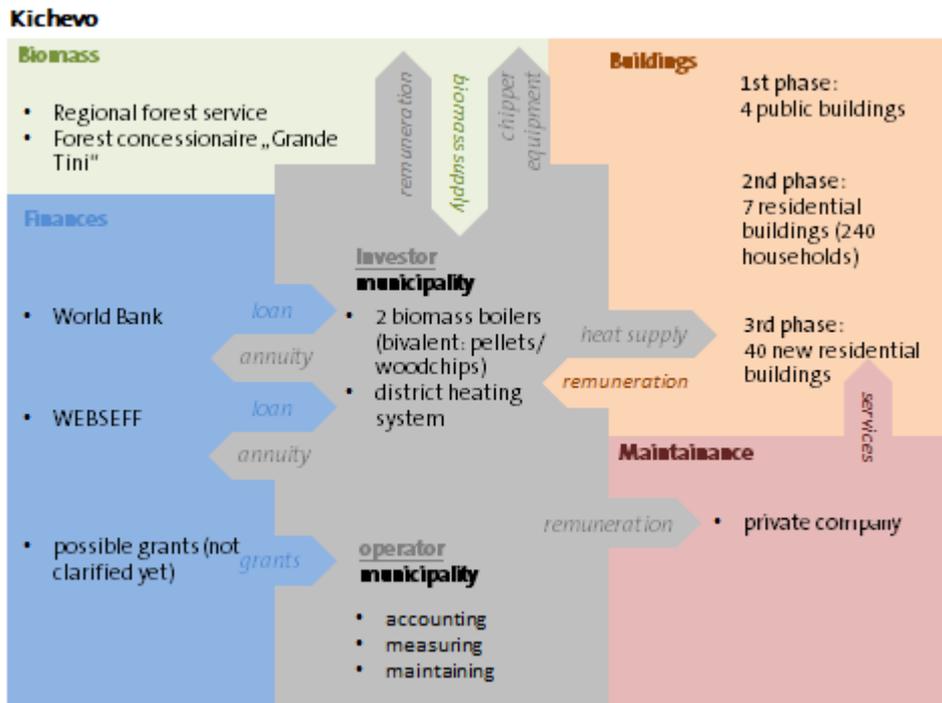


Figure 5: Business model in Kichevo

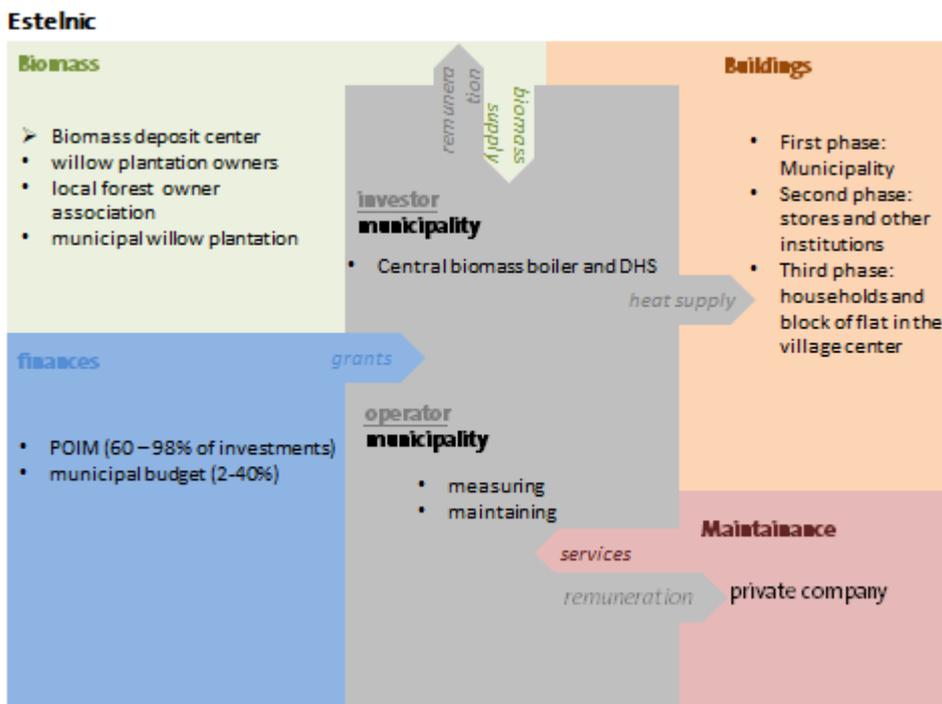


Figure 6: Business model in Estelnic

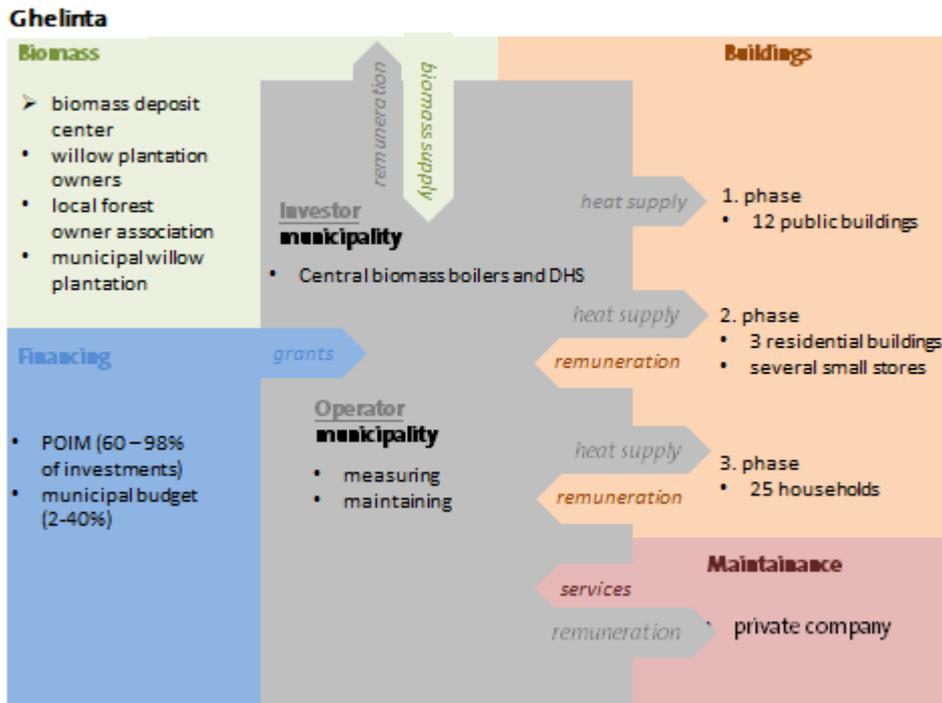


Figure 7: Business model in Ghelinta