Project co-financed by the European Regional Development Fund

FORBIOENERGY - Forest Bioenergy in the Protected Mediterranean Areas

Planning sustainable forest-wood-energy supply chain in the protected areas
Annex 1: Study area report - CROATIA

Workpackage 3 - Testing

Activity A.3.8. - Planning sustainable forest-wood-energy supply chain in the protected areas

Deliverable D.3.8.1 – Planning sustainable forest-wood-energy supply chain in the protected areas

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REGIONE SICILIANA
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VELEBIT
Park prirode • Nature park

Planning sustainable forest-wood-energy supply chain in the Nature Park Velebit, in Lika-Senj County (CROATIA) (IMFBE-RP 3/2 – C)

Project partner:
Public Institution „Park prirode Velebit“
Kaniža Gospićka 4b, 53 000 Gospić
Project:
Interreg Mediterranian
FORBIOENERGY - Forest Bioenergy in the Protected Mediterranean Areas

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Contents:

1.1 Introduction

This chapter deals with the existing biomass supply chain in the area of the supreme biomass district, which includes the economic units of state forests that are part or all within the PP Velebit and the surrounding private forests, evaluation (part of local self-governemt units (LAU) Gospić, Otočac, Perušić, Karlobag, Lovinac, Gračac). In this way, the biomass district is in line with the legal powers and possible influence on the policy of managing the forests, considering that all state forests are managed by Croatian forests d.o.o. (through forest administrations (FA): Gospić and Senj), and private forests are managed by private forest owners.

In this area there are very few settlements, residents and legal entities. It is also acknowledged that the Croatian Forests d.o.o. centralized management of state-owned forests and somehow represent a monopol in the existing biomass procurement chain and an analysis of supply and demand for the entire Lika-Senj County was made. In this way, a better evaluation of the biomass supply and demand market is achieved because it realistically depicts the current situation on the local biomass market.

Regarding the chain of gaining biomass for the production of various energy sources such as wood, chips and pellets, it has been established that this is a unique supply chain stemming from the existing model of state-owned forest management.

In the Explanatory Expenses, a brief overview of the method of calculation of investment costs is recommended, which is recommended in the Catalog of Typical Solutions for the Application of Alternative Building Systems of 50 up to 1.000 m^2 published by the Ministry of Construction and Spatial Planning of the Republic of Croatia.

Based on the above mentioned, a draft SWOT analysis was developed which should be discussed/supplemented with relevant stakeholders and recommendations for improvement of the biomass supply chain, in which the Croatian Forest d.o.o. has monopol position.

1.2 Main steps in establishing a wood energy supply chain

The supply chain is basically a series of legal and / or physical persons involved in the process of production / processing resulting in the provision of a product or service to the customer. In accordance with the aforementioned biomass supply chain includes forest owners, farmers, entrepreneurs in the forestry and agriculture sector, entrepreneurs in the transport sector, timber trade, and depending on the type of energy-based wood it includes private or public buyers. The growing complexity of the supply chain of biomass requires a detailed elaboration of all the steps of its implementation / establishment. The complexity of establishing supply chains is even

greater when establishing a biomass supply chain in protected areas. Wood biomass production usually does not start from scratch but is built on existing organizations and entities and only develops by missing supply chain segments.

Looking at this basis, the main steps in establishing a biomass supply chain are:

1. Analysis of the present state of affairs (simplified market analysis) that gives us insight into biomass potential, existing procedures and existing and potential buyers
2. Identification of end users will give an insight into the quantitative and technical requirements that must be met
3. Determining the network of stakeholders, providing support for the establishment of cooperatives / associations
4. Analysis of the procurement market
5. Economic evaluation of the planned production chain
6. Evaluation of possible „bottlenecks“ (SWOT analysis)
7. Final Investor Recommendations and the Cooperation Agreement between the various stakeholders in the production chain
8. Technical Assistance for Designing Project Documents and Finding Investing Sources

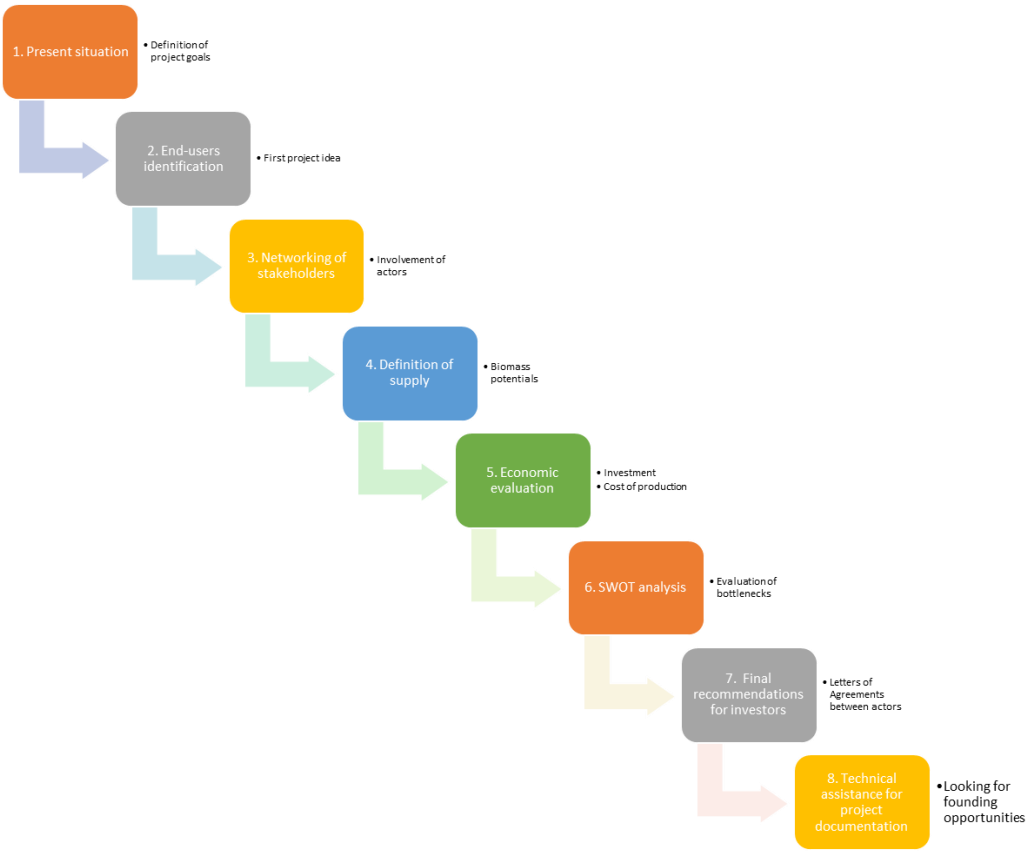

Figure 1: Main steps in establishing a wood energy supply chain.

1.2.1. Step 1: Analysis of the present situation

Before starting any project or new activities, it is necessary to make a basic market analysis. Therefore, a basic analysis of the present state of the biomass market was prepared based on the data collected (project analyzes so far, project data, statistical data, data from other public sources, NP Velebit, Croatian Forests d.o.o., etc.). Market analysis includes the procurement market and the sales market and other issues that may arise.

A. Offer Market Analysis

a) Brief overview of the spatial wood supply market

Hrvatske šume d.o.o., na području Ličko-senjske županije, upravljaju šumama putem dviju uprava šuma podružnice Gospić i Senj koje, kao daljnje upravne jedinice, imaju ustrojene šumarije.

The Croatian Forests d.o.o. (state-owned or public company), in the Lika-Senj County, manage the forests through the two forest management offices (branch offices, Forest administrations) of Gospić and Senj, which, further – include smaller, local, administrative subunits.

All the forests with which the Croatian Forests d.o.o. are divided into economic units, and are further divided into departments and subdepartments. The boundaries of the economic units are determined on the basis of different parameters and, as a rule, are tailored to the configuration of the terrain, organizational needs and roads. The economic unit includes one or more forest areas.

Dana which are used and presented in this study include data of FA[1] Gospić and Senj which are in almost whole teritory in NP[2] Velebit (including local subFA in Gračac which belong to FA Gospić).

Considering the economic value of the most important forests, they are located in the area of Senj, Otočac, Perušic and Gospić. In this area, most of the various processing capacities (from the producer of fuel wood to cogeneration) are found and the largest number of economic entities involved in the production of biomass are registered as sub-contractors of Croatian Forests d.o.o. (mainly forest and transport exploitation).

By analyzing defined areas in Corine Land Cover in the previous project delivery (*Planning biomass based energy production in protected areas in Lika-Senj County (regional level) - focusing on the Nature Park "Velebit" protected areas (incl. municipalities/LAUs within Nature Park, sub-regional level) (IMFBE – WP 3 – A 3.4)* there

[1] FA – Croatian Forests d.o.o. (Ltd), Forest administration (branch)
[2] NP – Nature Park

are no agricultural woody crops areas but there are only forest areas in the presence of deciduous (311), coniferous (312) and mixed (313) forests. Also, in areas of LAU[3] outside the NP Velebit borders, there is no agricultural woody crops marked with: 221, 222, 223.

Also, in the area considered there are no plantations of short-time wood crops[4], as well as wood processing capacities that can provide the appropriate plant residue. Due to the low population density, low living population, it can not be expected that any source of biomass would be the cascading use of wood previously used as furniture, parquet flooring and similar.
The only source of biomass in the observed area is the economic forest.

Commercially state-owned forests

Forestry management in Croatia is most focused on the management of state-owned forests, which characterizes the sustainability, long-term planning and implementation of management practices on the principles of sustainable management at all levels. On average, 66.75% of the 10-year increase is cuts in the area considered. The Lika-Senj County is a karst area where forest has very important protective function and the increase in wood stock is important.

Commercially private-owned forests

As stated above, there is not enough accurate data on the area of forests in private ownership (it is estimated that there are 4,000 ha of private forests in the District). The management of private forests in the area of the biomass district as well as in the whole of Croatia characterize unresolved property and legal relations, legal inaccuracy, fragmentation of land and unfavorable sociological characteristics of forest owners (large share of older population and adverse level of education).
For private forest owners, it is important to distinguish those who manage forests and put forest products on the market (enrolled in the Forestry Register) and owners of tiny forest particles that are mainly used for their own purposes. The area of the entire Lika-Senj County and part of the Zadar County (which belongs to the Gračac Municipality) is an area with negligible share of private forests estimated at up to 4.4% of total forest area[5]. The result of small areas and low economic value of private forests is the lack of

[3] LAU – Local self-government units (municipalities and towns)
[4] The Ordinance on the List of Plant Species for the Establishment of Woodcurned Crops (Official Gazette 16/19) in Annex I provides a list of plant species
[5] According to the data presented in the scientific work "The state and the challenges of private forests management in Croatia in the existing ecological and sociological circumstances in the Lika-Senj County" (original: „Stanje i izazovi gospodarenja privatnim šumama u Hrvatskoj u postojećim ekološkim i

forestry works, the lack of information on the state of the structure of private forests and the lack of consistent forest management. Private forests are used for the production of firewood, mainly for their own needs, some are sold to small producers of firewood, and some are illegally cut and placed on the hot market of firewood.
The offer market analysis was made on the basis of submitted data on the production capacities of the Croatian Forests d.o.o., FA Gospić and Senj and publicly available data of Croatian Forests d.o.o. on contracted quantities of spatial wood of different types and intended for different customers (producers of firewood, briquettes, pellets, woodcutters, cogeneration) during the period 2017. - 2019. This comparison was made due to changes in the supply area (which was limited by the annual growth and the ethos of certain forest management bases) and demand (which is constantly growing)

Production capacities of the Croatian Forests d.o.o., FA Gospić and Senj

Croatian Forests d.o.o. on the territory of the Lika-Senj County, manage the forests through the two Forest administations - Gospić and Senj , which, as further administrative subunits.

Table 1. Categorization of forestlands on the Lika-Senj County which is managed by Croatian Forests d.o.o.

Categories	FA Senj	FA Gospić[6]	Total
Surface (area)	50.775,05	319.111,97	318.731,79
Forested area	32.117,19	248443,11	269.610,39
The bare forestland area	32.117,19	28.662,49	60.779,68
The barren forestland area	5.132,81	2035,11	6.933,86

Data source: Croatian Forests d.o.o., Forest administration Gospić, March 2017., Report on the situation in the Zadar County area.

Table 2. Data regarding annual growing (wood) stock, annual growth and annual yield under Croatian Forests d.o.o. management (state-owned forests) in m^3

Categories	FA Senj	FA Gospić	Total
Annual growing stock	762.3143	46.469.976	54.093.119
Annual Increment	132.219	889.078	1.021.297
Annual Yield	108.609	683.568	792.177

sociološkim okolnostima na području Ličko-senjske županije“) there are from 1.5 to 4.4% of the private forest (page 462) The Institute for Spatial Planning of Lika-Senj County speaks of a share of 5%

[6] data were increased for data on forests in the area of Forestry Gračac that were excluded from the Basic Analysis of Biomass Production / Potentials in the Lika-Senj County, with an emphasis on the protected area of Velebit Nature Park [IMFBE - RP 3/1 - A] task.

Data source: Croatian Forests d.o.o., Forest administration Gospić, March 2017.

On average, 77, 56% of annual increment is being cut. In FA Gospić and FA Senj area is, in same time, karst area and has very important protective function as well as for increase of growing stock.

Table 3. The structure of yield, according to the assortments of Forest Administration Gospić.

Tree species	Technical wood			Cordwood			Total/ netto	Waste/ cca
	Logs/ netto	Thin technical wood/ netto	Total wood/ netto	VM processed wood/ netto	M Firewood/ netto	Total cordwood/ netto		
	m^3	m^3	m^3	m^3	m^3	m^3	m^3	%
Pedunculate Oak	0,00	0,00	0,00	23,36	0,00	23,36	23,36	17
Sessile Oak	76,00	0,00	76,00	1.575,84	0,00	1.575,84	1.651,87	17
Beech	65.918,99	1,59	65.920,58	180.152,57	0,00	180.152,57	246.073,15	17
Ash	0,00	0,00	0,00	0,00	0,00	0,00	0,00	17
Hornbeam	0,00	0,00	0,00	2.390,01	0,00	2.390,01	2.390,01	17
Sycamore	320,96	0,00	320,96	4.025,61	0,00	4.025,61	4.346,57	17
Other hard non conifers	76,47	0,00	76,47	6.521,20	0,00	6.521,20	6.597,87	17
Other soft non conifers	0,00	0,00	0,00	0,00	0,00	0,00	0,00	17
Fir	67.029,37	376,27	67.405,64	45.120,31	0,00	45.120,31	112.525,95	17
Spruce	4.637,27	7,70	4.644,77	4.738,82	0,00	4.738,82	9.383,79	17
Pine	2.788,33	18,58	2.806,93	5.382,13	0,00	5.382,13	8.189,06	17
Other conifers	1.312,47	290,55	1.603,02	1.361,81	0,00	1.361,81	2.964,86	17
TOTAL	**147.159,88**	**694,69**	**142.854,57**	**251.292,22**	**0,00**	**251.292,22**	**394.146,79**	

Data source: Croatian Forests d.o.o., Forest administration Gospić, March 2017

The analysis of wood assortment hasn`t been delivered by Forest Administration (hereafter: FA) Senj, but it is evaluated that on the County area, 183.000 m^3 logs as raw material are being produced for wood processing industry, which means that annual production of logs on the Forest Administration Senj area amounts cca 36.000-40.000 m^3.

According to the listed, it can be valuated, that annual reached amount of cut cordwood on the FA Gospić and FA Senj area is cca 290.000 m^3.

15% of cut growing stock stays in forest causing a decrease of this unused waste as an aim, if it will be proved that it is economically justified. Exploitation of branches waste, below 7 cm thickness, isn`t silviculturally justified because this biomass, whose

exploitation is expensive, is needed because of humus production, which causes remaining of branches waste in forest (on the ground, in piles, depending on type of management and silvicultural work, which determined occurrence of branches waste).

The most important industrial wastes which represent biomass source are sawdust and bark pieces. They remain in wood processing industry during primary processing of logs. On the County area, in the most of wood processing machineries, primary functions are wood processing and production of wood and corks, except furniture; manufacture of articles of straw products and plaiting materials. A part of bigger machineries are being used for industrial waste in production of thermal and electric energy, and smaller machinery sell bark pieces to the citizenship, while saw dust is being treated as waste. Aimed to data collecting about the way of using industrial wastes, according to the Croatian County Chamber of Commerce, a survey is issued to legal entities, registered under Nace code C16: *Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials.* Within 14 days, none of the legal subjects have answered the survey. After the interview with certain entrepreneurs, the gotten information was that bark pieces are being sold to citizenship and to legal entities at a cost of 75 HRK/m^3. Wood processors, who deal with Beech Wood Processing, use sawdust in their steaming chambers contrary to the ones who work with Fir and sell the sawdust to pellet factories. Also, some of wood processors, who are processing bark pieces, make offers for selling them in Italy. It has been estimated, that the industrial wood waste, which can be reused, amounts on annual level 25.120/m^3 [7].

Agricultural residues such as straw, corn and branches represent a very important source of biomass and are produced by pruning fruit trees and vineyards. According to the data of Paying Agency for Agriculture, Fisheries and Rural Development (hereafter: PAAFRD), in the system of agricultural support measures (direct payment), there have been 2.712,74 ha of registered wheat planted acres, 572, 01 ha of orchards and 144,11 ha of olives and grape vines planted acres (these two cultures are being grown on the area of City Novalja, i.e. on the island Pag). Cropped biomass can be chipped, plowed, composted or burned. On the County area, the biomass is mostly burned, till orchards are mostly extensive and pruning is manual. There are more neglected old orchards on the County area, which are mostly mixed or planted with Plum infected with Plum Plox Virus. Except plums, the Virus infects other sorts of stone fruits. Infected and abandoned orchards endanger new plantations and that is the reason why they have to be destroyed and cleared. These measures haven´t been achieved because most of infected trees belong to the orchards of elderly households and are located on infields.

[7] Page no.99 of The Third National Energy Efficiency Action Plan of direct consumption for the Period 2014-2016 on the Lika-Senj County area.

The most of used agricultural areas are karst pastures, meadows and acres planted with fodder because of the characteristic area for sheep breeding (for meat) and for cattle breeding. As a result of milk production collapse (for several years, the organized milk purchase doesn´t exist for bigger dairy farms located outside the County), a part of farms switch to the cattle breeding (beef breed in cow-calf operation). The average ratio of the grain and ground amounts 53% to 47% which means that is approximately the same amount of the biomass and the grain. Although it is undeniable, that the produced biomass must be returned to the soil, the recommended amount of the plowed soil is 30%-50%, which means that energy implementing amounts at least 30%.

According to the data of the Ministry of Agriculture in the area considered (including Gračac Municipality) there are 27.216,47 ha of private forests with a min. Increase of 3 m^3/ha and with the fell of 50%, 40.825 m^3 of biomass per year could be harvested. However, due to the large number of old people, the fragmentation of land and unresolved property and legal relations, it is estimated that the production of spatial wood in private forests is about 5.000 m^3 per year.

Market trends, Croatian Forests d.o.o., FA Gospić and Senj, from 2017. till 2019.

Table 4. Approved quantities of cordwood per year in FA Gospić and Senj, in m^3.

Year:	2017.	2018.	2019.
Croatian Forests d.o.o.	1.137.501	1.164.789	1.161.123
FA Gospić + FA Senj	186.660	178.450	169.173
%	16,41	14,74	14,57

Data source: Croatian Forests d.o.o., 2017.-2019.

FA Senj and Gospić participated in the year 2019. with 14.57% in the planned production of spatial wood production of the Croatian Forests d.o.o., at the national level.

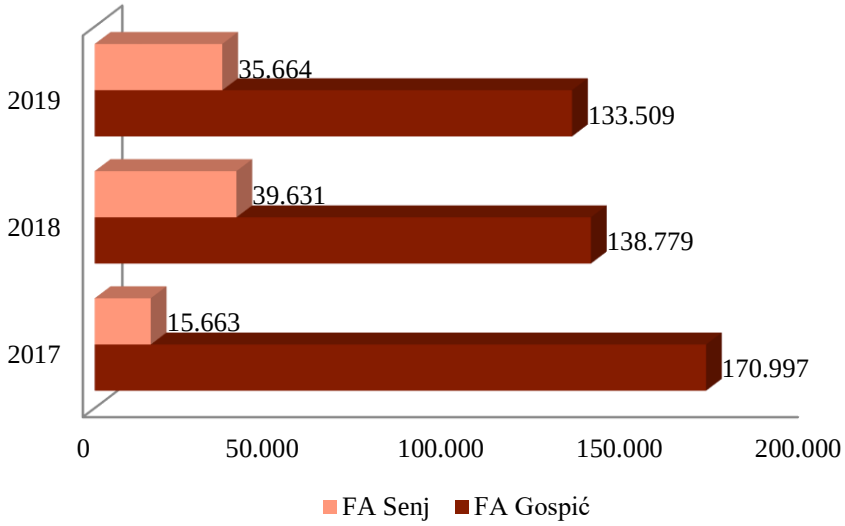

Figure 2. Finally approved quantities of spatial wood of the Croatian Forests d.o.o. in m^3 (2017.-2019.)

Compared to 2017., the spatial wood production in the area of FA Gospić fell by 21,92%. The reason for this is more adverse weather conditions, lack of workforce, poor planning, inadequate mechanization, monopol position on the market.
In the discussion with individual entrepreneurs in this sector, one of the biggest concerns was the lack of contracted amount of spatial wood without any penalties at the expense of the Croatian Forests d.o.o.
According to available information, most small-scale wood processing companies in the County are continually reducing the amount of spatial wood (and other assortments).
The reason for this is the policy of the Croatian Forests d.o.o. according to which better conditions for procurement and the provision of larger quantities (at a lower price) are achieved by customers who have a higher level of product finalization.
This includes pellet and cogeneration plants that require large amounts of spatial wood to fully utilize the installed capacity.
Small producers do not have enough space to grow and rely less on the most important supplier of raw materials. Therefore, part of the producer of fuel wood is oriented towards owners of private forests.

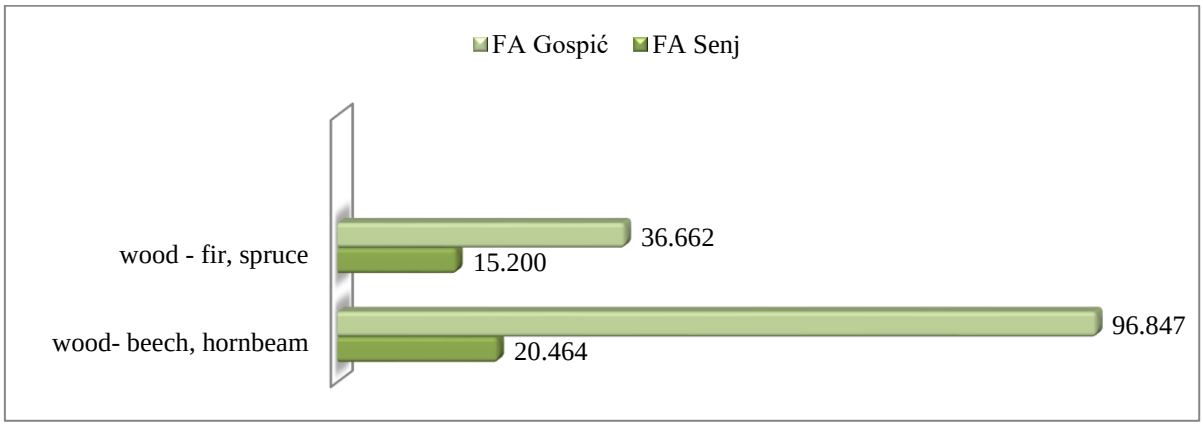

Figure 3. Spatial wood offer in 2019., Croatian Forests d.o.o. (2017.-2019.)

In 2019., 117.311 m^3 of fuel wood of beech-hornbeam mixture was approved to the customers, representing 69,34% of the approved amount of spatial wood. In the structure of approved quantities per FA, FA Gospić approved 96.847 m^3 of fuel wood of beech-hornbeam mixture, representing 72.54% of total approved quantities, while FA Senj approved 20.464 m^3 of fuel wood of beech-hornbeam mixture, representing 57,38% of total approved the amount of spatial wood.

Croatian Forests d.o.o. centralized implementation of a unified business policy for the whole of the Republic of Croatia, or for all forestry administrations, public announcements are made public at the beginning of the business year for the sale of

spatial wood for the production of electrical and thermal energy. Regulation on Auction of Certain Wood Assortments[8] (hereinafter: Regulation) the procedure for the sale of goods through auctions is prescribed for the heating timber of multi-meter (VM) and unprocessed wood. This Regulation stipulates that Croatian Forests d.o.o. determine the types and quantities of wood sorts to be published in the competition, originating from the forest they manage, in accordance with the operational annual plans. Wood-based wood sorts are sold, which are managed by the Croatian Forests d.o.o. and the forests owned by the Republic of Croatia, which are not managed by the Croatian Forests d.o.o. To overcome all legal and natural persons registered for the purpose of trade in the single market of the European Union, the European Economic Area market and those outside the European Union and the European Economic Area or their representatives. The bidding is published on the website of the Croatian Forests d.o.o. Wood sorting is sold in the following places of sale of auxiliary storage facilities, main dumpsite and end of ponds and must be marked in accordance with the valid Ordinance on the collection of trees, marking of wood assortments, coffers and forestry order.[9]

The initial price of wood sorting, in bidding procedures, is the valid price for the Croatian Forests d.o.o. increased by the cost to the point of sale and the fee for the use of forest roads and can not be supplemented or changed subsequently. The bids are delivered through the web portal with the accompanying document: https://prodaja.hrsume.hr.

Only bidders who fulfill certain conditions stipulated in the Regulation may not be liable: they have no debts owed to the Croatian Forests d.o.o. or more than 15 days old, provided the appropriate payment instruments, provided a guarantee of 10% of the shortage of wood assortments for which the offer is submitted. The statement of the responsible person is also electronically affirmed by means of criminal and material liability that the legal or natural person or the responsible person in the legal person is not penalized for violation of regulations in the field of forestry, customs regulations and regulations regulating the trade in wood products, overdue public debts.

Implementation of tenders is carried out by a Commission appointed by the Minister responsible for the economy, upon whose proposal the said Minister shall make a notification on the selection of the most favorable tenderer's basis by the respective Forestry or Subsidiary Directorate, conclude contracts with the most favorable tenderers in which it is clearly and unambiguously indicated that the right to buy and put into the market of the wood sorting group in question, acquired by the most favorable offer on the public tender in question.

Croatian Forests d.o.o. also announce Public Calls for Strategic Raw Materials Sales exclusively for the production of electrical and thermal energy in highly efficient cogeneration plants. In 2019. 265.000 t (or 265.000 m^3) of cuttings and fuel woods were

[8] Regulation on Auction of Certain Wood Assortments – Official Gazzete, No. 100/15
[9] Official Gazette, No. 17/15, 57/17

available for cogeneration. Cogeneration plants could prove to be capable of demonstrating the high efficiency of their systems (at least 60%). The points will also be allocated according to the planned number of new employees per unit of capacity for which this valuable raw material will be used and the development index of the area, while the advantage will be for the companies that have obtained the usage permit, they have a decision on the status of a preferential electricity producer of the Croatian Energy Regulatory Agency, Croatian Electricity Company certification that proves that companies have the right to permanently connect the plant to the power grid and certify that they have spent at least 75% of the planned investment costs in the construction of the plant. In the Public Call, wood chips and firewood of FA Gospić and Senj were offered in a total quantity of 86.944 t, which represents 32,62% of the total quantity offered at the national level. Of this, 78.504 t (90,29%) of planned production of FA Gospić and 7.950 t (9,71%) of production of FA Senj.

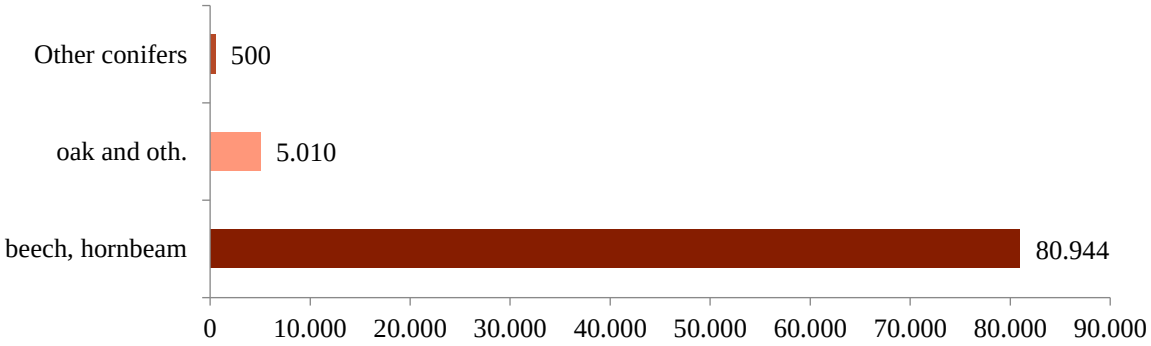

Figure 4. Structure of spatial wood offered by the Public Call for Cogeneration 2019.; FA Gospić and Senj[10]

This amount of spatial wood should also be added to about 30.000 m^3 of spatial wood sold to natural persons as firewood.
In accordance with all the mentioned in 2019., the total planned spatial wood production for all purposes FAGospić and FA Senj amounts to 285.627 t (or m^3).

In conclusion, all biomass produced for the market in the area of NP Velebit will be won by the organization of Croatian Forests d.o.o. FA Gospić and FA Senj were delivered to well known buyers.
By comparison of possibilities and contracted quantities for 2019., it follows that the FA Gospić and Senj do not cut all the annual crops estimated at 290.000 m^3.

b) Main biomass producers: FA Gospić and FA Senj

[10]Source:http://nadmetanja.hrsume.hr/javnipoziv/20190228_sjecka2019/01_Javni%20poziv%20za%20prodaju%20drvne%20sjecke%20ili%20ogrjevnog%20drva%20za%20proizvodnju%20elektricne%20i%20toplinske%20energije%20u%202019.pdf

Croatian Forests d.o.o. are a state-owned company that manages the majority of state-owned forests in the area of NP Velebit, Lika-Senj County and Croatia. In the area considered, state forests are managed by FA Gospić and FA Senj, while the sale of wood assortments is centralized at the level of Croatian Forests d.o.o.
Other legal entities manage small areas of state forests. Forests and forest land within protected areas such as national parks, nature parks, protected landscapes and forest parks are under the jurisdiction of the Ministry of Environmental Protection and Energy. Forests within national parks are managed by public parks in accordance with national park management plans. In nature parks (such as NP Velebit), which have a lower level of nature protection, state forests are managed by Croatian Forests d.o.o., through its subsidiaries but with the use of nature conservation measures refined by the park management plan and nature protection measures adopted and established for each economic unit.
Active forest owners who seek to manage their forests and regulate property and legal relations can be more easily identified by inspecting the Forestry Register of the Ministry of Agriculture.
According to the Ministry of Agriculture data (on 31.12.2014.) in the area of Lika-Senj County and Gračac Municipality is 27.216,47 ha of private forests.
On the territory of the County in the Register of Forest Owners 62 persons registered with 123 ha of forest and their biomass production for the market is negligible.
The average forester on the national level is a man, older than 60, with a completed or incomplete elementary or secondary school. It should be emphasized that the improper property and legal status of private forests is further complicated by the precise identification of the socioeconomic characteristics of the forests.

B. Demand market analysis

Despite the availability of raw materials and the tradition of wood processing and furniture production, the least developed in the Dubrovnik-Neretva, Šibenik-Knin, Zadarska and Lika-Senj counties. Lika-Senj County forests are characterized by a large percentage of degraded forests and large spatial wood production. Until the production of pellet and cogeneration plants in the County, the production of spatial wood was unprofitable.

After opening several pellet and cogeneration plants that produce heat and electricity, the demand for spatial wood has increased considerably.
Currently, most of the fuel woods in the District of Biomass District and the County are primarily used for household heating purposes.
In the area of the County there are several pellet production plants with different capacities. Although some of the businesses currently operate with certain financial

difficulties because of insufficient own capital, a change in ownership structure can be expected before leaving production.

Table 5. Pellet and briquette producers in the Lika-Senj County

Producer	Product	Installed capacity
Viševica komp d.o.o. (Perušić)	pellet	25.000 t/year
Moderator d.o.o. (Udbina)	pellet	50.000 t/year
Lika pelet d.o.o. (Gospić)	pellet	10.000 t/year*
TOTAL		85.000 t/year*

Data source: Catalogue of forest biomass producers in Croatia, REGEA
**estimation; Lika pelet d.o.o. (Gospić) was removed from court register on 09.07.2018 by court decision Tt-18 / 4123-2 and the plant is not currently in service*

Table 6. Plants which use biomass in the production of thermal and electric energy on the Lika-Senj County area

Company	Plant	Tariff system based on which the purchase agreement was concluded	Installed power kWh
Concluded Contracts in premanent plant			
LIKA ENERGO EKO d.o.o.	Biomass Cogeneration Plant	Official Gazette 33/07	1.000
WHITEFIELD ENERGY d.o.o.	Biomass Cogeneration Energy Plant in Bjelopolje	Official Gazette 133/13	1.000
HROTE (National agency) has concluded a power purchase contract and whose plants have not yet been put into operation			
VIŠEVICA ENERGO d.o.o.	Cogeneration energy plant	Official Gazette 133/13	2.000
ENERGANA GOSPIĆ 1 d.o.o.	Biomass Cogeneration Energy Plant	Official Gazette 133/13	4.960
DEPOD PROJEKTI d.o.o.	Biomass Cogeneration Energy Plant, in Brinje	Official Gazette 133/13	5.000
TOTAL:	5 plants		13.960

Data source: HROTE Annual Report, 2018.

Compared to the 2017. situation outlined in *Baseline Review / Situational Analysis of Production / Biomass Potential of Lika-Senj County - focusing on the Velebit Nature Area (IMFBE - RP 3/1 - A)* Nature Park with individual investors termination of biomass delivery contracts because they did not realize their investment plans, and they are not even listed on HROTE.

In addition to the mentioned plants, there is a biomass heating plant in Gospić owned by Croatian Forests d.o.o. which is located in the wider city center, with a power of 1.000 kWh, which supplies more public buildings in the 200 m radius (Croatian Forests - Development Office, Cultural Information Center, Elementary School building in Gospić). Also, in Gospić is used biomass (pellet) for heating the Retirement Home and used with two pellets firns of 250 kWh power, each (supply of thermal energy is done by Craft ASIĆ from Gospić, which for this purpose procures pellets of pellet factories from Lika- Senj County).
Overall, it is estimated that the demand for spatial wood after installing all the plants with a total installed power of 14.960 kWh will be approximately 193.300 tons.
The volume of biomass expressed in cubic meters will depend on the average density of humid wood ranging from 0,75 to 0,9 t/m^3 and ranges from about 63.750 to 76.500 m^3.
To this need for biomass also must to be added the annual heating needs of the citizens of Lika-Senj County, where 16% of housing is located in multi-storey buildings, while other family houses are not expected to change in the way of living in the near future. It is also expected that the number of inhabitants in residential buildings will decrease from 2,96 (Census 2011.) to 2,88 inhabitant per object. The average surface area of residential buildings was 88 m^2. Housing facilities that used central heating had an average floor area of 115 m2 and their expected further increase (on average) to 120 m^2 by 2020. The ratio of heated to total area averages 68% and is expected to increase to 85%, due to the increase in standards and the increase in households with centrally heated facilities. Households are expected to continue using fuel wood as the main energy source and its consumption is estimated at 1,525.3 TJ or 189,043 t of heating wood in 2016.
With the estimation that 80% of households (15,694) are used for heating heating wood, it results that approximately one household consumes 12 m^3 of fuel wood annually.
Also firewood is used by entrepreneurs who also procure from the Croatian Forests d.o.o. FA Gospić and FA Senj.

Table 7. Wood purchasers in Lika-Senj County, m3 in 2016

Purpose	Persons/No	Companies/No
Firewood	29.612	187.292
Processing	262	220.321
Total	29.874	352.771

Data source: Croatian Forests, FA Gospić, March 2017.

Table 8. Estimation of biomass offer and demand on the Lika-Senj County area after building all cogeneration plants in m^3 till 2023.

Estimate production of cordwoods (without additional opening roads and demining) – FA Gospić i Senj	350.000
Estimate of industrial waste	25.000
Cordwoods production on private-owned forests	5.000
Total offers	**380.000**
Cogeneration demands	195.000
Pellets factories demands	70.000
Small and medium entrepreneurs demands for cordwood for firewood	187.000
Citizens demands	30.000
Total Market	**480.000**
Difference	**-100.000**

Source: Baseline review/Situational analysis of production / biomass potential of Lika-Senj County - focusing on the Nature park "Velebit" protected area (IMFBE – RP 3/1 – A)

This estimate is made in a conservative manner, assuming that all projects in the Lika-Senj County will be completed and put into operation by 2023. Also, it is assumed that pellet production will not be increased nor will the production of firewood grow, although there is a possibility of export (Italy) and sales to other regions (Zadar and Šibenik-Knin County).

It is evident that there is a danger that the supply will not meet demand if the state forest productivity is not increased as the largest biomass supplier. It is necessary to improve the management of private forests, to regulate the management of industrial residues. It is also necessary to promote the breeding of short-term crops.

However, without any further increase in the recovery of biomass in state-owned forests and potentials (use of modern mechanization, increase forest openness, where possible other breeding methods), it will not be possible to meet the growing demand for biomass.

Figure 5. Administrative building of FA Gospić, Croatian Forests d.o.o., with chimney of biomass heating (wood chips) (*Source: FA Gospić*)

In the next 3 years it is expected to complete the energy renewal projects of a series of public buildings within which the existing energy (fuel oil) was replaced by the use of biomass as an energy source for heat energy. According to the mentioned holders of all energy projects are the Lika-Senj County and some local self-government units.

Table 9. Potential biomass users for heating

Projects are under preparation	Approved projects by MA	Project in implementaton
Gymnasium and vocational schools in Gospić	Perušić Elementary School Building	Public Health Building in Gospić
Public Health Building in Korenica	Plitvička jezera, Elementary School Building in Smoljanac	
Public Health Building in Otočac	Elderly Home building in Udbina	
Elementary School Building in Lički Osik		

Elementary School Building in Korenica		

Source: LIRA – Lika – Senj County Development Agency, 2019

C. Other issues

As previously addressed in project deliveries under project activity 3.4. and 3.7, the most significant limitations in the production of biomass in the area of the Biomass District, as well as the entire NP Velebit as well as the Lika-Senj County counties are:

- mine suspected areas (MSA) of forests and forest land
- insufficient openness of economic forests
- a mode of production that limits the use of modern forest mechanization.

These restrictions relate to state-owned commercial forests (managed by Croatian Forests) as well as to private-owned forests.

For private forests, a large limit is represented by unresolved property rights relations, fragmentation of land and lack of active forestry associations

The construction of cogeneration and the pellet plant increased interest in the use of biomass as raw materials in the production of electrical and thermal energy and pellet production. Demand for biomass is steadily increasing. This led to the fact that already (March 2018), although most of the planned power generation plants were not built and put into operation, the market felt a lack of raw material. This disadvantage is most felt by locals and small companies involved in the production of firewood. This extreme shortage has also been caused by the ever-increasing export of pellets and fuel woods, which in 2018. endangered the local market supply (data obtained by interviews with consumers and SMEs in the County). In the local market, there is a lack of pellets and a lack of fuel wood. For small companies that produce firewood for the local market, the main supplier of raw materials (Croatian Forests) does not deliver pre-contracted annual quantities causing earthquakes in their regular business (lower revenues, reduced liquidity, layoffs and reduced capacity for investments in modernization of production). The lack of biomass in the market, consequently, leads to a rise in the price of biomass and the price of fuel wood and pellets. There is also an increase in uncontrolled harvesting of forests in private forests, but also in the part of state forests. The lack of biomass, if continued, will endanger the operations of existing cogeneration and pellet factories.

Reference and data sources are listed in the text and at the end of the text.

1.2.2. Step 2: End users' identification

1. **General goal: To increase the use of biomass inside the area (biomass district).**

The overall goal of the project was to increase the use of biomass a specific goal to identify the potential users of biomass gained in the area of NP Velebit.

From the Basic Analysis it is clear that the use of biomass in the whole field of interest is in full swing; so that by the completion of all planned cogeneration capacities it will be necessary to accelerate the production of biomass in all economic forests in order to use the installed capacities at a profitable level.

In addition to cogeneration, biomass is used by pellet factories and small entrepreneurs (in the area considered, but also in other areas of the Republic of Croatia - in accordance with the contracts concluded with Croatian Forests d.o.o.) and the local population.

The local population traditionally uses firewood and, to a lesser extent, pellets for heating of residential buildings. Wood is purchased from local producers or forest owners, and the pellets are mostly purchased from local factories. The increase in the price of pellets per tonne and the inability to continuously supply pellets during the winter months (most of the production was intended for export) had a negative impact on the further increase in the number of consumers.

2. **Specific goals: End users identification for wood biomass use**

Given the number of cogeneration that is being built, it is necessary to determine the way in which they plan to use the received heat energy (the part will use the gained heat energy in their own cogeneration pellets in Perušić and Udbina, and some plan to use thermal energy for agricultural production in greenhouses and for heating public buildings.)

In the area considered, the most populous NP Velebit are the small towns of Gospić, Otočac, where in a relatively small area there are a number of larger buildings that can potentially use biomass for their heating.

- Objects can be identified by using data from Real estates Registers which are required to be created by the Lika-Senj County and local self-government units. Part of the public buildings is owned by state law bodies and it is necessary to interview the same when making this list. Lists of all facilities included in the Assessment of Fire and Technological Explosions can also be used for this purpose, which are also being adopted and updated at the level of local self-government units and also in privately owned facilities (most often shopping malls, hotels and larger restaurant).
- Possibility to build a heating system for individual settlements for the use of thermal energy of cogeneration and / or pellets / chips. It is necessary, in cooperation with the local administration, to determine the spatial planning options or the need to modify them. (For the settlements of Otočac and Gospić,

it is planned to carry out gasification through the selection of concessionaires for the construction and distribution of gas. This is an alternative energy for which technical preparations have been made and it is necessary to consider whether there is still interest in plinification because in that case the largest population and the largest number of facilities there is no need to use biomass (or will be substantially reduced).

- The local population is identified as the end user primarily of the fuel wood and the smallest part of the pellet, and it is estimated that these two forms of biomass will in the future be the primary energy source for heat energy and heating of residential buildings. Therefore, it is most important in cooperation with the largest producer of Croatian forests d.o.o. to determine the needs of the population of fuel wood and to provide sufficient quantities of raw materials, regardless of the emergence of new biomass consumers (cogeneration, pellet factories).
- Private forests, due to increasing demand for biomass, have become the target of uncontrolled illegal dumping, often by people who are not their own owners. Striking are forests whose owners are people of high age and who are not able to manage them efficiently. It is therefore necessary to support the organization of private forests, to find an efficient way of monitoring them and to prevent uncontrolled and illegal cutting (theft).

The biomass obtained from the plant (agricultiral) residue (especially the orchards) is negligible, but it is necessary to present the possibilities of its use in order to burn as much as possible the herbal remedy.

1.2.3. Step 3: Networking of interested stakeholders and providing support for establishment of cooperatives

As previously established, the most important resource for acquiring biomass are state-owned commercial forests managed by Croatian Forests d.o.o. through FA Gospić and FA Senj, which, in a centralized manner, contracts with the customers of the biomass quantity, while the cogeneration and pellet factories have priority.

On the other hand, the most important final beneficiaries are owners, primarily public utilities (state public bodies, local and regional self-government units) or, in the case of organizing the use of ballistic energy in settlements, they are local self-government units.

In the Lika-Senj County, there were more attempts to organize cooperatives that, due to the lack of understanding, but also the lack of interest of individuals and the poor legal solutions in the Cooperative Law[11], failed.

Therefore, in order to optimize the use of biomass produced in the protected area in the local community, it is suggested, in cooperation with Croatian Forests d.o.o. and LAU and investors in biomass production and utilization plants (pellet and cogeneration plants), establishes an optimal model for supplying the energy chain. Inclusion of JLS provides insight into all the options available in spatial planning documentation, and through the Local Committees it is possible to better detect the interest of each community (as a rule, each settlement has its own local council of 5 members elected for a period of 4 years on election for members of local committees).

In this way, all the most important stakeholders will be represented that have an impact on the energy chain planning process. Careful planning of various activities aimed at strengthening capacity in the local community is desirable.

The specificity of the biomass production in the protected area is that the producer of the Croatian Forest d.o.o. has sufficient knowledge, technical and human capacity to carry out all forestry work and wood harvesting works, while respecting all restrictions imposed by nature conservation measures for each individual economic unit. This is also their legal obligation. It also has a wealth of knowledge about the use of biomass at the local level. The disadvantage is that this company makes all business decisions highly centralized and the powers of the managers of FA Gospić and FA Senj are limited.

Private forest owners, on the other hand, do not possess any of the above mentioned.

Members of the local administration are prepared to cooperate with the administration park, Croatian Forests d.o.o. and act in the interests of citizens.

From all the above, it is clear that conditions have been created for biomass to be utilized as a renewable source of energy, but so far there has been no organized approach to its use at the local level. So, after the initial state campaign (2007.-2008.), a part of the population was self-initially incorporated into pellet heating systems in households, while a part of the pilot heat pump was built in Gospić. Due to the long economic crisis, further local-level initiatives have stopped. By entering the European Union and opening up new sources of funding, local and regional administrations carry out several projects (at different stages) of increasing energy efficiency in the building and use of biomass for heating public buildings.

Due to the high demand for biomass **in the next period, the most important goal will be to provide sufficient amount of biomass**, above all fuel wood and pellets for the local population, and to ensure optimum use of thermal energy produced by cogeneration,

[11] Official Gazette No. 34/11, 125/13, 74/16, 114/18

which is at the same time the most important and the first specific objective of the project itself.

Another important goal will be to increase productivity in private forests.

The third important goal will be to raise awareness of the importance of biodiversity of NP Velebit and to prevent illegal cutting in the protected area.

Table 10. Inclusion of stakeholders and target groups and first steps towards achieving specific goals.

Goal	Target group	Main 3 steps
Ensuring sufficient quantities of biomass for its local use and optimal use of the cogeneration thermal energy produced	Administration of the Park, Households, Local Administration Entrepreneurs, Croatian Forests d.o.o., Private forets owners	Presenting the idea to members of the target groups Organizing Working Groups Organizing Local Procurement Chains
Increase the productivity of private forests	Administration of the Park, LAUs, Private forets owners, employees of Advisory Service of the Ministry of Agriculture	Presenting the idea to members of the target groups Preparation of the appropriate long-term program Provision of funds for program implementation
Increase awareness of the importance of biodiversity in the protected area, preventing illegal cutting	Administration of the Park, inhabitants, NGOs for environmental protection and local administratin in LAUs,	Presenting the idea to members of the target groups Preparation of the appropriate long-term program Provision of funds for program implementation

1.2.4. Step 4: Analysis of the potentials for biomass supply

In the protected area, as well as in the whole of Croatia, the largest supplier of biomass are the state-owned Croatian Forests d.o.o.., which manages all state forests and is responsible for the implementation of all breeding activities, implementation of 10-year management plans in economic units and implementation of all prescribed nature protection measure.

As established so far, state-owned commercial forests are the most important resource for acquiring biomass, and the greatest potential for development is to improve the productivity of private forests.

Other sources of biomass do not have great significance. There is no tree plantation of short-lived woodcuts, and the whole wider area is not suitable for raising them

(restrictions stemming from nature conservation conditions in protected areas and Natura 2000). Quantities acquired in the wood processing industry are used by plants themselves and / or known buyers.

In this area, exceptionally weak populations, wood previously used is not a significant source of biomass.

A detailed insight into the current biomass production in the entire Lika-Senj County (the area where the state forests are managed by Croatian Forests d.o.o., through its FA Gospić and Senj) is given in Basic Analysis (project delivery 3.2) and a detailed insight into the production of biomass in economic units The biomass district that is, in whole or in part, located in the area of NP Velebit is given as part of project delivery for WP 3.7.

Figures 6.-9. Source: Technology of stump forest production, Brinje, 2011.

The market analysis was made for the Lika-Senj County and the data were updated in relation to the time when the ForBioEnergy project started. This is done because in the protected area there is a relatively small number of inhabitants, mainly older living ages, and the whole area is characterized by low economic activity. On the other side of the Croatian Forests d.o.o. manage centralized economic forests throughout the Republic of Croatia. In the County area, they also implement a unified business policy, while 10-

year management plans are followed by forestry works, while respecting prescribed nature protection measures that are prescribed for each economic unit separately.
Potential for the growth of biomass production in the protected area as well as in the County area exists, and it is primarily due to the opening of insufficiently open economic units or the construction of new forest roads.
It is also necessary that the Croatian Forests d.o.o. modernize the forest mechanization they have and consider the possibility of applying newer management methods to make more efficient use of modern forest machinery.
Additional potential for growth of production is demining of all mine suspected areas in forests.
In order to improve and increase production, a feasibility study is proposed that will give an answer on the steps and in what order would be optimal in order to increase biomass production and meet growing demand.
Potential for the growth of biomass production in private forests also has access to this requires greater engagement of various expert services and foresters themselves. It is proposed to develop a program for improvement of private forests management in the area of NP Velebit and / or for the Lika-Senj County. This program would require the reorganization of the forestry association, the procurement of equipment, the use of the funds of the Rural Development Program 2014-2020, the establishment of facilities for the construction of logistic centers and the possibility of raising the tree plantations of short-term patrols (respecting the protected areas, Nature 2000 and other positive legal regulations).

1.2.5. Step 5: Economical evaluation of a planned production chain

The economics of obtaining biomass in the area of state-owned forestry forests is part of the business of the Croatian Forests d.o.o. and as such is not available.
The productivity of private forests at a very low level. In order to consider increasing the productivity of private forests, it is necessary to create the basic preconditions, which should be an integral part of the future private forest management improvement program, namely: identification of plots, settlement of property and legal relations, creation of forest owners' association (due to very well-built plots there is no economic justification for some foresters to invest in forest mechanization and / or to carry out significant forestry breeding work).
As already mentioned, the economics of obtaining biomass in state forests are part of the business of the Croatian Forests d.o.o. and as such it is not available extrinsically.
Sale of purchased biomass from state-owned forests is centralized on the basis of published public tenders in the public procurement system, and a special public call provides the quantities needed for cogeneration work.

1.2.5.1. Biomass production technologies

For the level of biomass recovery organization and associated costs from state-owned forests in the area considered, it can be said that it depends significantly on whether it is lowland, mountainous or mountainous forests. Further on the organization and the level of costs are influenced by a number of factors such as stand quality, forest openness, climatic conditions, ground slope, nature conservation measures.

The costs of obtaining biomass in economic units that are wholly or partly located in a protected area are higher than the costs of obtaining biomass in mountainous and lowland forests.

Until the construction of processing plants (pellet mills, cogeneration plants) in the Lika-Senj County (but also the Republic of Croatia), a significantly smaller size was cut as spatial wood production was higher than demand and the cost of gaining significantly higher than the selling price.

Today, the situation on the spatial wood market has changed significantly and if the production of biomass in the County area does not increase the existing constructed processing capacities and those in construction will not be able to produce the planned capacity.

Due to increasing demand for wood as an energy source, it is necessary to increase the productivity and efficiency of wood harvesting and pre-industrial wood processing, while simultaneously protecting and preserving forest ecosystems, introducing new technologies and technologies, and applying and developing innovations. Private contractors in wood procurement and small and medium-sized enterprises by introducing new techniques and technologies and applying and developing innovations. Private contractors in wood harvesting and small and medium-sized pre-industrial wood processing, due to the high cost of machinery, tools and equipment, often use weakly effective, environmentally harmful and human health and environment harmful machines, tools and processes causing occasional over-damage to forestry ecosystems, contractor health, reduced competitiveness and a significant decline in employment. In the area under the management of FA Gospić no entrepreneur dealing with cutting and pulling has a new forest articulated tractor. FA Gospić has acquired several such tractors, which is insufficient in terms of needs.

Given that forests in the Republic of Croatia manage on the principles of sustainable management, all efforts in the forests of forests include the continuous renewal and maintenance of forest communities with the aim of long-term continuous exploitation. In the various forest communities, medium-term impact on natural vegetation, plant composition, reduction and damage to natural regeneration have tree shredding operations and preparation for transport (the plant community structure or its function will be recovered in the period measured in years). Shredding operations and preparation for transport also have medium-term impact on nature.

There are three management models in the area of Biomass District (Regular economic forests, Selection forests varied, Size structured forests). The main model for carrying out wood harvesting operations is the use of workforce (woodcock) pulling (by traction on the ground) of felled trees to the handicraft dumps where the gained wood mass is further transported by forestry trucks. In this mode of exploitation in the woods remains about 15% of the wood stock hewn, the bulbs with a volume greater than 7 cm, because it is economically unjustified to extract this wood stock from the forest.
In selected forest management is lot of using labour force (loggers). Also skidders and forest trucks are used.
Operations in regular economic forests needs less manwork, but in the same time workers have to be educated for using modern forest mechanisation – forwaredrs, harvesters and cable ways.
At the moment FA Gospić has only one harvester and forwarder and in case of increasing the areas of forest with stand management will be necessar to invest in education of workers and in acquisition of modern forest mechanisation. Private forests owners do not have any type of modern forest mechanization.

Therefore, possibly reviewing economic bases and a new model of management in some economic units would require additional investment in training the appropriate workforce and the acquisition of modern forest mechanization.
In Croatian forestry, cutting and making is carried out by manual machine work. The chainsaw crushes the trees, raises branches, and makes logs and spatial wood, and then the biomass gained from the forest is pulled out of forest global tractors (skidding).
In the process of gaining wood in a protected area of the forestry division (part of the economic unit), the loggers cut trees marked for felling according to management plans and other internal procedures of the Croatian Forests d.o.o.. Afterwards, a forest articulated tractor enters them at the site and draws, where the raw material is taken over by a forklift with a crane, which further carries the goods to the buyers according to the order of the competent FA.
The wood harvesting process is organized by the FA with its own mechanization and humanity or by using the services of small entrepreneurs in forestry. In case the contracted sale of the raw material is "at stake" then the wood harvesting organization takes over the woodsman (spatial wood).
Throughout this process, Croatian Forests d.o.o., FA Gospić through its monitoring bodies to monitor whether the cutting was done according to the plan, the quality of cutting, the way of harvesting and the removal of the raw material.
Customers usually take over the warehouse with their own forest trucks (or truckers engaged in transport) and transport goods (biomass) to further processing in their idyllic yards where processing facilities, raw material and ready-made warehouses are located.

This chain is characteristic for all processing capacities (from the producer of fuel wood to cogeneration).

Machine cutting and wood harvesting can replace heavy human and life-threatening manual machine-tool work with a saw, and also boost productivity, reduce costs, and reduce the need for heavy physical work. Combined harvesting and harvesting work is a rounded whole. In comparison to manual cutting and tree making, and the attracting of wood by using articulated tractors by the ground, the harvest harvester and forvarder is more environmentally friendly production technology. The main drawback of a single harvester is its complexity due to which drivers must be superbly trained. The training of the driver is expensive and can take up to two years, while the driver does not entirely master the handling of the machine. It should also be taken into account that there is already a lack of workforce (loggers) who, due to higher wages, goes to work in other EU countries and is already difficult to execute all planned works in the forest due to lack of labor force.

The organization of the acquisition of biomass in private forests begins with an appropriate harvest approval, and then, foresters themselves organize harvesting and transport. Given that manual and obsolete mechanization (chainsaw, agricultural tractors, trailers, vans) is used, this job is extremely dangerous. Increasingly, the elderly population engages local entrepreneurs in woodwork. It is very often the case that the received dosage is used to cover the forests and later to traffic on public roads, and that the scrap that is happening significantly exceeds the 8th dose of knowledge or without the forests). It has also been noted that in some settlements where most of the old people's population is systematically coming to illegal felling without the knowledge of forest owners. Such a pledged spatial tree is still the most commonly marketed in the local market, and it is not uncommon for some plants to take up the biomass so much without too much questions.

These procedures represent the most serious injury and potentially most dangerous for different habitats in the protected area because the harvest takes place under the principles of "clean cutting", endangering flora and fauna, watercourses, destroying private and state property.

1.2.5.1.1. Forest production value chain

In the area considered, biomass is widely recognized in state-owned forests and is used for the production of firewood, chips and pellets. Croatian Forests have a unique chain of forest biomass production, which, on the basis of a public call, is centralized, supplying all customers.

Pridobivanje drveta u navedenim šumama započinje pripremom radilišta – planiranjem izvoznih trasa (vlaka) te se određuju mjesta uz šumsku cestu na koje će se traktorima izvlačiti posječeni i izrađeni sortimenti. odabire senajpovoljnijametoda izrade drvnih

sortimena. To ovisio velikom broju faktora: stanju šumskerasporedu vlaka, duljini vuče i privlačenja, tehničkim karakteristikama i mogućnostima traktora, znanju i umjeću samog izvođača radova,aliiokasnijoj namjeniivrsti izrađenih drvnih sortimenata. Krojenje oborenih stabala vrši se u šumi, a na stovarište se izvlače gotovi sortimenti (izrađeni trupci i višemetrica ili metrica). Nakon obaranja stabala (u najvećem broju slučajeva obaranje se vrši motornim pilama), posječenim stablima okrešu se grane i nakon toga se izvlači cijelo deblo. Ovom metodom postižu se uštede kod izvlačenja jerse vuku duži drvni sortimenti pa vrijeme izvlačenja kraće traje. Prije sječe stabala određivanje ispravnog smjera obaranja stabla može znatno smanjiti količinu poslova kod uspostave šumskog reda. Kod planiranja i odabiranjavlaka osim uvjeta okolne sastojine i duljine privlačenja vrlo bitan faktor je stanje tla. Najidealnije vrijeme za vuču sortimenata je dok je tlo suho,ilizimi-akojesmrznuto.Tada su štete na tlu minimalne,a sam postupak izvlačenja olakšan.

Harvesting of wood in these forests begins with the preparation of the site - by planning the export routes and determining the places along the forest road to which the harvested and made assembled tractors will be drawn. selects the most appropriate method for making wood sorts. This was due to a large number of factors: the state of the forest-to-rute ratio, the length of traction and attractiveness, the technical characteristics and the possibilities of the tractor, the knowledge and expertise of the contractor himself, but the more intensive use of wood sorts. The felling of the fallen trees is done in the woods, and finished collections are made on the dumpyard (trunks and multimetric or metric). After deforestation of trees (in most cases the deforestation is carried out by chainsaw), the branches are cut and the whole trunk is pulled out. This method achieves savings when pulling the jerseys, pulling longer wood sorting and drawing time shorter. Before harvesting trees, determining the correct tree deflection direction can significantly reduce the amount of work involved in establishing a forest tree. When designing and selecting the patch except the conditions of the surrounding stands and the length of the attraction, a very important factor is the state of the soil. The most ideal time to for sorting is when the soil is dry or frozen. Then the damage to the ground is minimal, and the drawing procedure itself is easy.

On wood storage, woodcutted woodcuts along the forest road should be properly grooved to prevent traffic on the forest roads. By pulling the wood sorting on the stalls, they are loaded on forest trucks and exported from the forest to known buyers who have their own raw material storage.

1.2.5.2. Wood fuel producers

There are more biomass fuel producers, such as chips, pellets and fuel woods, in the area under observation.

Table 11. Wood chips, pellets and fuel wood producers in Lika-Senj County.

Producer	Type of fuel	Remark
Hrvatske šume d.o.o. (Croatian Forests d.o.o.)	Wood chips	For the needs of its own facility in Gospić
Viševica comp d.o.o.	Pellet	
Moderator d.o.o.	Pellet	
LIKA ENERGO EKO d.o.o.	Wood chips	For their cogeneration needs
WHITEFIELD ENERGY d.o.o.	Wood chips	For their cogeneration needs
15 crafts for fuel wood production		

Izvor: Hrvatske šume d.o.o., Hrvatska gospodarska komora, HERA, Hrvatska obrtnička komora

1.2.5.2.1. Units of measurements

Two metric units of m^3 and kg are used in the biomass fuel market. The spatial meter is used as a spatial and firewood unit of measurement, while the kg is used as the unit for the chip and pellet unit.

1.2.5.2.2. Quality of wood fuels

What is the system of plant for the production of heat energy is less important than the quality of the fuel used. The best wood chopper for small plant needs can be from fragmented small tree trees. Where the lower quality wood pieces can be burned, chunks are made of untreated small trees - using a high share of the entire tree. The key parameters are:

- Moisture content
- Wood chip dimensions
- Wood ship origin
- Contents of ash

Table 12. Basic requirements for the quality of fuels obtained from biomass

Type	The basic requirements of the ISO standard	Relevant standard
loggs	Class A1: Determined by diameter and length, humidity below 25%, no visible decay, more than 90% of particles split	HRN EN ISO 17225-1:2014
wood chips	Class A 1: Chips of P16S or P32S size, humidity below 35%, ash content less than 1,5%, small pieces less than 15%	HRN EN ISO 17225-1:2014
pellets	Class A1: humidity below 10%, ash content below 0.7%, mechanical endurance of more than 97.5%, density greater than 600 kg / m^3	HRN EN ISO 17225-1:2014

The pellet characteristics are listed on the product declaration (most of the products are packed in bags of 30 kg). Cogeneration and heat pump products are produced for own use, and small firewood producers producing for the local market have no prominent quality declarations (nor are they required by the market).

1.2.5.3. Wood fuel prices

In the considered fuel market produced from biomass, fuel wood (the most important household energy) and pellet appears in the offer.
The increase in demand for spatial timber along with the increase in production costs (fuel, transport, labor prices) also saw the rise in price of wood and pellets.

Table 13. Firewood and pellet prices on the local market, heating seasone 2018./2019.

Energy source	Unit of measure	Retail price/HRK/EUR[12]
Firewood	m^3	250-280 HRK/33,78-37,83 EUR
Pellet	in tons	1.600 HRK/216,22 EUR

Source: Market research by author, 2019.

However, the biggest problem is the shortage of pellets in the heating season, which is very long for 6 to 6.5 months. This shortage is due to the large pellet exports.

[12] Exchange rate; 1 EUR=7,4 HRK

So in the heating season 2017/2018. the pellet shortage was pronounced and the pellets could not be obtained directly from the manufacturers or retailers (large shoping centers) almost all over Croatia. The failure occurred in February-March 2018. This forces local consumers to acquire larger quantities of pellets at the beginning of the heating season and creates problems with their storage, and has a negative impact on the further use of pellets as sources of heat energy in households. As mentioned above, the number of public buildings that exceeds the use of biomass is increased. It is to be expected that all public consumers will have fewer problems with continued pellet supply because they can enter into a public procurement framework framework (4 years) for the procurement of pellets.

In the fuel wood market there are disturbances related to the supply of illegally sold firewood and/or sales by unregistered producers (sales on the "black" market), which makes the condition of registered small-scale firewood producers difficult.

1.2.5.4. Storage of wood biomass

In the existing established chain of procurement of biomass (spatial wood) where is the largest supplier of Croatian Forests d.o.o. Biomass is landfilled on temporary cemeteries, picked up by forest trucks to reach the end-shop of the end-customers, located within their industrial yard.

In this way, the burden of storing biomass gained from state forestry economies (the costs and quality of delivered wood assortments) is borne by the end-customer.

Storage of recovered biomass from private forests, which is used mainly in yards in rural and suburban settlements, where well-pruned logs and / or meters are matched and dried and are continuously sold in the period June-September. Since buyers do not require quality control and sales are not being made through wholesalers, it has not yet been necessary to build a covered warehouse. Also the fragmentation and dispersion of private parcels on which forests have been so far lacked economic justification for investing in providing optimal conditions for storage of biomass.

If approaches to the development of private forest management improvement program in the area concerned, consideration will need to be given to the need to improve storage conditions. This includes assessing needs, defining optimal locations, areas, sources of funding, defining ownership relationships, and the need to align spatial planning documentation at the level of local self-government units (LAU).

1.2.5.5. Investments costs

Investment costs are one of the key factors when deciding on switching to fossil fuels on renewable energy sources, in this case biomass fuels.

The use of firewood in the protected area as well as in the Lika-Senj County (as the observed supply and demand market) is the most common energy source in households and it is estimated that it will remain in the next period of 10 years. Households using fuel wood are the most old households, family farms and households with lower annual income while pellets are predominantly used by larger households with larger annual revenues (estimated over 27.000 Eur in annual income). The greater use of pellets has recently limited the price of pellets, but the even more unsuccessful pellet offer in the heating season (autumn-spring), which is extremely long and lasts more than 6 months a year.

Construction Law[13] stipulates that designers are obliged to draw up an alternative energy supply system (decentralized energy supply system based on RE[14], cogeneration, district heating or cooling system if it is based partly or entirely on RE, cranes, etc.) prior to the construction of a main building project that has to meet energy efficiency requirements heat). These elaborates are being developed for new buildings and renewable buildings, and include technical, ecological and economic feasibility of available alternative systems. In Croatia, effective from 01.01.2015, it is obliged to draw up an elaboration of alternative systems prior to the design of the main project. Elaboration is not required if an alternative energy supply system is installed in the building.

In order to simplify and harmonize the elaboration of the report, the **Technical Regulation on Rational Use of Energy and Thermal Protection in Buildings**[15] (hereinafter: Technical regulation) than the Ministry of Construction and Physical Planing (hereinafter: Ministry of Construction) publish **Catalogue of technical solutions for the application of alternative building systems from 50 to 1,000 m²** (hereinafter: Catalogue)[16] for 8 buidling types (family houses, multi-storey buildings, office buildings, educational institution buildings, hotels and restaurants, wholesale and retail buildings, hospitals, sports halls) with a surface of useful surfaces of the building *Ak* = 50 - 3000 m^2, for continental and coastal Croatia. In the catalog of the given tables and diagrams, the designer can quickly and easily determine the delivered and primary energy of each

[13] Official Gazette No. 150/13, 20/17, 39/19
[14] RE - Renewable energy sources
[15] Official Gazette No 128/15, 70/18; http://thoriumaplus.com/procisceni-tekst-tehnicki-propis-o-racionalnoj-uporabi-energije-i-toplinskoj-zastiti-u-zgradama-nn-128-15-i-70-18/
[16] Source: https://mgipu.gov.hr/pristup-informacijama/zakoni-i-ostali-propisi/podrucje-energetske-ucinkovitosti/3569

of the analyzed alternative systems for the arbitrary *Ak* and determine the costs of investment, energy and maintenance, or the selection of a cost-optimal project solution.

a) Record the current state
   The current specification describes the existing energy systems for heating, cooling, ventilation, air conditioning, hot water supply (DHW) and lighting and appropriate energy sources. Also, according to the collected data from the electricity and gas distributors, the average electricity and gas consumption is shown on an annual basis.
b) An assessment is made of the possibilities of using different forms of renewable energy sources and their applicability at a particular location. The features of solutions, ie energy systems, are taken from the official study of the Catalog of the Ministry of Construction. The Catalog contains detailed schemes and guidelines for calculating the cost of investing or converting existing biomass plants to be applied.

The method of calculating the energy flows in the thermotechnical system is based on the determination of thermal losses and energy for the operation of auxiliary devices in the subsystems to which the thermotechnical system is divided::

- subsystem of delivering heat energy to space (heating bodies)
- a subsystem of distribution of heating medium and hot water supply
- a subsystem of thermal energy production, including tank and primary conduit pipes to the heat generator.

In this way, the input / output sizes are determined in the sub-systems of the thermoelectric heating system and the preparation of hot water.
The required heat energy in the observed time period (hour, month, season) for heating is calculated according to:
QH,nd QTr QVe K H,gn ~ QH,gn [kWh]
QTr - transmission heat losses (kWh);
QVe - ventilation heat losses (kWh);
QH, gn - heat gains from people, appliances, lighting and solar radiation (kWh);
KH, gn - degree of utilization of thermal gains (-), according to HRN EN 13790.

Investment in an alternative system is calculated in relation to conventional heating systems using the expression:
Iproj + alt - total investment cost covering all parts of the originally designed system and the alternative system (HRK);
Iproj,em – Cost, the cost of investing in the subsystem surrenders the originally designed system (HRK);
Iproj,dis - Innovative, disinfectable investment in the divorce subsystem of the originally designed system (HRK);

Iproj,gen - cost of investment of all parts of the substructure of production of the originally designed system not covered in *Ialt* (HRK);
Ialt - cost of investment in alternative system (HRK).

Based on the calculation (guideline in the Catalog) it is possible to compare several conceptual solutions that include different alternative systems and choose the most cost-effective and energy-efficient solution (attached to the building permit application).

Using the data on delivered and primary energy to the originally designed system (required to check the compliance of minimum requirements with Technical regulation) and the above mentioned data for a project solution with an alternative system, it is possible to determine the period of investment return to a particular alternative system compared to the original design solution according to the expression
P = *Ialt* / *U* [a]
Ialt= *Iproj+ alt -Iproj* [HRK]
U = *Ten,proj* - *Ten,proj+alt* [HRK/a]
P – a simple return period of investment into an alternative system (a);
U - annual energy savings when using an alternative system compared to the originally designed system (HRK/a);
Ialt - cost of investment in alternative system (HRK).
Iproj - above
Iproj+ alt - above
Ten,proj – annual energy cost when using the initially designed system (HRK/a);
Ten,proj+ alt – the total annual energy cost when using an alternative system (HRK/a).

Costs of annual energy consumption are determined according to the expression:
Ten=Edel,HW.Tg,i+Edel,aux.Tel [HRK/a], where: *Tg,i* – price of *i*-of that energy source (HRK/kWh), electricity price (HRK/kWh),
Energy costs over a period of *n* years can be determined according to annual energy consumption data using the term:
Ten(ng.)=*Ten*+*Ten*. (1+*p*/100) +*Ten*. (1+*p*/100)2+……*Ten*. (1 +*p*/100)n [HRK] with
r=1+*p*/100[HRK/a]
Ten(ng.)=*Ten*. (1+*r*+*r*2+*r*3….*r*n) [HRK] where are
Ten(ng.) – total cost of energy through *n* years (HRK);
Ten – cost of energy in one year (HRK);
p – annual rate of fuel price increase (%).

Example: Family Houses - Continental Croatia (Source: Catalog)
Thermotechnical System Data: Pellet boiler

Ak		Boiler	Tank (PTV)	
m^2	Type	QN, kW	l	Placement

50	on pellet	10	80	heating room
100	on pellet	12	130	heating room
200	on pellet	20	300	heating room
500	on pellet			heating room
1.000	on pellet			heating room

heating bodies: radiators
accommodation: exterior walls
regulation: via reference room + thermostatic valves (1K)
Heating division subsystem
temperature: 70/55 ° C
accommodation: heated space, interior walls
regulation: external temperature, variable temperature of the heating medium
insulation: = 0.2-0.3W / mK
pump: unregulated

PTV Distribution Subsystem (hot water supply)
temperature: 60 ° C, circulatory loop
accommodation: heated space, in the interior walls
insulation: = 0.2-0.3 W / mK
Investment in the Ialt alternative system includes a boiler, a pellet set (tank, conveyor pellet, burner), the associated regulation and installation work.

Ak	QH,nd	QW	Edel,HW	Edel,aux	Edel	Eprim	edel	eprim	CO2
m^2	kWh/m^2a	kWh/m^2a	kWh/m^2a	kWh/m^2a	kWh/m^2a	kWh/m^2a	-	-	kg/m^2a
50	69,7	12,5	128,2	5,5	133,7	19,0	1,63	0,23	3,41
100	69,7	12,5	119,7	3,3	122,9	13,5	1,49	0,16	2,21
200	69,7	12,5	115,5	2,2	117,8	10,9	1,43	0,13	1,65
500	69,7	12,5	111,4	1,6	113,0	9,3	1,37	0,11	1,30
1000	69,7	12,5	109,2	1,3	110,5	8,5	1,34	0,10	1,14

Source: Catalogue of technical solutions for the application of alternative building systems from 50 to 1,000 m^2

Ak	Grijanje i PTV		Pomoćna el. en.		Ten,uk	Todržav.	Ialt
m^2	kWh/a	kn/a	kWh/a	kn/a	kn/a	kn/a	kn
50	6.411	13795	273	287	2.082	500	21.106
100	1.196	3.350	327	344	3.694	700	22.829
200	23.106	6.470	450	472	6.942	900	29.030
500	55.682	15.591	803	843	16.434	1.200	43.943
1.000	109.158	30.564	1.325	1.391	31.956	1.600	58.090

Source: Catalogue of technical solutions for the application of alternative building systems from 50 to 1,000 m^2

In the prescribed compilation (elaborate), the use of several different renewable energy sources is compared, and on the basis of the obtained savings parameters, the availability of energy sources, the price of maintenance is chosen by the most suitable system.

Due to a large number of projects involving the transition to renewable energy at the national level, a Ordinance on Cost and Benefit Analysis is under preparation for heating or cooling projects in a specific geographic area for the needs of planning heat energy consumption. Following the adoption of this Ordinance, cost and benefit analysis for so-called energy projects will be developed according to a single methodology with the aim of determining the most cost-effective and most useful heating or cooling options in a given geographic area for the purposes of planning heat energy consumption. This Ordinance also includes a methodology for calculating economic effects at plant level (it will be mandatory when constructing or reconstructing and revitalizing thermal power plants larger than 20 MW), ie the investor will be obliged to conduct an analysis of costs and benefits for the use of high efficiency cogeneration in the energy authorization process and efficient remote heating and cooling, taking into account rational features that include technical feasibility and distance.

In the area considered because of the availability of energy sources (production of firewood, pellet factory, cogeneration) the optimum use of biomass is thus the heat source of energy. Past experience, however, suggests that excessive demand and exports are negatively reflected on regular pellet supply during the heating season.

1.2.6. Step 6: Evaluation of possible bottlenecks (SWOT analysis)

SWOT analysis is a strategic planning tool used to identify the strengths, weaknesses, opportunities and threats associated with the biomass energy supply chain. Attached is a draft SWOT analysis to be discussed in cooperation with key stakeholders.

SWOT analysis table with the question: "*Where do you see the main advantages, weaknesses, opportunities and threats associated with the supply of wood energy in your biomass area*?"

Strengths	Weaknesses
– State-owned forests are managed according to the principles of sustainable management; – Biomass is recognized as an RE and a number of processing capacities (firewood production, pellet factory, cogeneration) have been built or under construction; – Biomass is recognized as an RE by consumers, primarily citizens and local and regional self-government units that use available European funds to finance energy efficiency projects in buildings and plan to use biomass as an energy source for space heating; – There is a potential for increasing biomass gains in commercial forests in the protected area and in other areas.	– Insufficient use of modern forest mechanization; – Mined suspected areas in the protected area prevent the capture of biomass; – Insufficient openness of economic units prevents the acquisition of biomass; – Inadequate use and management of private forests management; – Private forests owners are not able to manage forests in quality way.
Opportunities	**Threats**
– The use of modern forest mechanization makes it possible to increase the attractiveness of biomass in state-owned forests with the proper implementation of nature protection measures;	– There is a possibility that supply does not meet biomass demand for the construction of all cogeneration at some stage of realization; – There is a possibility to continue to grow biomass prices;

– Improvement of private forest management program opens up the possibility of increasing their productivity – Demining of forest areas and the opening of inadequately open forests in individual economic units allows for increased biomass gains in state-owned forests; – Use of funds provided through the Rural Development Program 2014-2020 for the purchase of modern forest machinery and forest road construction.	– There is a possibility of delays in the supply of local consumers with fuel wood (firewood) and pellets; – There is a possibility that existing capacities and capacities under construction (primarily cogeneration) will not work with planned capacity due to insufficient recovery of biomass; – Further increase in demand for biomass (spatial wood) leads to the growth of illegal logging/cutting that threatens flora and fauna in the protected area.

1.2.7. Step 7: Final recommendations for investors and Letters of Agreements between different actors in production chain

The supply chain includes various stakeholders from the Croatian Forests d.o.o., energy producers, consumers, NP Velebit administrations, local and regional (regional) administrations and entrepreneurs in the area considered. It is important to identify key stakeholders, especially those of the Croatian Forests d.o.o. which manage state forests and large biomass consumers (pellet and cogeneration plants).

The most important goal should be to secure sufficient quantities of biomass for installed capacity and those in construction, as well as to provide sufficient quantities of biomass for local consumers (populations, small and medium-sized businesses producing firewood) in order to reach the larger number of local consumers or the direct benefit of biomass as a renewable energy source.

This approach also enables the achievement of the objectives of the protected area - preserving biodiversity (flora, fauna, habitats) while simultaneously raising local community standards (by reducing heating costs, which represent an important item for all consumers and creating new jobs).

1.2.7.1. Forest owners

In the area of NP Velebit, in addition to the state-owned forests, which are arranged, with FSC certificate and subdivisions are managed by Croatian Forests d.o.o. (through their FA) there is also a part of private forests whose condition, production capacities and challenges faced by their owners are detailed in the previous chapters and work packages.

Improving the management of these forests will require significant energy and effort from many stakeholders, including park administration, local and regional self-government administration, the involvement of the Croatian Agricultural and Forestry Service (in the Ministry of Agriculture) and forest owners themselves.

Given their disorder, frequent illegal cutting and low productivity in the interest of the Public Institution Nature Park Velebit, this situation improves. Also, their arrangement and inclusion of biomass gained into the biomass biomass market will enable increased by-felling revenue, increase economic activity, and will contribute to increasing the biomass supply market.

Given the above-mentioned socio-economic characteristics of forest owners at the level of the Republic of Croatia, which are applicable to forest owners in the protected area, a long-lasting and demanding process can be expected. It is therefore optimal to bring a long-term program of improvement of private forests management.

It is proposed to try to bring a unique program not only for forest owners who have forests in the protected area, but to include all forest owners in the County, and to fund the way to finance program activities by means of several different stakeholders (Public Institution NP Velebit budget, local and regional self-government).

It is also proposed that this activity be included in the NP Velebit Management Plan for the period 2017.-2027. so that the public administration in the Park has the appropriate basis for its action (in the work program and financial plan).

1.2.7.2. Market conditions for wood fuel users and producers

Improving biomass market conditions requires first of all the prevention of imbalances in the supply and demand market as there are several possible tools.

One of these is to disable (through spatial planning documentation at regional and state level) the construction of new processing capacities. This document may be a contribution to a more detailed analysis that would require such a politically sensitive issue.

The second parallel approach depends on the business policy of the Croatian Forests d.o.o. (Ltd), which refers to possible changes in the management base by creating forestry conditions that are more tailored to the use of modern forest mechanization,

the procurement of modern forest mechanization, the opening of economic units (new forest roads) where inaccessibility is insufficient and demining of mining areas.
It is also necessary to invest in the development of human resources through the education of employees for the use of modern forest machinery and the increase in salaries for employees who, due to low wages in Croatia, go to other EU countries. (these proposals are perceived in the business policy of the Croatian Forests d.o.o., which is a state owned company, and changes in business policy are strategic national decisions requiring detailed analysis and preparation at the management and ownership level).
Since a large quantity of pellets produced is exported, it is necessary to open a discussion on the possibility of concluding multi-year contracts with pellet consumers. It is to be expected that such contracts will be concluded with the public sector (in accordance with the legal regulations regulating public procurement). However, in the heating season 2017./2018. and 2018./2019., there was a shortage of these retail energy retailers (citizens).
Most of the firewood producers have their own permanent customers and also have organized delivery of household garbage.
The construction of logistics centers at this time seems redundant, but improving the productivity of private forests may be such a need. Therefore, the construction of one or more of these centers should be foreseen in the Private Forest Management Program and foreseen in the spatial planning documentation of LAUs and Public Institution Nature Park Velebit.

1.2.7.3. Environmental recommendations

As stated in all the plans for the management of state forests, nature protection measures have been incorporated, whose respect is compulsory.
Also, all heat and power plants that are located (or will be located) and pellet factories and most other processing facilities (such as pellet production) are outside the boundaries of the protected area. In this way, direct threats to protected habitat habitats have been avoided. Also, such space operations require the preparation of an environmental impact study / study on the basis of which a program of measures to mitigate the negative impact that is compulsory and monitored during the life of the plant is required as part of the preparation of technical and technical documentation.
The greatest threat to the protected area from the habitat of environmental protection and nature can be considered as a state in private forests (danger of fire, illegal logging with and without knowledge of forest owners). Therefore, this situation can be changed by continuous investment in the improvement of private forests management, with increased efforts of police and police services and in the implementation of activities aimed at raising public awareness of the importance of conservation of biodiversity in the protected area.

Therefore, the most important recommendation is to continually cooperate with the Croatian Forests d.o.o. during the planning and execution of all forest operations in state forests, and especially in forests.

It is also necessary to actively engage in the development of a forest management improvement program in the protected area and / or the Lika-Senj County. Taking due account of the existing demographic and economic situation in the protected area, the low population density of the entire county and the small economic activity, the elaboration of a single Program (which in some of its segments can be directed to private forests in protected areas) is overwhelming. In this way, it is possible to ensure a uniform and transparent implementation of the measures, concentration of financial resources, simplification of monitoring of achieved results and indicators and further planning.

1.2.8. Step 8: Technical assistance for project documentation preparation and finding funds for investments

The establishment of a supply chain can be implemented only gradually in cooperation of all stakeholders and for the realization of this project it is necessary to provide technical assistance funds from which will be financed activities such as coordination and organization of meetings, workshops, etc. of all stakeholders, preparation of documents, working materials. Provision of technical assistance is necessary to establish cooperation, identify deficiencies, and establish a hierarchy for all activities.

Technical assistance can also be provided for finding sources of funding for individual investments, as well as for preparing the necessary project documentation.

The technical assistance funds can be used at local, regional, national and European levels.

Financing of individual segments is possible from various sources of funds such as the Ministry of Agriculture, the Ministry of Science and Education, the Environmental Protection and Energy Efficiency Fund or the use of dedicated funds at European level.

One of the options is to use ESI Fund ELENA for technical assistance to establish a supply chain. ELENA is a joint initiative of the European Investment Bank and the European Commission within the Horizon 2020 program. The ELENA Technical Assistance Fund can be used to implement projects and programs of energy efficiency and energy distribution from renewable sources. Funds can be used to finance costs associated with feasibility studies, market research, business plans, contracts, audits, bidding procedures and project implementation. Link to a page where all the details for using these resources are:
https://www.eib.org/en/products/advising/elena/index.htm.

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1.4 Annex 1. Questionnaire for data collection of interested buildings in the park and in/near Biomass District

Description	Data/Information
Building type	
Building ownership (public, private)	
Number of potential buildings to be connected to district heating system	
Address of the building	
Local community	
Number of tenants	
Year of construction / age of the building	
Year of construction / age of carpentry	
Daily temperature in the building	
Heating surface	
Existing energy source	
Average energy consumption (calculated on the last 3 heating season)	
Energy used in kWh for boiler	
Year of installation of existing boiler / age of built-in heating system	
Annual energy consumption (eg liters)	
Hot water (with or without boiler)	
Energy efficiency of windows and doors (yes / no)	
Wall insulation (yes / no)	
Roof insulation (yes / no)	
Energy Building Certificate (yes / no)	
The year of the beginning of measuring the energy efficiency of the building	

1.5 Annex 2. Questionnaire for determining the annual quantities of pellets required by households, which can be obtained from local feeders

Poll for pellet users/buyers/consumers

Question	Response
Name and surname	
Address	
The amount of pellets required (tons) for one heating season	
Where do you get pellets?	
Do you get pellets once or several times during the year?	
Would you join a pellet consumer association that would purchase pellets for its members under the same conditions (price, delivery, quality, etc.)?	
Would they participate in the executive body of consumer associations (board of directors, supervisory board)?	
Would you pay membership fee as a member of the pellet consumer association?	

Poll for pellet producers

Question	Response
Do you sell pellets in the local market?	
What percentage of the annual production of pellets are poured on the local market (Lika-Senj County)?	
How many tons of pellets are plated annually on the local market (Lika-Senj County)?	
Would you be willing to cooperate with a pellet consumer association?	
Would you be ready to negotiate framework agreements with the pellet consumer association on the supply of pellets for multiple end consumers, where they would uniquely negotiate the quantities, the price, the delivery deadlines?	

Based on the conducted survey if justified and surveys with pellet producers could be suggested establishing a consumer association that would conclude a framework agreement with the interested producers.

Forest Bioenergy in the Protected Mediterranean Areas

Municipality of Petralia Sottana

Zadar County

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