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FORBIOENERGY - Forest Bioenergy in the Protected Mediterranean Areas

Planning sustainable forest-wood-energy supply chain in the protected areas

Workpackage 3 - Testing

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

Methodology for the planning and management of sustainable agroforest supply chain_ draft version

Partner in charge: PP3 Slovenian Forestry Institute

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

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1 INTRODUCTION

Most of the Mediterannean forests are included in protected areas and they represent a great opportunity for the production of sustainable energy from biomass. But the current regulatory restrictions, the lack of appropriate plans as well as the incomplete wood-energy supply chain impede and slow down the forest biomass exploitation.

The main objective of ForBioEnergy project is fostering bio-energy production in the protected areas providing transnational solutions for reducing obstacles that hinder the development of the sector and planning models in order to exploit the full potential of biomass and to preserve biodiversity of the natural areas at the same time. The energy production from forest and agricultural biomass represents a new business and work opportunity for rural areas and furthermore it increases the share of local retail energy suppliers (RES) in the energy production.

Within the activity 3.8 we will define the criteria for planning sustainable wood-energy supply chains. Criteria will be identified in relation to the main success factors registered in the analysis of best practices in the field of exploitation of the biomass for energy purpose. Low environmental impact work systems (cutting, logging) for forest biomass production, sustainable management models of wood-energy supply chains, more appropriate sites for the storage of biomass and location of processing power plant, and power plants with technical characteristics appropriate to ensure environmental sustainability of the biomass transformation will be identified. Furthermore, a traceability system and quality standards for biomass (A3.9) will be defined in order to ensure the respect of the sustainability criteria necessary for the development of the biomass chain in the protected areas.

Concretely, this deliverable is linked to deliverable 3.4.1 Geographical identification and description of biomass districts in protected areas since we will plan to establish a sustainable wood-energy supply chain within the selected biomass district. This activity will be implemented involving all relevant actors (forest owners, management bodies of protected areas, State Forest Service, wood biomass producers, wood biomass users etc).

The activity is divided in two parts:

- **Guidelines for the planning and management of sustainable agroforest supply chain** which contain recommendations for the key actors to establish a new wood-energy supply chain within the biomass district in protected area. Recommendations for the establishment of biomass chain will be taken from BIOEUPARKS project Guidelines and capacity building material. They will be adapted to the needs of Mediterranean protected area.

- **Case study of planning a sustainable agroforest supply chain in the protected areas**. Each country involved in the project will prepare a case study for at least one biomass district (BD) in their protected area.

2 OBJECTIVE

The objective of this activity is to design a sustainable wood-energy supply chain within the selected biomass districts (defined in the deliverable 3.4.1) through:

- identification of a low environmental impact work systems (cutting, extraction) for the production of forest biomass,
- identification of efficient biomass production and extraction systems in agricultural areas inside or close to protected areas- establishment of efficient and sustainable management models of wood-energy supply chains,
- identification of stakeholders, that are interested in taking part in wood-energy supply chain establishment and management,
- networking of interested stakeholders and providing support for establishment of cooperatives,
- definition of technical criteria for identifying the most suitable sites for the storage of biomass and the location of processing power plants,
- identification of power plants with technical characteristics, appropriate to ensure the environmental sustainability of biomass transformation,
- providing technical support for project documentation preparation and
- finding funds for investments to move to renewable energy sources.

3 RECOMMENDATIONS FOR PARTNERS IN PREPARATION OF THIS DOCUMENT:

1. We recommend that partners work in selected biomass district – if possible, for district where also Forest management plan will be prepared
2. This document is a kind of general guideline, you should take this guideline and adapt it for your situation, you don’t have to describe all possible technologies but select only those that are or will be used in your district
3. If there are steps that are not relevant for your case, you can skip them, or you can add other steps that are not included here
4. When preparing a case study use data that were collected through all tasks of the ForBioEnergy project (WP3)
5. We recommend you prepare one document for your district area with two parts:
    a. Guidelines – more general part
    b. Case study – with concrete solutions and numbers
6. Anexes are not obligatory to be used, they are just recommendations that can be used if needed.

4 GUIDELINES 3.8.1 – Planning sustainable wood-energy supply chain in the protected areas

4.1 INTRODUCTION

Wood biomass still represents an important type of fuel in many European countries. To support further development and the use of wood fuels also within protected areas, step-by-step guidelines for the development of biomass production chains were developed in the frame of BIOEUPARKS project and further developed in the frame of ForBioEnergy project. This methodology is a set of recommendations from the Guidelines – Steps in setting up wood biomass production chains in protected areas, adapted to Mediterranean area. Our overall goal is to show different options regarding establishment and management of local wood biomass production chains.This Guidelines are not meant to give the final decision and "to present the best option" for setting up wood biomass production chains but rather to act as a guide through different options and to show what kind of data and information are needed before taking the final decision regarding development of production chains.

Biomass supply chains need to be established in a way that supports preservation of ecosystems and biodiversity as the protected areas are the main actors in the process.

At the same time, this choice implies a new way of looking at the role of protected areas; not only as a body in charge of managing natural and protected areas, but also a key actor with the ability to trigger a new way of local development matching nature conservation, and social and economic growth.

The engagement of local inhabitants, economic actors and policy makers in the process is the only way to achieve consensus. Local actors should be the first to be involved in the process. Awareness raising about the opportunity that sustainable exploitation of solid biomass offers, and their agreeing with the sustainability criteria and the social-economic commitments that the supply chain represents, is of key importance.

Let us firstly look at sustainability in its wider sense in terms of:

- biomass use, sustainable forest management and sustainable biomass exploitation criteria must be followed;
- landscape, the value of natural and cultural heritage must be respected;
- social acceptance, the value of public overall health and wellbeing must be respected and
- economic development, the requirements for natural protection must be taken into consideration.

4.2 MAIN STEPS IN ESTABLISHING A WOOD ENERGY SUPPLY CHAIN

A supply chain is basically a sequence of organizations or individuals that are involved in different value performing processes that provide products or services for the customer. Accordingly, a biomass supply chain includes forest owners, farmers, forest and agriculture entrepreneurs, transport enterprises, biomass traders, and – depending on the type of wood fuel – private or public customers. The increasing complexity of biomass supply chains demands a step-by-step implementation guide. The complexity is even higher when implementing biomass supply chains in protected areas. Wood biomass production chains do not usually start from zero but are built from existing organisations or individuals, while only identified missing links have to be newly developed.

Looking from this point of view, the main steps in establishing wood biomass production chains are (picture 1):

1st step Analysis of the present situation (symplified market analysis) – this kind of analysis gives us an insight into biomass potentials, existing producers, and existing and potential consumers

2nd step Identification of end-users– analysis of end-users will provide the quantity and technical requirements of needed biomass

3rd step Networking of interested stakeholders and providing support for establishment of cooperatives

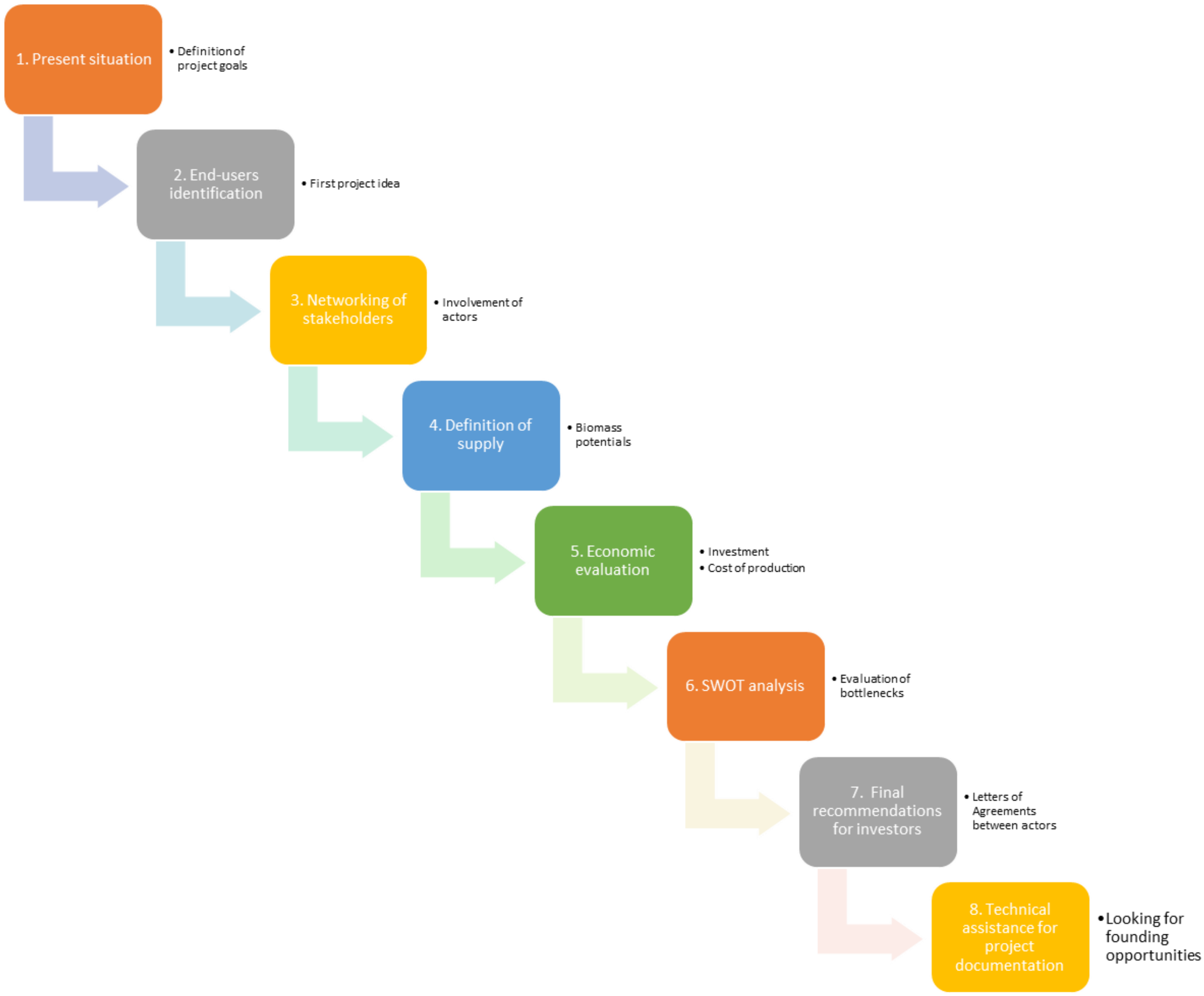
4th step Analysis of the potentials for biomass supply

5th step Economical evaluation of a planned production chain

6th step Evaluation of possible bottlenecks (weaknesses and strengths analysis)

7th step Final recommendations for investors and Letters of Agreements between different Actors in production chains

8th step Technical assistance for project documentation preparation and finding funds for investments



Picture 1: Steps in establishing biomass production chains

4.2.1 Step 1: Analysis of the present situation

Prior to starting any project or new activity, a basic analysis of the market situation is necessary. A simple analysis of the present situation of the market should be prepared using existing data (data gathered in the activity 3.4.1, data obtained from the relevant statistical office, public authority, park administration, public forest service and other publicly available data sets).

The analysis of the present situation should include the following Chapters:

A: Supply side

Short description of supply side should cover following topics:

a) Short overview of the wood fuel market. What is the offer on the market (how and where wood fuels are marketed, existing biomass trade centres, wood fuel prices). This kind of informations were already collected in the frame of D3.4. and D3.5.

b) Wood biomass producers – a list of larger biomass producers should be prepared as these are possible wood biomass suppliers (see Chapter 4.2.5.2 Wood fuel producers)

B: Demand side

Short description of demand side should cover following topics:

a) Existing wood biomass users – the focus should be on larger biomass users (systems with an installed capacity of over 100 kWh).

b) Potential wood biomass users (public and private owners that are interested in transition to renewable energy sources (systems with an installed capacity of over 500 kWh).

C: Other issues

e) Existing environmental and other limitations (existing concessions for natural gas, limitations for the use of wood biomass due to air pollution...).

f) References (data sources).

4.2.2. Step 2: End users' identification

When starting with the establishment of the wood-energy supply chain, we need to consider "What is our goal, what do we want to achieve?"

1. General goal:

To increase the use of biomass inside the area (biomass district).

This goal can be achieved through the promotion of modern wood biomass boilers in households for heating houses/apartments with wood logs, wood chips or wood pellets. It can be achieved also through heating public and commercial buildings with biomass (by individual heating systems or if possible, with district heating systems or cogeneration of heat and electricity). Usually the potential for increasing use of biomass for heating is higher in public buildings. The bottleneck could present the amount of wood biomass from forest and agriculture available from the sources inside the protected area or even inside the identified biomass districts, therefore a detailed analysis of wood biomass potentials should be performed in one of following steps. Assesment of wood biomass potentials is presented in Chapter 4.2.4 Analysis of the potentials for biomass supply.

When establishing biomass heating plants or boilers it is important to consider environmental restrictions. The main problem within the settlements is air pollution with the fine dust particles PM10, especially in the closed valleys. To reduce the air pollution, we need to consider three main recommendations:

- a modern and properly installed heating plant,

- appropriate and quality wood fuel (wood with the appropriate moisture),

- use of the heating plant should be according to the manufacturer's instructions.

2. Specific goals:

- **To heat public buildings inside the biomass districts with wood biomass, obtained through the maintenance of protected areas.** An inventory of all public buildings (and other interested buildings like hotels, restaurants, private blocks) in the biomass district should be prepared. Required data should be collected for each building. An example of the questionnaire for data collection is available at the end of the document (Annex 1).

- **To heat the settlements inside the biomass district (district heating system) with wood biomass supplied from the area within biomass district.** A list of settlements with maps and an overview of existing infrastructure should be prepared, interested buildings should be marked and possible locations for a boiler house should be identified. A simple pre-feasibility study should be prepared. The data presented in the questionnaire (Anex 1) for buildings connected to the district heating system grid should be collected.

Picture 2: Map in pre-feasibility study – heation of a settlement

- **To heat the offices of the protected area administration with wood biomass and present the system as a good practice example to the other potential users.** The offices can be in one or more buildings which are in one or more locations. As with all other projects, some basic data should also be gathered and the first decision regarding the heating system (micro district heating system of individual boiler houses) should be taken. The data presented in the questionnaire (Anex 1) for the buildings should be collected.

- **To produce wood fuels and sell them to inhabitants inside the biomass district.** The basic types of wood fuels that can be produced on the local level are following (according to EN ISO 17225-1-7 and UNE 16004, 16400, 164003, 164004):

Picture 3: wood pellets

Biomass from forests:

- Firewood
- Wood chips
- Wood pellets
- Wood briquettes

Biomass from agricultural area:

- Vineyards, orchards and olive tree prunings
- Olive stones
- Nut shells (walnut, almond, pine nut, hazelnut, pistachio)
- Chopped pine cones

The production technologies and characteristics of each type of wood fuel are presented in Chapter 4.2.5.1 Biomass production technologies and 4.2.5.2 Wood fuel producers. For the purpose of an estimation of possible annual production of selected wood fuel, an estimation of available raw material should be prepared (see Chapter 4.2.4 Analysis of the potentials for biomass supply). Prior to any decision making, market conditions also need to be analysed (an overview of the existing biomass producers – see Chapter 4.2.5.2 Wood fuel producers and 4.2.5.3 Wood fuel prices).

- **To give local population the rights to produce wood fuels inside of the biomass district to heat their homes.** This goal is not connected with any investment costs and as such doesn't need an investment plan. We need written rules and a written and signed agreement with the interested local population to prevent the degradation of ecosystems and non-professional exploitation of forests. A proposal for a written agreement was prepared within the BIOVILL project and it is attached as Anex 2. The preparation of a plan for forest operations is vital (e.g. for the next 5 or 10 years), and it should include marked areas of intervention, present all limitations (technologies that can be used, terrain and weather conditions and part of the year when operations can be performed…). This plan should be a part of the written agreement.

Each of these goals include different steps and different project ideas, and that is why it is very important to discuss different options, analyse different approaches and determine goals at the beginning of the planning processes.

An example of the questionnaire for collecting data is shown in Anex 1. Based on this data, a structured data set for interested buildings can be created (also for future purposes).

This data presents the basis for the calculation of the installed capacity of the wood biomass boiler and the first estimation of wood biomass consumption per heating season. The practical calculation of the installed capacity of a boiler can be calculated and the annual amount of wood biomass needed can be estimated (Chapter 4.2.5.5 Investment costs). These estimations can be used for determining whether there is enough wood biomass available for the planned systems (matching supply and demand sides).

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

Various stakeholders have different knowledge and capacities with regards to wood biomass production. Therefore, it is necessary to bring their knowledge and capacities to a similar level. The optimal way to do this is to gather relevant and interested stakeholders at the beginning of the planning process. All capacity building activities should be carefully planned and designed for specific target groups.

All stakeholders that will operate in the protected area must possess knowledge about conservation principles and limitations in the area, as well as about consequences and possible negative impacts that forest utilization can have on the area. Administrators in the protected areas often lack capacities for planning new biomass supply chains, so capacity building activities for them should be directed towards this issue. Private forest owners are usually not aware of the benefits they could gain from wood utilization and joint initiatives, therefore work with them should include these aspects. Capacity building is also necessary for experts coming from different sectors. Although experts in their respective fields, they usually do not have an in-depth understanding of other fields, therefore mediation between different sectors could be necessary. Biomass producers should have enough knowledge about the biomass supply chain, the technologies they use and the modern technologies they can benefit from.

Promotional activities are also very important. They should be used to “spread the word” and to increase the level of knowledge the general public has about forest utilization activities in the protected areas. If the general public does not approve these activities, conflicts are possible to happen.

In table 1 target groups and the most important first three steps to reach the goals are presented. Promotion of the idea among target groups is the first important step to reach our goals. Local public authorities and park authorities might be the most accessible and responsive target groups. Since they are public and visible, they could present a good practice example which local inhabitants could follow.

Through the promotion and round tables, we could access the target groups and present them the idea of wood-energy supply chains, give them the knowledge to obtain technical and financial support and help them connect to each other in groups (e.g. forest owner assocciations, cooperatives and machinery rings). The ideal connection of target groups would be establishing a cooperative. In this case land owners, contractors and producers could work together and appear on the market together.

Table 1: Engagement of target groups and first steps for achieving specific goals

Goal	Target group	The most important first 3 steps
To increase the use of wood biomass inside the biomass districts	Park authorities, households, local authorities, industries in the area, wood fuel producers, forest owners	1. Promotion of the idea among target groups 2. Organization of round tables 3. Technical and financial support
To heat public buildings inside the park area with wood biomass obtained through the maintenance of protected areas	Park authorities, local authorities, wood fuel producers, forest owners	1. Promotion of the idea among decision makers in local communities 2. Organization of local supply chains 3. Looking for possible investor and funds
To heat the settlements inside the biomass district (district heating system) with wood biomass supplied from within the biomass district	Park authorities, households, local authorities, wood fuel producers, forest owners	2. Promotion of the idea among target groups 3. Looking for possible investors 4. Organization of local supply chains
To heat offices of the park administration with wood biomass and present the system as a good practice example to the other potential users	Park authorities, wood fuel producers, forest owners	1. Promotion of the idea among decision makers in the park 2. Looking for possible investors 3. Organization of local supply chains
To produce wood fuels and sell them to inhabitants inside the biomass district	Park authorities, households, wood fuel producers, forest owners	1. Promotion of the idea among households and wood fuel producers 2. Organization of local supply chains 3. Organization of local biomass trade centres
To give the local population the rights to produce wood	Park authorities, households	1. Promotion of the idea among households

fuels inside of the biomass district to heat their homes		2. Organization of round tables 3. Written agreement 4. Technical and financial support (for investing in modern boilers)

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

When talking about biomass potentials (theoretical and practical) from different sources in the biomass district, region or from protected areas in general, we need to take into account all limitations of protected areas and Natura 2000 sites.

The main sources of wood fuels are:

1. Forests, plantations and other virgin wood (gardens, parks, vineyards, orchards …).
2. Byproducts and residues from the wood processing industry.
3. Used wood (post consumer wood waste and natural or merely mechanically processed wood, without heavy metals or halogenated organic compounds).

Picture 4: Forest as a main source of wood fuels in SE Europe.

In order to set up basic limits (operation scale) for the wood biomass projects, first estimations on wood biomass availability should be prepared. The main aim of this action is to determine the main sources and to estimate the theoretical wood biomass potentials.

The **theoretical market potential** is a maximum quantity of wood which could be sustainably cut down and offered on the market. The **actual market potential** is the actual average quantity of lower quality wood which was felled in the last five years and offered on the market. In this first stage, only theoretical potential is estimated.

The collection of basic data of the biomass districts and the theoretical potentials of wood biomass from forests and agricultural area, is presented in the Deliverable 3.4.1 Geographical identification and description of biomass districts in the protected areas. In the Deliverable 3.5.1 some socio-economic indicators are gathered and presented.

In addition, also data presented in a questionnaire (Anex 3) can be collected.

4.2.5. 5th step: Economical evaluation of a planned production chain

4.2.5.1. BIOMASS PRODUCTION TECHNOLOGIES

Many protected areas have limited budgets, and forest owners and operators are usually not so keen in investing in new technologies due to their high prices. On the other hand, modern technologies are more productive, cost-effective and environmentally friendly, so they can help fulfil requirements of protection regimes. Local biomass chains in protected areas should work towards introducing modern technologies, where economic aspects will certainly have an important role in the decision. For that purpose, the Slovenian Forestry Institute has developed a free access online tool – WoodChainManager (http://wcm.gozdis.si/en). It offers various interactive tools suitable for the organization and optimization of applications in forestry:

- Creation of interactive transparent descriptions of the forest-wood chain
- Creation of transparent cost calculations of forest machinery
- Determining norms of forestry production
- Converting between volume, weight and energy units

Modern biomass boilers have lower emissions and a higher efficiency, and they are therefore the most suitable choice in protected areas. Many countries are granting subsidies or favourable credits for this kind of investments, so additional help could also come from the state.

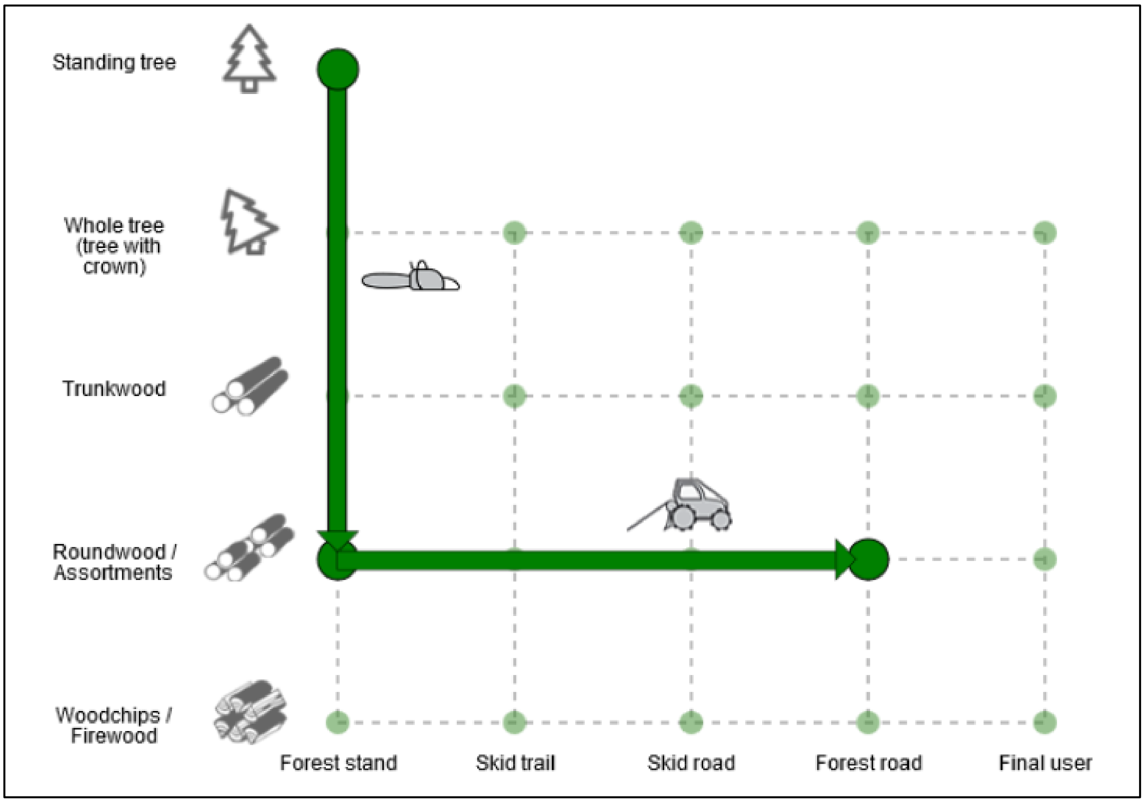
In many countries / regions, special frameworks are available to help forest owners or entrepreneurs with subsidies or credits to invest in modern machinery. These options should be analysed and presented to target groups in the park area to support investments in modern technologies.

A biomass production technology varies along the value chain. Examples below are based on Slovenian conditions and present the value chain of forest production as well as wood fuel value chains. The most attention is given to the wood chips production chain. Calculations and graphs were prepared with Wood Chain Manager calculation tool developed at Slovenian Forestry Institute. It is freely available on the internet: http://wcm.gozdis.si/en/cost-calculation.

Each country involved in the project will prepare an economical evaluation of a planned production chain based on the country conditions.

4.2.5.1.1. Forest production value chain

The most common system of wood production is a technology implemented in combination with traditional felling with a chainsaw and skidding with an adapted forestry tractor. This process begins in a forest stand with felling. After felling, the tree is trimmed and cross-cut with a chainsaw with the power of 4 kW. Next follows the collecting and hauling of timber to the forest road with an adapted forestry tractor. An adapted forestry tractor is a tractor which has been completely upgraded for forestry use (safety frame), has a double drum built-in winch (5 tons), a radio-control unit, and forestry chains at least on its back-rubber tires. A simplified illustration of this production chain is illustrated on Picture 5.



Picture 5: Production chain of timber felling and skidding; (source: Slovenian Forestry Institute, 2018)

Picture 6 illustrates felling with a chainsaw, whereas Picture 7 shows skidding with an adapted forestry tractor.

Picture 6: Felling with a chainsaw

Picture 7: An adapted forestry tractor

Source: J. Klun

The total cost of this production chain is 45.2 EUR/h, whereas the direct material costs chain with the assumption of an average predicted efficiency in an eight-hour working day amounts to 15.3 EUR/m^3 (Table 2).

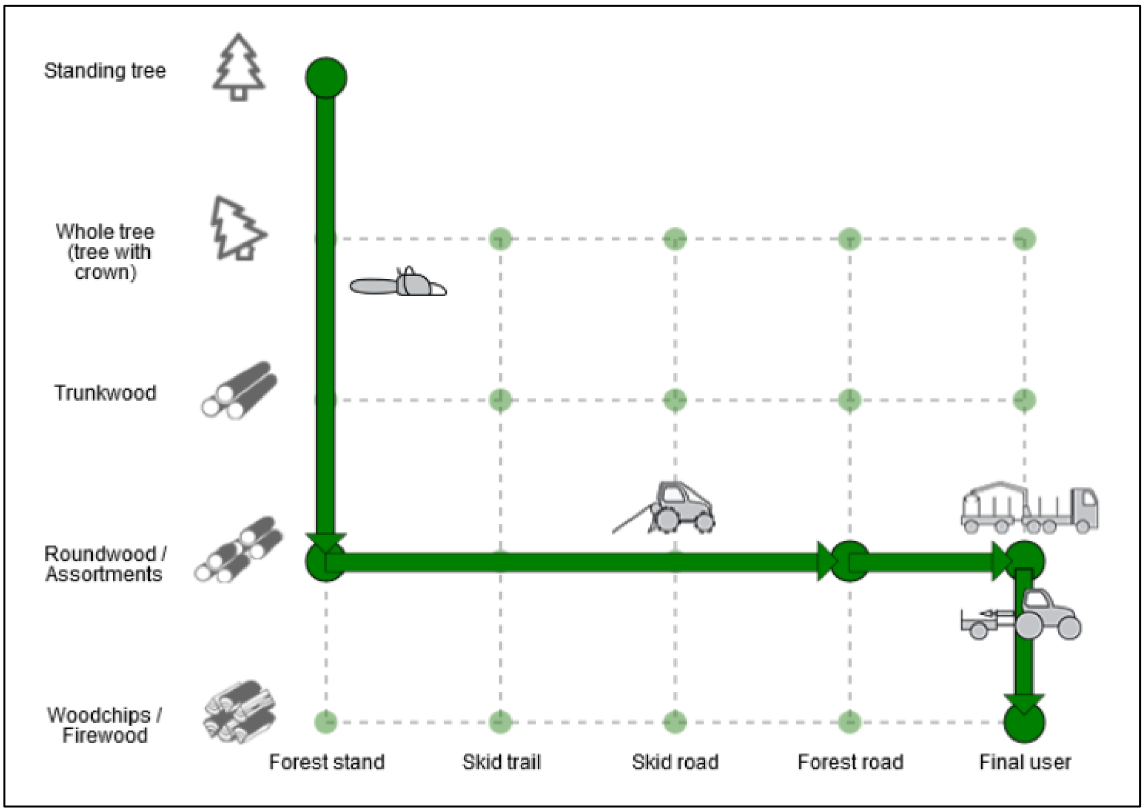
Table 2: Material costs and predicted efficiency of the timber felling and skidding production chain

Machine	Total cost (EUR/h)	Direct material costs (EUR/m^3)	Predicted efficiency (m^3/8h)	Comment
Chainsaw (4 kW)	4.0	2.1	15.0	Felling, delimbing
Forestry tractor (4 WD, 65-74 kW)	41.2	13.2	25.0	Skidding
Production chain costs	45.2	15.3		

Source: Slovenian Forestry Institute, 2015

4.2.5.1.2. Firewood production chain

The traditional production of firewood is the most widely used method for firewood production in households and agricultural holdings. As in forest production, the manufacturing process begins in a forest stand with felling, delimbing, and crosscutting with a chainsaw with the power of 4 kW. These operations are followed by collecting and hauling of timber to the forest road. This is done with an adapted forestry tractor which has been completely upgraded for forestry use (safety frame), has a double drum built-in winch (5 tons), a radio-control unit, and forestry chains on its tires. Roundwood assortments are transported from the forest road to the end-user by a forestry transport composition. This composition includes a three-axial truck for roundwood with a crane and trailer. Roundwood is cut into 1 m long logs with a chainsaw with the power of 6 kW at the location of the end-user. Logs are then split into chunks (1 m long firewood logs) with a hydraulic horizontal log splitter (up to 30 tons) on a standard tractor. The final step is the production of firewood (length of 33 cm), which is done with a standard tractor and a tractor driven circular saw (Picture 9).



Picture 8: Traditional firewood production chain; source: Slovenian Forestry Institute, 2018

The pictures below show examples of a tractor driven circular saw and a hydraulic horizontal splitter.

Picture 9: Tractor driven cirkular saw

Picture 10:Hydraulic horizontal splitter

Source: M. Dolenšek

Table 3 shows direct material costs of the production chain with the assumption of an average predicted efficiency in an eight-hour working day. The table shows that the total costs are 167,4 EUR/h, whereas direct material costs amount to 56,7 EUR/m3.

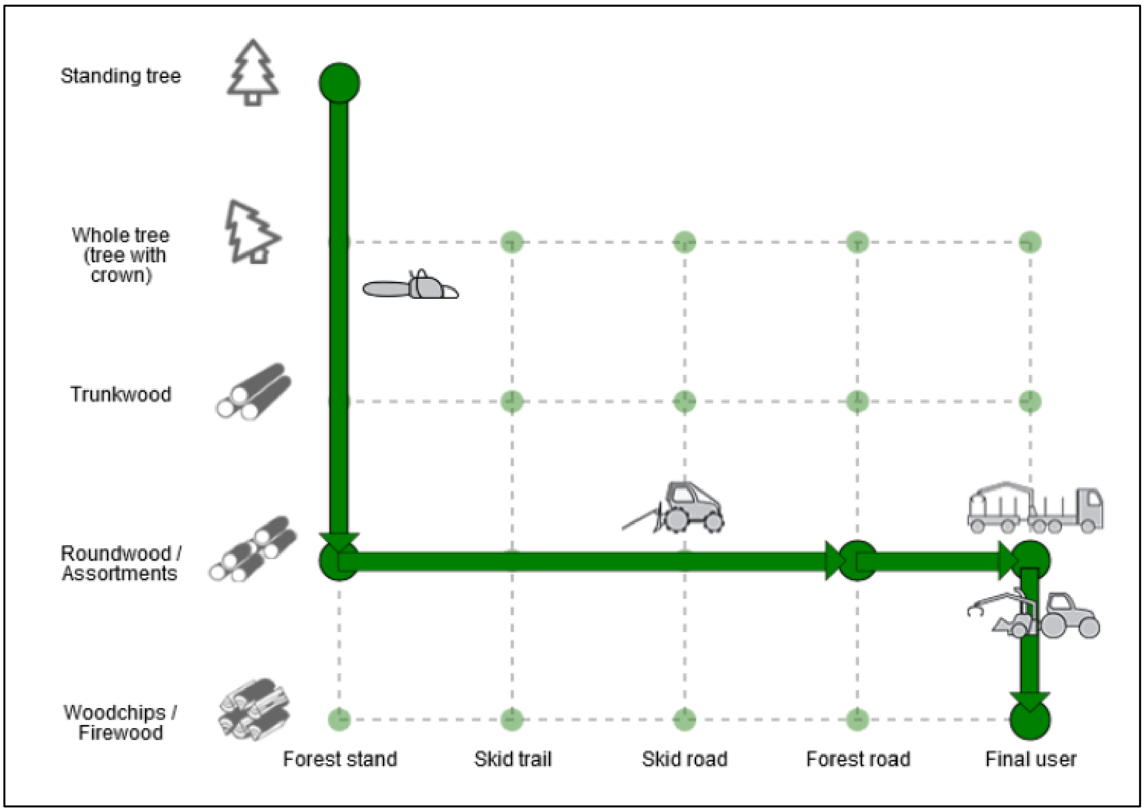
Table 3: Material costs and predicted efficiency of the traditional firewood production chain

Machine	Total cost (EUR/h)	Direct material costs (EUR/m^3)	Predicted efficiency (m^3/8h)	Comment
Chainsaw (4 kW)	4.0	2.1	15.0	Felling
Forestry tractor	41.2	13.2	25.0	Skidding
Forestry transport composition	44.4	5.1	70.0	Roundwood transport
Chainsaw (6 kW)	5.7	1.5	30.0	Cutting to 1 m
Standard tractor	25.8	12.9	16.0	Logs (1 m)
Splitter (30 t)	13.0	6.5	16.0	Logs (1 m)
Standard tractor	25.8	12.9	16.0	Firewood (33 cm)
Circular saw	7.5	2.5	24.0	Firewood (33 cm)
Production chain costs	167.4	56.7		

Source: Slovenian Forestry Institute, 2015

4.2.5.1.3. Traditional wood chips production chain

This chain provides the traditional way of timber harvesting. The chain starts in the forest stand with cutting, delimbing, and crosscutting with a chainsaw with the power of 4 kW. Timber is then collected and skidded to the forest road with an adapted forestry tractor with a light forestry safety frame, forest chains, and an electro-hydraulic single drum winch with a radio-control unit (6 tons). Roundwood (i.e. pulpwood and fuelwood) is transported from the forest road to the end-user by a forestry transport composition (a three-axle truck for roundwood with a crane and trailer). At the location of the end-user, wood chips are produced using a tractor PTO (Power Take Off) driven chipper with a loading device. This process is illustrated in Picture 11, whereas some of the machinery from this production chain is shown in Pictures 12 and 13.



Picture 11: Traditional wood chips production chain; source: Slovenian Forestry Institute, 2018

Picture 12: Forestry transport composition

Picture 13: PTO driven wood chipper

Source: J. Klun

Table 4 shows the direct material costs of the production chain (based on the assumption of an average predicted efficiency) in the eight-hour working day. The table shows that the total costs of this production chain are 198,6 €/h, at what direct material costs are 28,7 €/m3.

Table 4: Material costs and predicted efficiency of the traditional wood chips production chain

Machine	Total cost (€/h)	Direct material costs (€/m^3)	Predicted efficiency (m^3/8h)	Comment
Chainsaw (4 kW)	4.0	2.1	15.0	Felling
Forestry tractor	29.9	7.5	32.0	Skidding
Single drum winch	5.5	2.5	18.0	Skidding
Forestry transport composition	44.4	5.1	70.0	Roundwood Transport
Standard tractor	40.7	4.1	80.0	Wood chips
PTO Wood chipper	74.1	7.4	80.0	Wood chips
Production chain costs	**198.6**	**28.7**		

Source: Slovenian Forestry Institute, 2015

4.2.5.1.4. Mechanized wood chips production chain

This production chain assumes the production of wood chips on a forest road or at a temporary storage location and transport them over long distances to major customers (i.e. district heating systems). Felling begins in a forest stand and is then followed by delimbing, crosscutting, and collecting the timber with a wheeled harvester with the power of 140 kW. Timber is transported to the forest road by a forwarder with a load capacity of 12 tons. Wood chips are produced on the forest road using a wood chipper on a truck with a loading device. Wood chips are transported to the end-user by a truck with a segment moving floor (cargo floor) trailer for loose material. The pictures below show the machines that are used in this production chain.

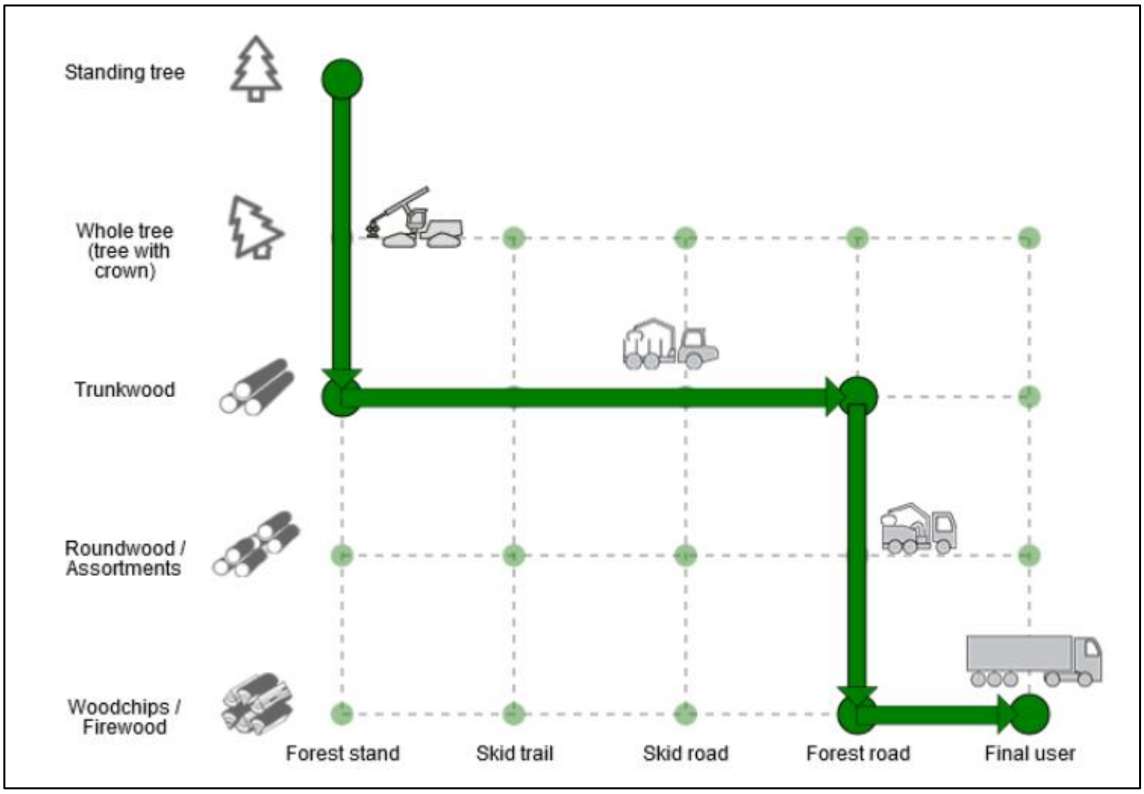
Picture 14: Harvester

Picture 15: Forwarder

Picture 16: Wood chipper on a truck

Picture 17: Truck with cargo floor trailer

Source: SFI



Picture 18: Mechanized wood chips production chain; Source: Slovenian Forestry Institute, 2018

The direct material costs of the production chain are shown in Table 5. The table shows that the total costs of this production chain are 710,4 EUR/h, whereas direct material costs amount to 57,0 EUR/m3.

Table 5: Material costs and predicted efficiency of the mechanized wood chips production chain

Machine	Total cost (EUR/h)	Direct material costs (EUR/m^3)	Predicted efficiency (m^3/8h)	Comment
Harvester	115.0	13.1	70.0	Felling, collecting
Forwarder (12 t)	87.7	11.7	60.0	Extraction
Truck wood chipper	421.5	16.9	200.0	Chipping
Wood chips truck	86.3	15.3	45.0	Transport (30 km)
Production chain costs	**710.4**	**57.0**		

Source: Slovenian Forestry Institute, 2015

4.2.5.2. WOOD FUEL PRODUCERS

Picture 19: Wood biomass production

The analysis of wood fuel producers in the biomass district and its surroundings should be an essential part of the analysis. The methodology for data collection should be adapted to time and resources available. Data on registered wood fuel producers should always be collected from the official register. Data can be collected from the European Business Register (hereinafter referred to as "EBR"). EBR is an information system through which Member States provide data and certain services from their national business registries. This growing network currently includes 24 European countries. The EBR information system provides fast and simple access to data and information regarding business entities based in EBR Member States, as well as to certain documents related to the business entities' operations (https://www.ajpes.si/ebr3). Additional data sources are regional Chambers of Commerce (if they exist), Forest Services, local internet pages and advertisements in different media. A catalogue of wood fuel producers in 9 countries / regions (Slovenia, Croatia, Romania, Italy – Northern part, Austria – Styria, Germany – Bavaria, Spain, Ireland and Greece) was published within the framework of the BIOMASSTRADECENTRE II project and is still available on http://www.biomasstradecentre2.eu/wood-biomass-production/service-providers/.

Information regarding the wood fuels producers was already recorded in the Deliverable 3.4.1. For more detailed analysis data can be also collected with the form presented in the Anex 4.

When buying or selling wood fuels, we need to consider two important criterias:

- Units of measurements
- Wood fuels quality

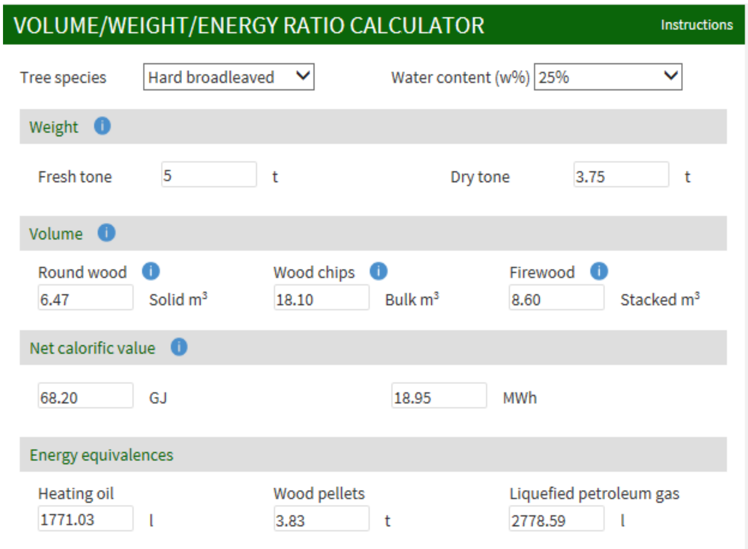
4.2.5.2.1. Units of measurements

The table 6 shows the units of measurement for volume and weight that are commonly used in the marketing of wood fuels.

Table 6: Units of measurement

Ton	Kilogram	Stacked cubic metre	Bulk cubic metre
t	kg	stacked m³	bulk m³
log woods chips pellets and briquettes		log woods	firewood chips

The Slovenian Forestry Institute developed a simple calculator (see picture 20) that enables the calculation of different units of measurements: http://wcm.gozdis.si/en/unit-converter.



Picture 20: Volume/weight/energy ratio calculator

Table 7: Basic conversion factors for wood fuels

	Round wood	Logs		Wood chips	
		Stacked	Heaped	Fine	Coarse
	[m³]	[stacked m³]	[bulk m³]	[bulk m³]	[bulk m³]
1 Roundwood	1	1.2	2	2.5	3
1 stacked m³ logs	0.85	1	1.67	2	2.5
1 bulk m³ logs	0.5	0.6	1	1.25	1.5
1 bulk m³ wood chips, fine	0.4	0.5	0.8	1	1.2
1 bulk m³ wood chips coarse	0.33	0.4	0.67	0.85	1

4.2.5.2.2. Quality of wood fuels

The quality of wood fuels has to match boiler requirements. Smaller boilers (with a capacity of under 200 kW) have higher quality requirements. The water content should be under 25%, the size of particles is strictly defined, and the percentage of fine dust particles should be low. The requirements for the highest quality classes are presented in table 8.

Picture 21: Different types of wood chips

Table 8: Basic quality requirements for wood fuels

	Basic requirements (according to ISO standards)*1	Relevant standard
Wood logs	Class A1: Diameter and length should be stated, M20 or M25 (moisture below 25%), no visible decay, more than 90% of pieces should be split	EN ISO 17225-5:2014
Wood chips	Class A1 or A2: Particle size P16S or P31S, up to M35 (moisture below 35%), ash content less than 1.5%, fines fraction less than 15%	EN ISO 17225-4:2014
Wood pellets	Class A1: M10 (moisture below 10%), ash content less than 0.7%, mechanical durability more than 97.5%, bulk density more than 600 kg/m^3	EN ISO 17225-2:2014
Olive stones	Class A1: Particle size < 15 mm, oil content ≤ 0,6 %, moisture M12 (moisture below 12 %), ash content less than 0,7 %, bulk density more than 700 kg/m^3	UNE 164003
Almond shells and hazelnuts	Class A1: Particle size < 16 mm, oil content < 0,6 %, moisture M12 (below 12 %), ash content less than 0,7 %, bulk density more than 500 kg/m^3	UNE 164004
Chopped pine cones	Class A1: Particle size < 31,5 mm, moisture M12 (below 12 %), ash content < 0,8 %, bulk density more than 400 kg/m^3	UNE 164004

Pine nut shells	Class A1: Particle size < 31,5 mm, moisture M12 (below 12 %), ash content < 0,8 %, bulk density more than 400 kg/m^3	UNE 164004

Remark: *[1]The values in the table are only informative, for a more detailed quality check of wood fuels, the original ISO standards should be used.

The properties of wood fuels should be specified in the product declaration. It is important to emphasise that the whole responsibility for correct and accurate information is on the side of the producer/supplier.

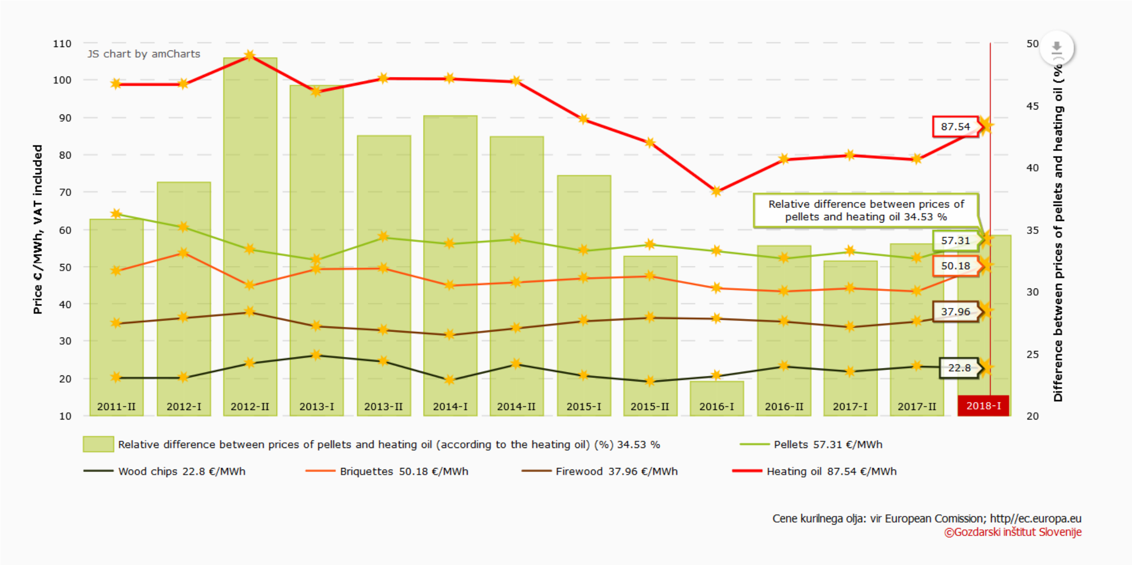
For more detailed information about the issues regarding the quality of wood fuels, see two publications produced within the framework of the BIOMASSTRADECENTRE II project (literature is available on www.biomasstradecentre2.eu).

4.2.5.3. WOOD FUEL PRICES

Precise and up-to-date information about the market situation is needed for the successful and effective development of wood biomass trade. The unavailability of data on quantities, market flows or prices, constitutes a major barrier to trading, since important strategic decisions need to be made without proper knowledge or market information. The availability of information is therefore the key to ensuring a transparent, competitive and efficient market. While prices of petroleum products are extremely fast and easily accessible, prices of wood fuels are usually not published on any official web site of state authorities. The collection of wood fuels prices is more extensive, because prices depend on quantity, quality, region, provider, time, etc.

When collecting data, we often encounter different quantity units; in the case of firewood and wood chips, the suppliers usually refer to cubic meters (m3), stacked cubic meters (stacked m3) or loose cubic meters (Bulk m3), while pellets and briquettes are most often traded by weight (in tons). To facilitate the comparison of the prices of various wood energy products, all prices are quoted by weight (in EUR per ton), where VAT is already included in all those prices. Since conversion of different units is a major problem in wood fuels trading, an online calculator that makes it easy to convert different units have been created (see chapter 3.2.5.2.1, Units of measurments).

In picture 22 the movement of different wood fuel prices in Slovenian market are presented.



Picture 22: Different prices of wood fuel (in €/MWh) compared to heating oil prices (Slovenian Forestry Institute, 2017)

4.2.5.4. STORAGE

Picture 23: A biomass trade centre

Storage is important in relation to buffering biomass either over a longer period somewhere in the supply chain (e.g. to compensate for seasonal effects of biomass supply from forests and nature area, where it is impossible to harvest year-round) or on the short term just before delivering to the final conversion process. The method od wood fuels storage significantly influences their quality. Wood can be stored in the form of round wood or in any intermediate or final form of wood fuels. They can be stored in intermediate warehouses or in warehouses in the immediate vicinity of the heating plant. Regardless of the shape of the fuel and the duration of the storage, it is most important that the wood is dried at a suitable location (airy and dry space). The best storage area for drying wood chips is a covered toughened surface (concrete or asphalt) on a sunny and airy location. The architectural structure of the roof should allow maximum ventilation of the stored material and facilitate the handling of wood chips (height of the area and height of the chips).

Recommendations for the storage of the wood:

- the raw material intended for chip grinding must be stored for at least one summer in the airy and sunny space (natural dryed);
- wood, which is temporarily stored over the summer, has a water content of 25% to 30% when making chips;
- during rainy summer months, wood cover is recommended (wood, paper, textile or plastic sheets are available for covering the wood);
- chips are covered only with materials that allow free circulation of the air;
- the removal of chips from stored piles should be controlled and planned ("the first come in -first goes out");
- caution is needed when working with chips that have been stored for a long time (exposure to fine wood particles and micro-organisms);
- avoiding the storage of chips with a high proportion of needles and leaves; such chips will heat up due to the very intense action of the microorganisms, and the process of rotting will begin within a few weeks, so they should be stored in piles with a maximum height of 7 m and for the short period of time.

Properly arranged space as defined in Picture 23 (round wood is folded directly by the covered area) allows optimal production. For all storage cases that deviate from the optimum, it is necessary to consider the cost of the loader (aprox 5 €/m^3 in Slovenia), which either delivers the raw material to the chopper or draws chips into a covered warehouse.

The recommended area for low quality roundwood storage depends on several factors. These are: the length of the roundwood (determines the width of the stacks), the length of the stacks, the required distance between the stacks, the required distance between the stacks and other objects, the conversion factors (eg. the calculation between the quantities) and the estimated quantity of timber in the storage. Table 9 shows the variant calculation of the required areas for roundwood storage with assumptions: the width of the stacks and the intermediate distance between the stacks and the distance to other buildings is 4 meters, the height of the stacks is 4 meters, the conversion factor is 0.60 $m3_{ss}$ / stacked m^3.

Table 9: Calculation of storage surface for storage of lower quality roundwood

m^3_{ss}	Stacked m^3	Number of stacks	1	2	3	4	5	6	7
1000	1666,7	Surface (m^2)	1394	1282	1308	1370	1445	1527	1613
3000	5000,0	Surface (m^2)	3894	3365	3253	3245	3278	3332	3399
5000	8333,3	Surface (m^2)	6394	5448	5197	5120	5111	5138	5184

m^3_{ss} – m^3 of wood with bark
prm – stacked m^3

Storage can also be used in case of excessive quantities of feedstock in timber yard (e.g. natural disturbances). The large and sudden supply of raw material that subsequently becomes available may by far exceed the conversion and sales capabilities of the sawmilling industry. Eventually, a large proportion of the wood could be lost due to rot and insect infestation. Solutions, such as storage of logs on site or in special storage yards, aid to maintain the feedstock quality and the economic value of timber (Triplat et al., 2013). That kind of solutions are several different methods of storage of timber, used throughout Europe, to avoid especially fungi attack.

Biomass trade centres (BTC) are market spots where quality wood fuels (wood logs, chips and pellets) are sold in a transparent way all year round. The most important part of each BTC is a storage place which should be partly covered (for storing of final forms of wood fuels), but also large enough to store larger amounts of roundwood and other raw materials. It is important that it is located away from the settlements, as production of wood chips and logs is a noisy and dusty activity. A BTC should also have a weighting bridge for selling wood fuels by weight and it has to offer services (e.g. transport of wood fuels). It is important that in a BTC, only local wood fuel is sold and that it has a cohesive role in the local wood biomass production chains. It is recommended that BTCs should be established and managed by local forest owners. This type of local centre can also have an informational and educational role (an information point for those who would like to produce or use wood fuels).

4.2.5.5. INVESTMENT COSTS

The investment costs are one of the major factors when deciding to switch from fossil to wood fuel. The needed amount of wood fuel in a new boiler house can be calculated from data on past consumption of fossil fuels (in case of the replacement of an old boiler). In the following example, we will foresee the change from heating oil to wood chips.

b) *Calculation based on data on past consumption of light heating oil (the average from the past three years will be taken into consideration)*

- Average annual amount of light heating oil: 23,530 l per year

- Heating value (H_i) heating oil: 10 kWh per l
- Efficiency of the boiler (ŋk): 85 percent

Annual heat production in kWh:

$$\textbf{Heat (kWh per year)} = \textbf{23 530 l} * \textbf{10 per kWh per year}$$

c) *Calculation of the annual amount of wood chips*

- Needed amount of heat: 200,000 kWh/year
- Heating value (H_i) wood chips (M30 percent): 3.4 kWh per kg
- Efficiency of the boiler (ŋk): 80 percent

Estimation of the annual amount of wood chips:

$$wood\ \ chips\ \ (kg/year) = \frac{200\,000\ \ kWh/year}{3.4\ \ kWh/kg * 0{,}80} = 73.530kg\ \ (\approx 75t)$$

In case of wood chips with w = 35%, 75 tons is equivalent to 293 nm^3

c) *Rough estimation of the necessary installed capacity of the wood chip boiler (1,500 working hours per year)*

$$Q\ (kW) = \frac{200\,000\ kWh}{1\,500\ h} * \frac{1}{0.80} \approx 160\ kW$$

For the calculation of wood chip requirements in small-medium size plants, the following empiric formulas may be used:

Boiler capacity in **kW x 2.5** = wood chips requirement in **bulk m^3 per year**

If the plan is to build a new district heating system, data on past consumption in individual houses should be collected as shown in the table in Annex 1. The collected data can be used just as a first estimation. An expert should be consulted for the correct calculation of the installed capacity of the boiler and the dimensions of pipe lines.

4.2.6. 6th step: Evaluation of possible bottlenecks (SWOT analysis)

SWOT analysis is a strategic planning tool which will help identify strengths, weaknesses, opportunities, and threats related to wood-energy supply chain. It is intended to specify the objectives of the chain and identify the internal and external factors that are favorable and unfavorable to achieving our objectives (establishment of wood-energy supply chain).

When identifying the weaknesses and threats it is important to already think about solutions, how will we tackle the barriers when and if it comes to that point.

Table 10: SWOT matrix with question: „Where do you see main strengths, weaknesses, opportunities, and threats related to wood-energy supply chain in your biomass district?"

Strengths	Weaknesses
Opportunities	**Threats**

SWOT should be prepared in one of the workshops together with key stakeholders.

4.2.7. 7th step: Final recommendations for investors and Letters of Agreements between different actors in production chains

The whole wood-energy chain includes different actors; from forest owners, wood fuel producers to consumers e.g. households, park authorities, local authorities, industries in the area. It is important to include identify key actors when establishing the production chain. Within the BIOVILL project an example of model agreement was prepared for the purpose of stakeholders involment (Annex 2). This kind of model agreement will help in further establishment of biomass supply chains and will give a kind of formality and commitment to perform agreed steps in the process.

4.2.7.1. FOREST OWNERS

In many protected areas land is privately owned, whereas properties are often small and fragmented, and forest owners are not interested in forest utilization. The solution to this problem is the early inclusion of forest owners in planning in order to identify their needs and to motivate them for forest utilization. As utilization of small-scale forests is not economically cost-effective, forest owners should act together. If united in some kind of organizational form (i.e. cluster, association, etc.), they will manage a larger forest area, so the problem of small-scale forestry would be overcome. Additionally, they would be able to buy or rent machinery together, and act together in the market and have more competitive prices.

4.2.7.2. MARKET CONDITIONS FOR WOOD FUEL USERS AND PRODUCERS

Improving wood fuel market conditions requires a systematic approach and political commitments, so protected areas as such cannot really influence it significantly. If wood biomass chains are operating in the protected area, an agreement about supplying can be concluded between producers and the park administration. This way, the protected area would use endogenous biomass, and producers would have a market for their products. Also, if wood biomass is being supplied from a protected area, some kind of trademark or brand can be introduced as a way of certifying that wood was obtained in a sustainable way. It is recommendable for producers to assure and certify good quality of wood biomass fuels they produce. The promotion of locally produced wood biomass should be organised by park administration.

Very often, market conditions within the wood biomass production chain itself are weak. This can be overcome by building trust and good business relations between individual actors along the production chain. That is why all the interested stakeholders should be brought together at the very beginning of the planning process.

4.2.7.3. ENVIRONMENTAL RECOMMENDATIONS

Forest utilization in protected areas is often constrained by conservation principles and limitations they impose. Nevertheless, forest utilization in the protected areas is possible with respect to existing limitations. To avoid conflicts that can arise between various stakeholders and sectors operating in the protected areas, careful, integrated and participatory planning of wood mobilization is necessary. Steps of this process are shown on Picture 23.

Picture 24: Steps of integrated land use planning, Source: GIZ, 2012

As most of the protected areas already have management plans, it is possible that not all steps of integrated land use planning are necessary (i.e. steps *Gathering information* and *Analysis*). In any case, special attention must be given to existing limitations as they must be respected. For that purpose, it is advisable to conduct an environmental impact assessment of forestry operations. Step *Plan formulation, negotiation & decision-making* is of the highest importance as that is the only way to avoid or mitigate conflicts and to include all stakeholders in the planning process. This step usually consists of following sub-steps:

- Drafting forest utilization (documents and maps)
- Public presentation and discussion
- Negotiation
- Conflict management
- Voting
- Decision on the land use plan (GIZ, 2012).

The last step is *Implementation, monitoring & plan updating*. This step must not be skipped, as it serves to check whether all activities are running as planned, what arising problems maybe exist, and how forest utilization is influencing ecosystems and species in the protected area.

4.2.8. 8th step: Technical assistance for project documentation preparation and finding funds for investments

In the process of the establishment of biomass energy supply chain a step-by-step implementation is needed. Building biomass energy supply chains needs a support in terms of coordination and organisation, what technical assistance can offer. Technical assistance is crucial to connect different organisations or individuals and help finding the missing links for the chain establishment or encourage and support new ones to develop. By that a chain of all the stakeholders, needed for the establishment, are introduced and collaboration will help to build trust.

Besides organisation and coordination, technical assistance is needed to support stakeholders of the biomass energy supply chain with finding funds for investment and guide them through the process of project documentation preparation as well as through the funding process.

One of the possibilities to fund the technical assistance for establishment of biomass energy supply chains is ELENA - a joint initiative by the European Investment Bank and the European Commission under the Horizon 2020 programme. It provides grants for technical assistance, amongst other on implementation of energy efficiency and distribution of renewable energy projects and programmes. The grant can be used to finance costs related to feasibility and market studies, programme structuring, business plans, energy audits and financial structuring, as well as to the preparation of tendering procedures, contractual arrangements and project implementation units.

ELENA may co-finance investment programmes in the following fields of energy efficiency and distributed renewable energy:

- public and private buildings (including social housing), commercial and logistic properties and sites, and street and traffic lighting to support increased energy efficiency,
- integration of renewable energy sources (RES) into the built environment – e.g. solar photovoltaic (PV) on roof tops, solar thermal collectors and biomass,
- investments into renovating, extending or building new district heating/cooling networks, including networks based on combined heat and power (CHP), decentralised CHP systems,
- local infrastructure including smart grids, information and communication technology,
- infrastructure for energy efficiency, energy-efficient urban equipment and link with transport.

Example of good practice is the project of Goriška lokalna energetska agencija GOLEA (local energy agency) that provide technical support in the frame of the European Local Energy Assistance (ELENA) to help prepare and enable full - scale implementation of a planned investments. They are beneficiary of the project Preparation and Mobilisation of Financing for Sustainable Energy Investments in Primorska Region Municipalities (PM4PM), an investment programme located in 22 municipalities of the Primorska Region of Slovenia to improve the energy efficiency of 97 public buildings through deep renovation and integration of renewable energy sourced heating systems.

Within the project, a Project Implementation Unit was established in order to develop Energy Performance Contracting (EPC) in the region in order to help fulfil energy saving and renewable energy investment potential. The PIU undertook project preparation processes prior to procurement and implementation, including assessing financial structure, financial coverage and economic feasibility of projects. It bears the main responsibility for the preparation of the PM4PM Investment programme.

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6. ANNEXES

6.2. ANNEX 1

An example of a questionnaire for data collection for interested buildings inside the biomass district is presented in table 10.

Table 11: Questionnaire for data collection of interested buildings in the park

Data needed	Public buildings	District heating systems	Park administration buildings
Type of building (school, kindergarten…) and its name or first and last name of the inhabitants	x	x	x
Number of potential buildings to be connected to district heating system		x	
Address	x	x	x
Local community	x		
Number of occupants		x	
Year of construction/age of building	x	x	x
Age of windows and doors (carpentry)		x	x
Daily internal temperature	x	x	x
Heating surface [m^2]	x	x	x
Existing energy source	x	x	x
Average annual amount of fuel (during the last 3 heating seasons)	x		
Use of energy in kWh/y / power of boiler	x	x	x
Year of installation of existing boiler/age of heating system	x	x	x
Annual energy source consumption (e.g. litres)	x	x	x
Hot water (with or without boiler)		x	x
Energy efficient windows and doors (Yes/No)	x		x
Insulation of walls (Yes/No)	x		x
Roof insulation (Yes/No)	x		x
Energy efficiency measures for whole building (Yes/No)	x		x
Year of implementation of energy efficiency measures	x		x

6.3. ANNEX 2

An example of model agreement was prepared within the BIOVILL project for the purpose of stakeholders involment. Marked in yellow needs to be filled in by the involved stakeholders.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement N° 691661

BioVill

Letter of commitment

Project BioVill, with the title "Bioenergy Villages - Increasing the Market Uptake of Sustainable Bioenergy" (Grant Agreement No 691661), supported by the European Union's Horizon 2020 research and innovation programme, is a three year project ending in February 2019, which overall objective is to support the development of regional bioenergy concepts and the establishment of bioenergy villages in target countries.

Core activities of the BioVill project include national and local framework analyses, technological and economic assessments of local bioenergy value chains, development of the institutional set-up and energy management concepts for the potential Bioenergy villages as well as capacity building on financing schemes and business models. Thereby the market uptake of domestic bioenergy supply chains will be increased and the role of locally produced biomass as a main source of energy supply and added value for the local and regional economy will be strengthened.

Major result is the initiation of a bioenergy village in the target partner country up to the investment stage for physical infrastructure, raise of public acceptance and awareness of a sustainable bioenergy production and its commercial opportunities as well as increased capacities of users and key actors in business and legislation to sustainably manage bioenergy villages and to enact national and EU legislation.

The BioVill consortium, who was responsible within the project BioVill, for technical concepts, business models and feasibility checks

and

(Name of village), represented by the involved stakeholders:

- Municipality *(Name)* represented by the Mayor *(Name)* and Deputy Mayor *(Name)*
- Local community *(Name of village)* represented by the president of local comunity *(Name)*
- Working group for the development of village represented by *(Name)*
- Residents of the target village represented by *(Name)*
- …….. (add or delete representatives)

by signing this letter of commitment, we confirm that:

- We were involved in the discussions about the elaboration of the project results, and that the results were presented to us;
- We are committed to reach the strategic bioenergy goals set up during Biovill project
- We are highly interested in the realization of a small renewable district heating grid in *(target village/municipality)*, in order to contribute to the …. (short description on the motivation: could be environmental issues, social issues, etc.).
- We are committed to support the project realization which technical, economical and legal aspects have been presented, under following assumptions given in the feasibility check:

Project partner logo and contact information

Picture 25: An example of the Letter of commitment of involved stakeholders (part 1)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement N° 691661

BioVill

1. The technologies: biomass-based boiler for wood chips (xy% water content) will be used.
2. The heat distribution grid in length of xy m will be built.
3. Total investment costs is estimated to be xy €.
4. The financing scheme will be around: xy € private equity, xy € credit line, xy € connection fees and xy € investment subsidy.
5. The ownership form will be public private partnership.

By signing this letter of commitment, we are also committed to the following tasks:

We, Municipality (*Name*), are .... (short description of the oreganisation(s) and which future role the organisation would have to bring the project to the implementation stage).

We, Local community (*Name*), are .... (short description of the oreganisation(s) and which future role the organisation would have to bring the project to the implementation stage).

We, Working group for the development of village, are .... (short description of the oreganisation(s) and which future role the organisation would have to bring the project to the implementation stage).

We, Residents of the target village, are .... (short description of the oreganisation(s) and which future role the organisation would have to bring the project to the implementation stage).

Place	(Stamp)	Municipality *(Name of physical or legal person)* Sign
Place	(Stamp)	Local community *(Name of physical or legal person)* Sign
Place	(Stamp)	Working group *(Name of physical or legal person)* Sign
Place	(Stamp)	Residents *(Name of physical or legal person)* Sign
Place	(Stamp)	Project partner *(Name of physical or legal person)* Sign

Project partner logo and contact information

Picture 26: An example of the Letter of commitment of involved stakeholders (part 2)

6.4. ANNEX 3

Table 12: Table for data collection on wood biomass potentials

	General information about the biomass district
Topic	Geographic information about the biomass district: location and geographic context (altitude, geo-morphology, extension, etc.) (taken from 3.4.1)
Description	Region, size of the district... Surface: .... km²; Altitude: .... m.a.s.l. *(no more than 250 characters)*
Topic	Climatic conditions
Description	Short description of park area climate: Description of the heating season: Heating season start date: Heating season end date: Average winter temperature: Lowest winter temperature: *(no more than 400 characters)*
Topic	Land use information
Description	Structure of the land use in the park area: Forests: xx%, Agricultural land: xx% from which: orhards xx%, olive plantations xx%, vineyards xx%, other xx% Building land: xx% Other: less than xx% Data source: Comments: *(no more than 250 characters)*
Topic	Population and socio-economic context (only most relevant information related to the forestry sector)
Description	Population: Density: people/km² Average age: Employed and self-employed: % Unemployed: % Agriculture: % farmers (share of population employed within the agricultural and forestry sectors) Forest ownership: % private forests Average size of the forest property: ha Data source: Comments: *(no more than 250 characters)*
Topic	Protected and Natura 2000 areas inside the biomass district
Description	Data relevant for the exploitation of forests: NATURA2000: km² Protected forests: km²

	Comments: *(no more than 250 characters)*
	Information about forest stands in the biomass district (taken from 3.4)
Topic	Forest cover (coniferous, broadleaved forest, other wooded land...)
Description	Forest area: ha (% of total park area) Broadleaves forests: % Coniferous forests: % Mixed forests: % Main tree species: Data source: Comments: *(no more than 250 characters)*
Topic	Growing stock (volume per hectare) and increment
Description	Broadleaves forests: m^3 Coniferous forests: m^3 Average increment: m^3/ha/year
Topic	Non-manageable forest area
Description	Area of non-managed forests: ha Main reason for non-management: *(no more than 250 characters)*
Topic	Accessibility of forests (forest roads) in the park area
Description	Total length of forest roads: km Average density: km/km^2 Total length of forest skidding trials: km Average density: km/km^2 Data source: Comments: *(no more than 250 characters)*
	Figures on wood production in the park area
Topic	Annual wood production
Description	Average annual harvesting: m^3 Structure of annual harvesting: Coniferous: ……% (% of total annual harvest) Logs: % Fuel wood: % Broadleaves: ……% (% of total annual harvest) Logs: % Fuel wood: % Total amount of wood available for energy production from the forests (estimation of theoretical potentials): ………………… m^3
Topic	Figures on biomass production from agricultural areas

	Average annual harvesting: m^3 or tons Structure of annual harvesting: Orhards: ……% (% of total annual harvest) Olive plantations: ……% (% of total annual harvest) Wineyards: ………. % Other: ……. % <u>Total amount of sources available for energy production</u> from the agricultural land (estimation of theoretical potentials): ………………… m^3
Topic	Wood processing industry
Description	Short description of wood industry in the area: No. of sawmills and their annual production No. of paper mills and wood boards producers and their annual production Other relevant information about the wood industry <u>Total amount of wood residues available for energy production</u> (estimation of theoretical potentials): ………………… m^3 (or tons) *(no more than 500 characters)*
Topic	Other land use classes
Description	Fuelwood from other land uses with trees: m^3 (or tons) Other relevant information about land use practices: <u>Total amount of wood biomass available for energy production</u> (estimation of theoretical potentials): ………………… m^3 (or tons) *(no more than 500 characters)*
	CURRENT NATIONAL OR LOCAL POLICIES CONCERNING BIOMASS PRODUCTION (Taken from D3.6)
Topic	Information about regulation or funding in regard to biomass production
Description	Short description of specific regulations that can foster or hinder biomass production in the district area: Available subsidies: *(no more than 750 characters)*

All gathered data should be used for the preparation of the summarizing table below, which serves as a basis for drafting further steps within the planning process.

Table 13: Summarisizng table for wood biomass potentials

Supply parameter	Estimation of theoretical potentials [1000 m³]	Availability for new wood biomass projects (in %)*1
Biomass from forests and other forest lands		
Biomass from agricultural land (vineyards, orchards, olive plantations and other)		
Sawdust and wood residues in wood-processing industry		
Fuelwood from other land uses with trees		

Remark: *1 this percentage is only an estimation, for example it represents the percentage of wood biomass from forests that could be used in a new wood biomass system – the present use of wood biomass in households and other existing heating systems should be taken into consideration.

6.5. ANNEX 4

Table 14: Table for data collection on wood fuel producers – first stage

Company name	Address	Type of wood fuel produced	Company size	Comments
Xy 1		Wood logs Wood chips Wood pellets	Micro SME Large	In the BD area In the surrounding area
Xy 2		Wood logs Wood chips Wood pellets	Micro SME Large	In the BD area In the surrounding area
……		Wood logs Wood chips Wood pellets	Micro SME Large	In the BD area In the surrounding area

The first stage of data collection can be done through desk research (the collecting of data from different resources). After the conclusion of the first stage, some more specific data should be collected and this has to be done through short phone interviews. The data, collected in this second stage, is more detailed (see table below).

Table 15: Table for data collection on wood fuel producers – second stage

Company name	Average annual production (tons*1)	Main source of wood biomass	Main existing buyers	Available wood biomass for new buyers (t)	Quality classes of wood fuel produced*2
Xy 1		Forests Wood industry Non-forest land Other	Households Existing biomass systems / Industry Export Other		
Xy 2					
……					

Remark: *1: Please specify whether fresh or dry tons are reported.
*2: In accordance with relevant ISO standards (ISO/DIS 17225 series (7 parts))

All gathered data should be used for the preparation of the summarizing table below, which serves as a basis for drafting further steps within the planning process.

Table 16: Summarising table for wood biomass producers

Type of wood fuel producers	Estimated No. of producers	Estimated annual production (t)	Available wood biomass for new buyers (t)
Wood log producers			
Wood chips producers			
Wood pellet producers			
Sum			

It is more important to gather data on wood chips and wood pellet producers in the biomass district than to collect the number of wood log producers. It is very common that wood log producers are smaller by scale, are often not registered for the activity and it is consequently harder to locate them.

Forest Bioenergy in the Protected Mediterranean Areas

Municipality of Petralia Sottana

Zadar County

Disclaimer