ID=3762598

FOROPA
Biomass to the Masses

SOUTH EAST EUROPE
Transnational Cooperation Programme

Programme co-funded by the EUROPEAN UNION

Regional Profile of the Biomass Sector in *Slovenia*

Authors:

Matevž Triplat
dr. Peter Prislan
Tina Jemec
Mitja Piškur
dr. Nike Krajnc

Ljubljana, June 2013

www.foropa.eu

Contents

1 Introduction

Wood is the most important renewable energy source in Slovenia. In 2009 more than 330,000 households used wood for heating and this number is still growing. In Slovenia firewood is traditionally used for heating, however in recent year's use of wood chips and pellets increased. The yearly wood biomass consumption depends on the length of heating season and the low winter temperatures. Beside more frequent use of wood in households, number of district heating systems also increased. Nearly 80 % of wood used for heating originates from forest and the remaining 20 % form unwooded areas.

Wood biomass is mainly used (95 %) for the production of heat, especially in households. The main problems are the conventional systems with obsolete technologies with relatively low efficiency and high emissions. Modern technologies are applied progressively. Currently we have in Slovenia a large number of households with wood chips/logs/pellets/briquettes boilers. There are also a lot of houses/villages/ settlements connected to the biomass district heating systems.

In Slovenia, the use of renewable energy is increasing; with 88 % share from traditional sources, solid biomass and hydro energy. In 2010 the share of renewable sources in electricity consumption was 34,4 % (target value is 33,6 %)(UMAR, 2012). Between 2010 and 2011 the use of energy from renewable sources has increased by 6 %, between 2011 and 2012 for 3 % (EBRS, 2012).

Increased use of RES brings many advantages to the country, e.g. they reduce dependence on imported fossil fuels since they are domestic energy sources, Beside, fossil fuels cause high pollution and environmental damage, which is far from the guidelines set by the EU energy and environmental policy. Around 59 % of renewable energy sources are used for heating, and the remaining for electricity production.

2 Condition and structure of regional/national forests

2.1 Geography and topography

Slovenia is characterised by great natural diversity, wide range of geologic conditions, broken relief and different climate conditions (continental, alpine and sub-alpine) on a relatively small area. Due to varied climatic conditions, a highly diverse vegetation structure can be found in Slovenian forests.

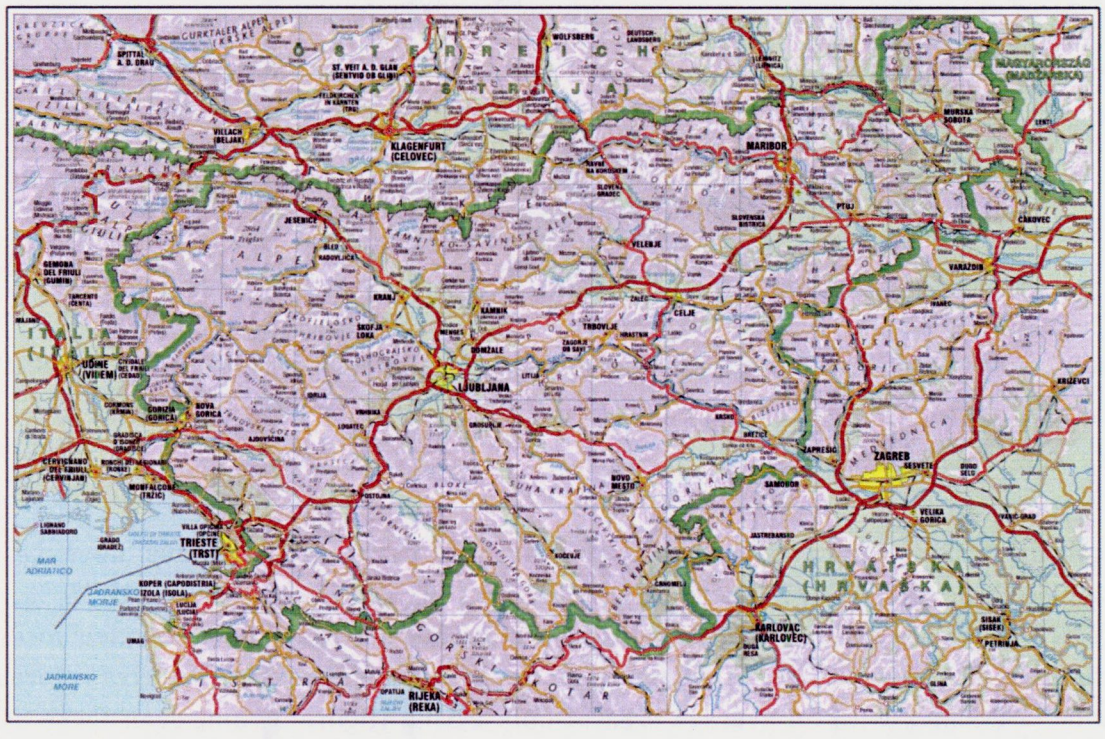


Figure 1 Map of Slovenia 1:1.000.000 (Surveying and Mapping Authority of the Republic of Slovenia)

2.2 Forest condition

With 1.184.369 hectares of forests, Slovenia is among the most forested countries in Europe. More than half (58.4 %) of the country surface are cover different forest types. Most Slovenian forests are located within the area of beech, fir-beech and beech-oak sites (70 %), which have a relatively high production capacity. The growing stock is approximately 334 million m^3. Annual increment is about 8.4 million m^3, but in the last few years the annual cut was between 3.4 and 3.9 million m^3. The difference in numbers shows that the potential of forests in Slovenia is not optimal exploited.

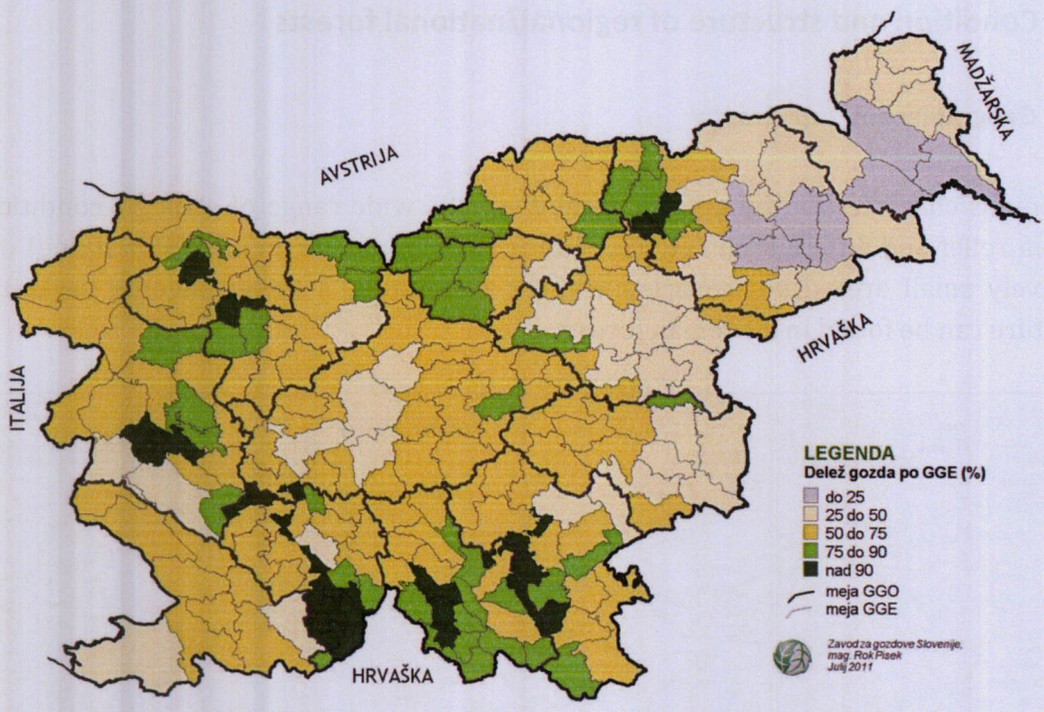


Figure 2 Ratio of forest according to forest management unit in Slovenia (Slovenian Forest Service, 2011)

2.3 Forest ownership structure

According to Slovenian Forest Service - SFS (Poročilo Zavoda za gozdove Slovenije o gozdovih za leto 2011) 77 % of Slovenian forests are privately owned and 23 % of forests are public (owned by the state or communes). Larger and undivided forest estates of state-owned forests enable good professional management. Private forest estates are small, with an average area of only 2,5 ha (figure 3) and even these are further fragmented into several separate plots. For the great majority of these estates forests are not of economic interest. Private forest property is becoming even more fragmented as the number of forest owners is increasing. According to the latest data there are already 313,000 (with co-owners even 461,000) forest owners in Slovenia (SFS, 2010). The major fragmentation of forest property, the number of forest owners and co-owners, present a serious obstacle for professional forest operation managment in private forests, to optimize timber production and utilization of forest potential.

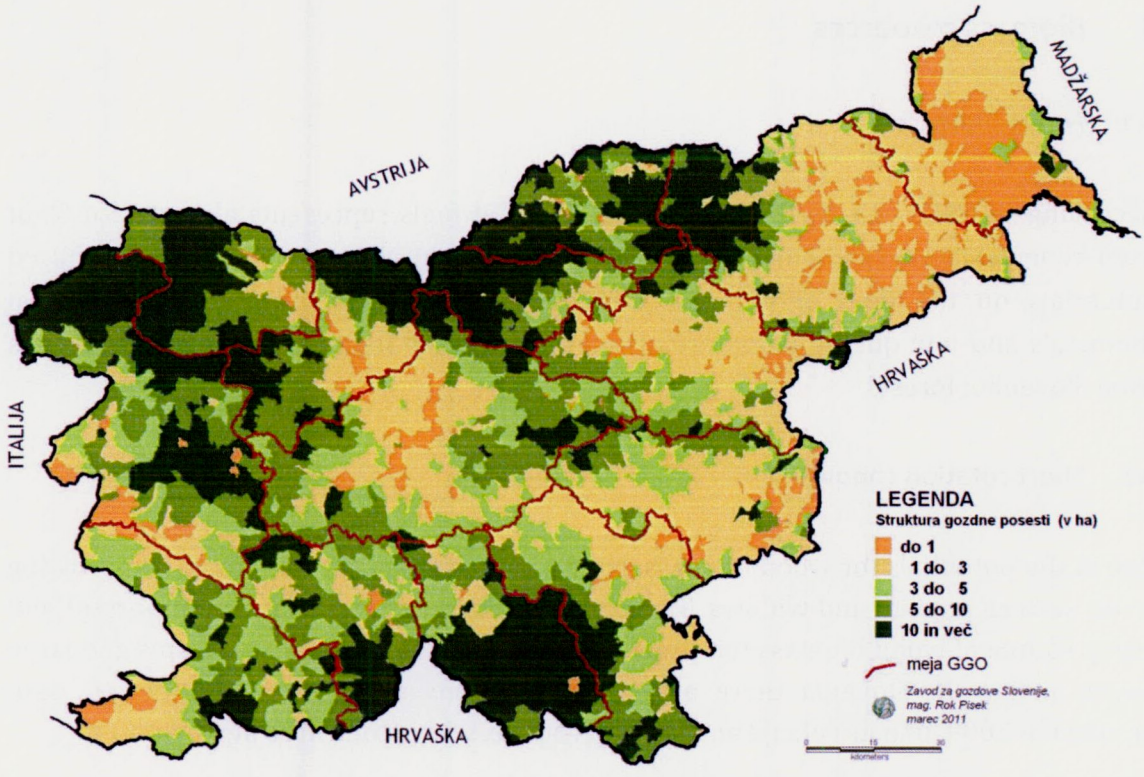


Figure 3 Structure of the forest ownership in ha (Slovenian Forest Service, 2011).

2.4 Forest owner cooperation's (FOCs)

Forest owners have been associated since 1991 in different ways. In the beginning there were forestry cooperatives, agro-forestry cooperatives and machinery rings. In 1999 the Association of forest owners and hunters beneficiaries was founded and in 2000 the Chamber of Agriculture and Forestry of Slovenia. This was followed by a period when many forest owners associations were established. The main mission of the association is to represent and coordinate the interests of its members.

Another aspect of forest owner's cooperation is the accessibility of new forest technologies to private forest owners. In recent year's use of new forest technologies in Slovenian forests increased. Due to the forest estate fragmentation and unfavourable socio-economic structure, exploitation of modern technology in forestry would be questionable in case of private forest owners without integration into forest owners associations.

3 Biomass resources

3.1 Forest biomass

According to EBRS (2012) Biomass and other solid fuels represents almost 75,4 % of used renewable energy sources. As already mentioned above, there are still unused potentials on the field of biomass exploitation. Tree tops, branches, wood from thinning's and low quality wood are also a big potential for production of wood fuels from Slovenian forests.

3.2 Short-rotation coppice

One of the potentials for wood biomass exploitation are also plantations of fast-growing trees, such as poplars and willows. These plantations could represent an important and cheap source of wood biomass for large users such as district heating systems and large power plants. In Slovenia there are two plantations of fast-growing species, both founded in 2009, one in Velenje and one in Trbovlje, with a total area of 6 ha.

Analysis of the situation on the Velenje plantation showed that the conditions for the growth of trees (*Salix* sp., clone *Tordis* and *Inger*) are suitable. The amount of produced biomass yield in the year 2012 was 27,3 t atro/ha (*Tordis)* and 9.2 t atro/ha (*Inger*). The main reason for the lower total yield of wood biomass for clone *Inger* lay in smaller diameters and, consequently, volume.

According to our opinion, the plantations of fast-growing trees in our country are less important, since there is enough suitable wood for wood biomass production in Slovenian forests. Besides, there is also a question/dilema about exploitation of fertile land for such purposes. As well as we do not have enough degraded land for the establishment of these plantations.

3.3 Wood residues

Production of wood chips from forest residues is not a common practice, the main barrier are harvesting technologies and the economics aspect. In addition, production costs (transport of forest residues to skidding trails or forest roads, producing wood chips on a forest road or trail etc.) play an important role.

In Slovenia motor-manual harvesting is still the most common approach. With such techniques removal of forest residues is time-consuming and difficult. In last year's harvesting with special machines was introduced and we are in the process of estimation of costs for green chips production. We already have some case studies for production of green wood chips where cable-yards were used (alpine space) and

currently we are measuring the exploitation of forest residues from different types of forest using different combinations of mechanization.

3.4 Agricultural biomass

One of the sources of wood biomass are: wood from shrubs, residues/remains of maintenance activities in orchards and vineyards, parks and green areas but also cleaning wastes of pastures and other agricultural or urban land. Possible potential of biomass obtained outside the forest areas needs to be evaluated. According to the study done by Slovenian forest service, the potential of wood biomass outside the forest is 270.000 m^3 per year.

4 Wood and Biomass use in Slovenia

4.1 Production and demand of biomass in Slovenia

As already mentioned, the most commonly used wood fuel type in Slovenia is firewood, but the use of wood chips and pellets increases rapidly. Increasing number of households decide to use wood fuels instead of fossil fuels for heating. Data from SORS (Statistical office of the Republic of Slovenia) for 2011 show that households consume 1,137,000 tons of wood fuels with a predominance of wood logs (1,100,000 tons). In year 2011 around 1,700,000 m^3 of roundwood were used for energy purposes (including bark), 70 % of which was used in households; the other 30 % were used in large energetic systems.

4.1.1 Wood chips

In July 2011 a study about state of the art of wood chips and firewood production was performed within the project *Biomass Trade Centre 2*. A database was set up with 122 wood chippers all around Slovenia (Krajnc and Čebul, 2012).

We divided wood chippers in three categories, according to their power on small, medium and high power wood chipper. In Slovenia middle size chippers (capacity from 5 to 50 loose m^3/hour) are predominant with 60 % share followed by large chippers with 36 % and small chippers with only 4 %. Most chippers are in Central Slovenia region, followed by Upper Carniola (Gorenjska) and Savinja region (figure 5). Among the trademarks of small and medium chippers dominates domestic manufacturer Bider Bojan s.p. – Kmetijski stroji (figure 4) with 53 registered machines and Austrian manufacturer Eschlböch with 26 chippers. In the category of large chippers there are 11 Austrian chippers Mus-Max. In addition to these brands we also recorded trademarks: Heizohack, Pezzolato, Starchl, Jenz, Doppstadt, Bentele, Comptech, Junkkari, Willibald, Bruks, Woodsman and others.

Figure 4 **Slovenian manufacturer of wood chippers- Bider Bojan s.p. – Kmetijski stroji**

Despite higher number of medium chippers, the vast majority of all wood chips are produced with large chippers. The data show that the biggest producer of wood chips is Savinja region, followed by Central Slovenia, Southeast Slovenia, Mura, Inner Carniola-Karst and Upper Carniola region. Given, these are the regions with a high number of large chippers with a capacity over 50 nm^3/h. Production in other statistical regions is significantly smaller. The analysis also showed that the actual production of small chippers is negligible.

Figure 5 **Wood fuel producers in Slovenian regions**

The data obtained in our study show that the actual production of wood chips in 2010 was around 850,000 loose m^3. According to data from the study in 2008 the production of wood chips increased significantly. Production of wood chips in 2007 was estimated at 460,000 loose m^3. This means that in the past four years the number of chippers highly increased (for 97 %), from 62 to 122 chippers. The production of wood chips increased for 85 %. In 2010, 31 % of the input raw material for wood chips production presented low quality wood, while the remaining 69 % were wood removals and wood residues from wood processing industry.

The average transport distance of wood chips in Slovenia is 40 km. 18 % of all wood chips producers export wood chips abroad. In 2010 they exported 27 % of wood chips produced in Slovenia. According to external trade data (SORS), in 2010 278,400 m^3 of wood fuel were exported and 113,300 m^3 of wood fuel were imported.

4.1.2 Firewood

In the same study by Krajnc and Čebul (2012), we collected data of 125 firewood processors and wood splitters. This represents a low percentage of firewood processors and wood splitters, since it was impossible to include also those for personal use. According to SORS Slovenian households use about 1.1 million tons of firewood every year.

4.1.3 Pellets

The production of wood pellets was relatively constant between 2006 and 2011. According to wood pellets producers around 55.000 to 60.000 t per year of pellets were produced. In this period two large producers with yearly production above 15.000 t and four small producers were recorded. A detailed study of wood pellets production carried out in 2013 revealed that five new producers started with pellet production in year 2012 and in year 2013 three additional ones will start production. So we can expect to have 14 producers of pellets in 2013 in Slovenia.

According to the data gathered, the total pellet production in 2012 was more than 83.000 t. According to the planned new plants and the projected increase of production in existing plants we can estimate that the production of wood pellets in year 2013 will exceed 100.000 t.

Most of Slovenian producers are relatively small (average annual output is below 10,000 t), they don't have organized their own delivery system and they are mainly oriented to the local/regional market. On the contrary, our biggest producer with an annual production of 50,000 t is highly export-oriented.

Currently, most manufacturers offer pellets in 15 kg bags, which is generally intended for those who use pellets in indoor fireplaces or furnaces, and not for central heating of the whole household. Because houses have to small storage places for the fuel and the delivery with trailer, they often use 15 kg bags also for central heating.

4.2 Energetic use of Biomass

Despite the fact that Slovenia is rich with the forest biomass, its energy exploitation is rather poor. Most of the biggest cities in Slovenia have installed district heating systems powered by natural gas or coal. The promotion of the biomass district heating systems on the national level started with the project GEF in the year 2001, in the frame of that project several district heating on the biomass were co-financed.

According to the available data in Slovenia more than 40 district heating systems in range of the 85 kW to max. 152 MW are installed. Total power installed in all district-heating systems in Slovenia is estimated at 235 MW with the heat production of 212 GWh/a and electricity production of 31 GWh/a.

The biggest producer is TE-TOL Ljubljana with installed 152 MW power on biomass. Its yearly production of the heat is 60 GWh/a, electricity production 31 GWh/a with the wood chips consumption of 63,000 t/a.

According to estimates by SORS and SFI, around 180.818 tons of wood biomass (which is 30 % less than in 2008) was used for energy and heat production for larger energy systems in 2010. The main reasons for this decrease was the reduced use of wood biomass in two largest thermal power plants in Slovenia (co-incineration of wood and coal) and reduced use of wood biomass in industry (predominantly the wood processing industry). We estimate that the decreasing trend of wood biomass use in the wood processing industry has stopped and shall remain on a similar level also in the next few years.

4.3 Costs of solid biofuels

Prices of wood fuels are rising in last year's, however it is difficult to follow the trends, since an official system for monitoring wood fuels prices don't exists in Slovenia. The SORS is collecting only data about the average prices of wood fuel. According to this data the prices of wood fuel (deciduous trees) increased for 20 % between 2010 and 2011 and decreased for 4 % between 2011 and 2012. Average price of wood fuel (deciduous trees) in 2012 according to SORS was 38,07 €/m^3.

SFI controls/monitors wood fuel prices in selected European countries in the frame of IEE project BiomassTradeCentre2. During the project period data on wood fuel prices are collected in partners countries (Austria, Croatia, Germany, Greece, Ireland, Italy, Romania, Slovenia and Spain) at the beginning and at the end of each heating season. Prices for the following wood fuel categories are collected for:

- firewood with the length of 25, 33, 50 and 100 cm, and moisture content of 20% or 50%,
- wood chips category's P16, P31.5, P45, P63, P100, and water content of 20%, 30%, 40% or 55%,

- wood pellets: price per ton, the price for a bag (15 kg or 20 kg), with a water content of 10%,
- wood briquettes: price per ton, the price for a bag (10 or 15 kg), with a water content of 10%.

4.3.1 Price for wood chips

According to SFI monitoring of wood fuel prices the average price of wood chips (P31,5; M = 30 %) in 1st half of year 2013 in Slovenia was 86,6 € per ton dry matter, collected prices were in the interval between 84 and 93 € per ton dry matter (including VAT).

4.3.2 Price for wood pellets

SFI is also collecting prices of wood pellets. Average cost of wood pellets (6 mm, M=10 %) packed in 15 kg bags in March 2013 was 243 €/t including VAT (in the interval of 220 – 250 €/t). The current price (March 2013) for loose pellets is 222 €/t including VAT (in the interval of 216 – 228 €/t). Prices do not include the transport of pellets.

4.4 Technical standards for solid biofuels

In Slovenia currently we do not have a national scheme or national brand for wood fuels, but we see that more and more customers, especially from abroad, require a certificate of wood fuel quality and source of raw material. Certain domestic producers are also considering obtaining foreign trademarks for wood fuel. There is also increasing interest from wood fuel suppliers for laboratory analysis of quality of their wood fuel. As a member of CEN, Slovenia has adopted all EN standards into national standardisation. The most important standards related to wood solid biofuels of EN 14961 series has been adequately adopted.

4.4.1 Standards for wood chips

Slovenia doesn't have its own standards for wood chips, therefore European standards were adopted. The main standards for wood chips used in Slovenia are EN 14961-1 and EN 14961-4. Standard ÖNORM M 7133 was also quite relevant in the past.

4.4.2 Standards for wood pellets

Manufacturers that indicate on the package that their product meets the specific standard, they commit to abide it. Most of the pellets sold in Slovenia do not have any certificate, but there are some producers and traders interested for quality assurance of pellets. Self-declarations based on occasional laboratory tests are quite common on packaging and as such indicating selected values for parameters of pellet's quality according to some selected criteria obtained from EN 14961-1 and EN 14961-2.

Enerles d.o.o., is one of the major manufacturers of wood pellets in Slovenia, received in 2013 as the first manufacturer of pellets in Slovenia, the Quality Certificate ENplus

pursuant to the European EN 14961-2 Standard. The Enerles pellets meet the A2 quality grade. In the past the company possessed also Pellet Gold mark.

5 Forest Infrastructure and logistics

5.1 Forest road infrastructure

The actual use of wood fuel from forests is mainly dependent of forest openness for machinery and rational removal of wood to the point of processing or final consumption. According to the records of forest roads, led by the Slovenian Forest Service, there were 12,023 km of forest roads and additional 489 km of forest roads designed for fire protection in year 2011 (Poročilo Zavoda za gozdove Slovenije o gozdovih za leto 2011). 67 % of all forest roads are in private forests and 33 % are in state forests. According to estimations there are around 50.000 km of skidding trails in Slovenian forests. The average density of forest roads in state forests is 12.8 m/ha and in private 10.3 m/ha.

Construction of skid trails in recent years has reached the planned goals, while the construction of forest roads stayed behind the plan. This is noticeable especially in private forests, where the owners do not have sufficient funds for the construction (forest road: 40-80 €/m; skid trail: 7-21 €/m).

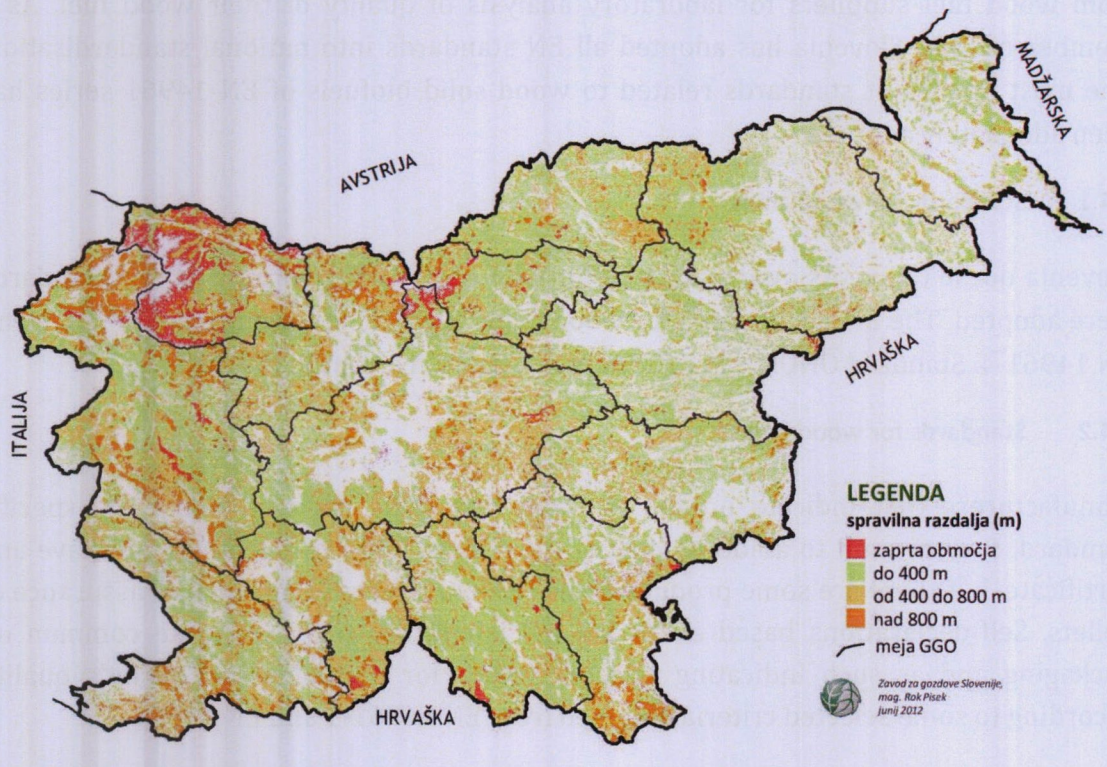


Figure 6 The skidding length in meters in Slovenia

5.2 Biomass supply chain

The production/supply chain depends on forest type/condition, forest management plan, forest accessibility and the timber quality. Besides, available technologies, current market situation, economy and logistic plays also an important role.

Three typical/most common supply chains for Slovenia have been reviewed and analysed within the FOROPA project:

- "Large scale forest – sawmill/CHP plant" supply chain,
- "Small scale forest – boiler house" supply chain,
- "Raw material – Pellet end user" supply chain.

5.2.1 Actors in the supply chain

Following actors are involved in the analysed supply chain's:

- Large/medium/small forest owners
- Forestry service,
- Logging company,
- Transport company,
- Primary processing,
- Consumer

5.2.2 Chain 1: Forest Association (large scale forest) – CHP

The "Large forest – CHP plant" chain involves processes from large scale forest (Forest Association) to the CHP plant. To start the activates within the chain **Forest Resources Management plan** must be provided by Slovenian Forest Service (where the annual cut is foreseen) for the particular forest area (owned by Forest Association). **Contracts or/and purchase agreements** are then signed between harvesting (logging) companies, wood chips producers or transportation service companies, sawmills and CHP plants. After **harvesting,** *roundwood* is inspected (on the forest road) by **manipulator** on quality and quantity and after shipment acceptance, the timber is **transported to sawmill**. The **Administration/Invoicing activities** are following between Forest Association and the sawmill company. *Logging residues* are **dried at the forest site** (to reduce moisture content) after harvesting and then **chipped at the road site**. The wood chips are then **transported** to the storage place at CHP plant where sorting and measurements (**manipulation**) takes place. CHP plant has further obligations with payment (**administration/Invoicing**) to the forest association who divide the paid amount among the contractors in the whole supply/production chain.

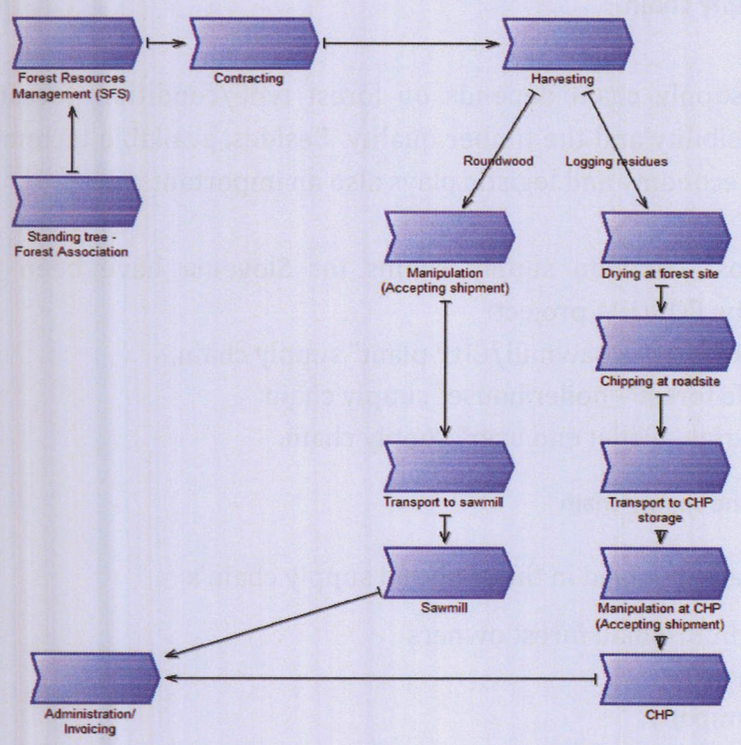


Figure 7 Process model for "Forest Association (large scale forest) – CHP" supply chain

5.2.3 Chain 2: Small scale forest owner – Boiler house

The "small scale forest - boiler house" chain describes processes from small scale forest to the boiler house. Similar then in above described process, the **Forest Resources Management plan** must be provided by Slovenian Forest Service for the particular forest area (owned by small scale forest owner). **Contracts or agreements** are then signed with the end user about type, quality, quantity and price of wood fuel. In this case **harvesting** is performed manually by the small scale forest owner, with chain saw and forest tractor. The logs and logging residues are then transported to the storage site, where the raw material is **dried**. **Wood chips are produced** also by the forest owner with a wood chipper. Wood chips are then **transported to the end user** where the product is inspected (shipment acceptance) weather it meets the agreed requirement form the contract. The wood chips are then **stored at the end user** till the combustion in the **boiler**. At the end wood chips are being paid according to heat produced (MWh) to forest owner.

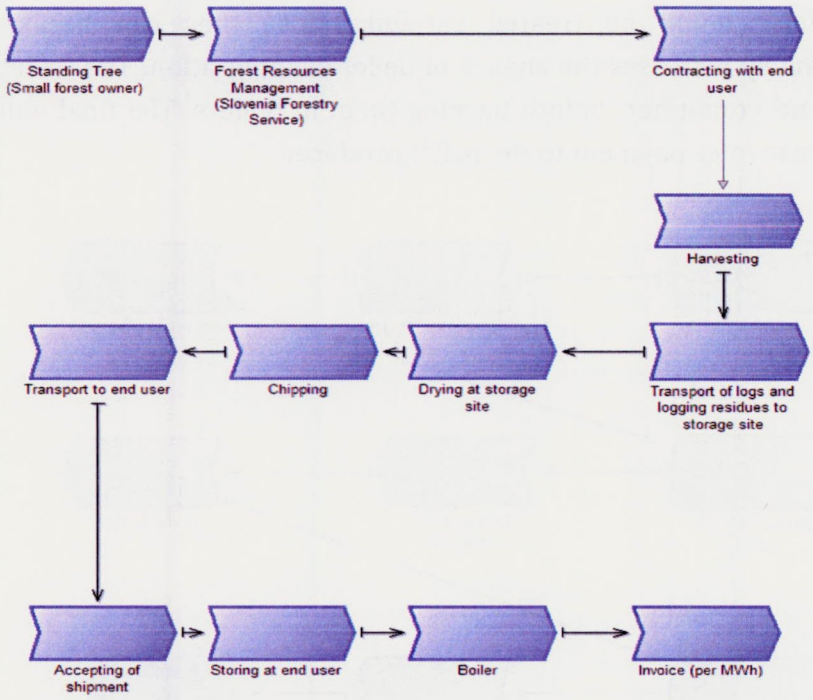


Figure 8 Process model for "Small-scale forest owner – Boiler house" supply chain

5.2.4 Chain 3: Raw material – Pellet end user

In the presented distribution chain the **raw material** is meant like a starting point e.g. in form of sawmill residues. At this stage the information about raw material origin are crucial, since it is an important quality indicator for the later end product (pellets). The **transport** of raw material to the pellet plant is mostly performed by containers for bulk material. At the pellet plant raw material is checked by quality and quantity (e.g. weighting of full and empty truck) and if the requirements are being fulfilled the shipment can be **accepted**. The material is then unloaded at the **storage** site of the pellet plant. **Drying** of raw material is important and expensive process before grinding of raw material. At this stage several different techniques/approaches are possible, but the output must be a dry material (10-12% of water content). **Palletisation** is performed in successive stages: (I) Milling and conditioning, where raw material is being reduced in size. At these stage final pellet particles size and their homogeneity need to be considered, since they have a significant impact on product quality. Sometimes different types or amounts of additives are added to increase pellet durability. (II) The main process in pellet production is compression in the press, where matrix (bores) geometry and roller press temperature have a great influence on product quality. After pelletizing the pellets are hot and humid and need to be dried and cooled down (**technical drying**). This phase takes place on the conveyor belt where ventilators are blowing dry air form side (the drying time can be regulated with the length of conveyor belt). **Packing and labelling** is following in different amounts; for households 15kg bags are usually prepared and for larger orders big-bags or silo are filled. During the

transport, pellets should be treated carefully since they can break. Frequent manipulation namely increases the chance of pellet disintegration. The pellets are then **stored at the end consumer**, before burning them in boilers. The final obligations of the consumer are invoice payment to the pellet producer.

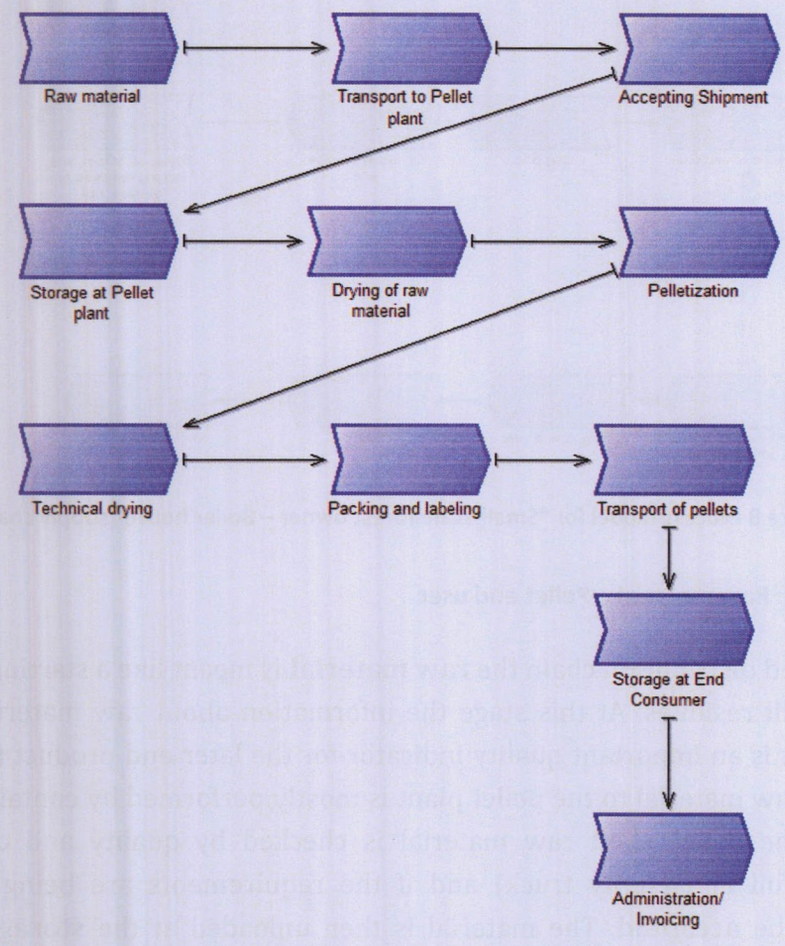


Figure 9 Process model for "Raw material – Pellet end user" supply chain

6 Stakeholders

The main relevant stakeholders are presented and described in the chapter below.

6.1 National stakeholders

6.1.1 National consortium of local energy agencies

Local energy agencies (LEA) are public institution financed by different amount of municipalities. LEA is working in accordance with local and national programs concerning renewable energy source and rational use of energy as a promoter. The main objectives, that LEA follows, are:

- promotion of use of renewable energy sources and efficient use of energy in the region;
- to guarantee the continuity of the agency's activities and
- to relay European energy policy at the local level.

The mandate of the LEA is enhancing the sustainable energy development in different regions with the developing projects, studies, documents, and with helping the municipalities to find the financial sources for projects and investments in energy sector, to control implementation (technical supervision) and to transfer sustainable energy technologies from universities, institutes, companies, especially from EU countries in order to find appropriate, sustainable and economically feasible measures to decrease energy consumption, to increase energy efficiency and to implement renewable energy sources (LEA 2013).

6.1.2 Biomass trade centres in Slovenia

Since 2008, four Biomass Trade Centres (centres with optimized logistics and trading organization where different biomass fuels are marketed at guaranteed quality and prices) are operating across Slovenia. Together, they are producing around 120.000 bulk cubic meters of chips. Their main activities are also energy contracting, wood biomass supply, district heating system installation and maintenance etc.

6.1.3 Forest owners association of Slovenia

Forest owner association of Slovenia was found in 2006 and links 11 local associations of forest owners. The goals of the organization are:

- representation and coordination of member interests;
- promotion and development of private forest sector as part of the development of rural areas;
- increasing the positive effects of sustainable forest management among private forest owners;
- promoting education and awareness in all fields of forestry;

- publishing of informative, professional, educational and other forestry related literature.

6.1.4 Chamber of Agriculture and Forestry of Slovenia

Chamber of Agriculture and Forestry of Slovenia is the umbrella interest organization of natural and legal persons in the Republic of Slovenia engaged in agriculture, forestry and fishery. Its central task is to protect and represent their interests, to consult them and accelerate economical and environment friendly activities.

Preferential tasks of CAFS are:

- acceleration of development and improvement of economic conditions,
- assurance of specialist services operation,
- co-formation of legislation,
- improvement of social conditions in life,
- keeping settlement of Slovenian rural areas,
- promotion of Slovenian agriculture at home and abroad.

7 Future scenarios

Slovenia prepared a national action plan for renewable energy sources (NREAP) for the period 2010 - 2020. In this plan wood biomass is defined as the most important renewable source of energy, followed by hydro energy, solar energy and biogas.

The goals of Slovenian energy policy for renewable energy sources are:

- ensuring 25% of renewables in the final gross consumption and a 10% share of renewables in transport by 2020;
- halting the growth of final energy consumption,
- implementing energy efficiency and use of renewable energy sources as economic development priority,
- increasing the share of renewables in the final energy consumption up to 2030 and beyond.

Increased biomass use in modern individual, communal and industrial heating appliances for heating, process heat and generating electricity is important for Slovenia to improve the reliability and competitiveness of its energy supply, to reduce greenhouse gas emissions and to protect the environment. As a primary energy, biomass also has an important part to play in transport (NREAP, 2010).

Share of RES (including non-renewable industrial waste and hydro energy) in the year 2011 in final energy consumption, calculated according to EU methodology, was 20,1 %, which is 0,2 % more than in year 2010. The desired goal (25 % by 2020) will be difficult to achieve without a strong incentive to increase efficient use of RES (EBRS, 2012). In the NREAP it is projected that in year 2015 in Slovenia the supply of wood biomass from

forests and other wooded land for energy production should be 1,302,000 m^3 and 1,338,000 m^3 in 2020.

According estimates, around 2.752.000 m^3 of wood biomass will be available in 2020 for energy exploitation, which is around 43% more than in 2010 (Action plan "Les je lep", 2012). In the Slovenian strategy for exploitation of biomass from agriculture and forests for energy production the potential for energy acquisition from forest biomass is estimated at 6.598 GWh/a of heat and 326 GWh/a of electricity.

According to NREAP, the required share of renewable energy sources in final energy consumption in 2020 will be achieved from domestic sources.

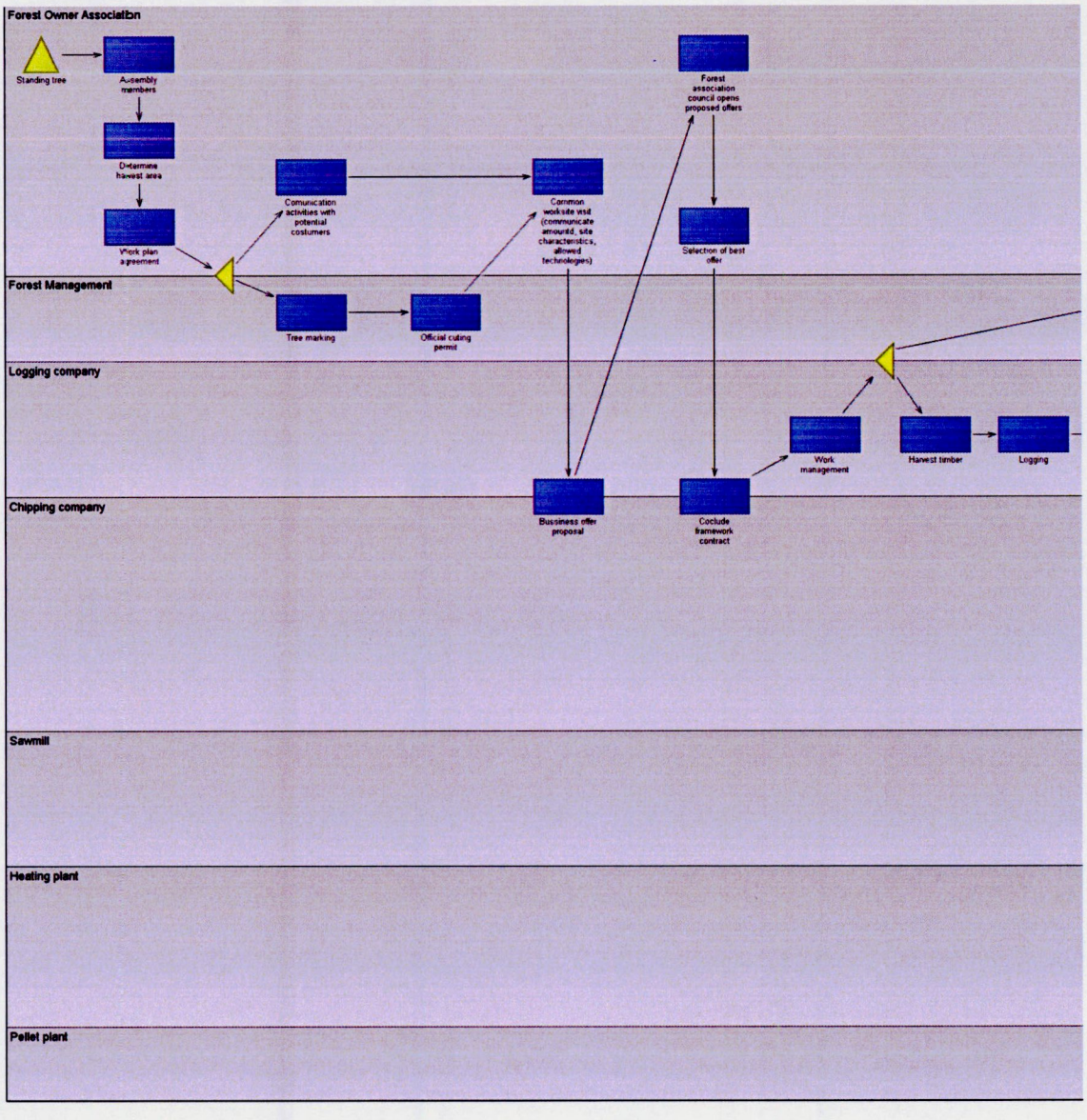
8 Annex

8.1 Annex 1: regional SWOT(S)

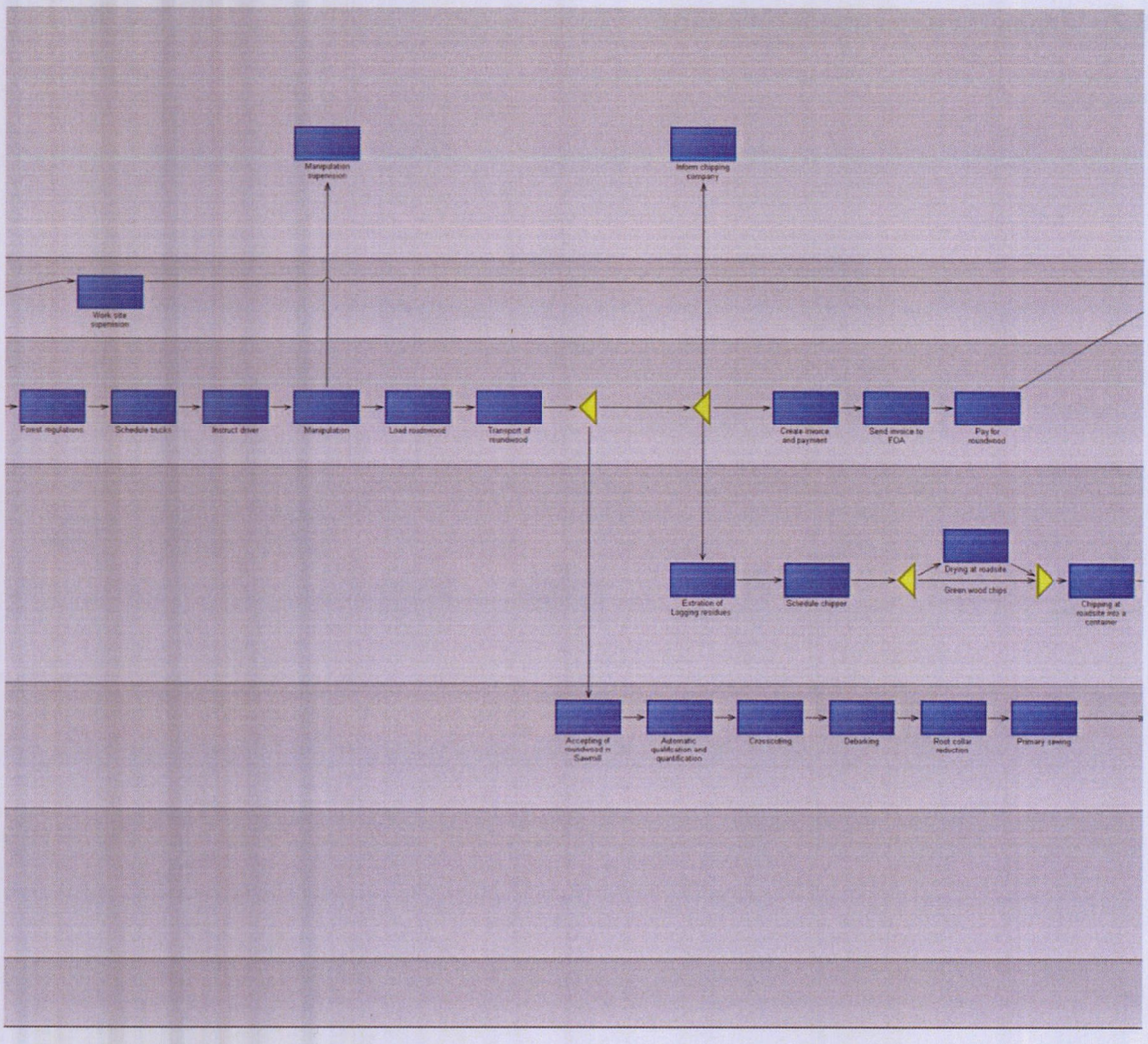
Forest Association (large scale forest) - CHP

Internal strengths	Internal weaknesses
S1. TRANSPARENCY OF OPERATION FOR ALL MEMBERS OF FOREST ASSOCIATION S2. STRONG SUPERVISION OF LOGGING AND SALES S3. OVERVIEW OF ENTIRE PRODUCTION CHAIN S4. COVERING ENTIRE SUPPLY CHAIN (CHIPING CO.) S5. OWN RAW MATERAIL (CHIPING CO.) S6. LOCAL MARKET - MAX. 30 KM (CHIPING CO.) S7. INTERNATION MARKET FOR GREEN WOOD CHIPS S8. SIZE OF PRODUCTION S9. NO COMPETITION IN SURROUNDING AREA	W1. PARTIAL INTEREST (FA) W2. SALE OF WOOD TO MEMBERS (FA) W3. CONTINUING INVESTMENTS IN PRODUCTION CHAIN W4. UNPREDICTABLE DELAYS (FAILURES), MAINTENANCE W5. HIGH INVESTMENTS W6. FLEXIBILITY OF PRODUCTION W7. SIZE OF PRODUCTION W8 HUMAN RESORCE MANAGEMENT W9. LACK OF ICT (FOREST MANAGEMENT)
External opportunities	**External threats**
O1. SETTING UP BIOMASS LOGISTIC TRADE CENTER (ORGANIZATION OF MORE SUSTAINABLE SUPPLY) O2. INVESTMENTS IN TECHNOLOGIES (TWO STAGE TRAILER, SMALL STORAGE TANK ON CHIPPER, etc.) O3. COMMON ORGANIZATION OF CHIPPING ALONG SMALL COSTUMERS (COVERING MORE COSTUMERS WITH ONE TRANSPORT OF CHIPPER) O4. EARLIER FIRST APPROCH (FOR NEEDS OF ORGANIZATION)	T1. QUALITY ASSURANCE/QUALITY CONTROL T2. CURRENT SITUATION ON MARKET (PAYMENT DICIPLINE IS VERY BAD) T3. PRODUCTION DEVELOPMENT IS TO MUCH DEPENDING ON MARKET DEVELOPMENT T4. FOREST MANAGEMENT (TO MUCH ADMINISTRATION) T5. FOREST MANAGEMENT (TREE MARKING IS NOT FOLLOWING THE NEED OF MARKET) T6. UNPREDICTIBLE WEATHER

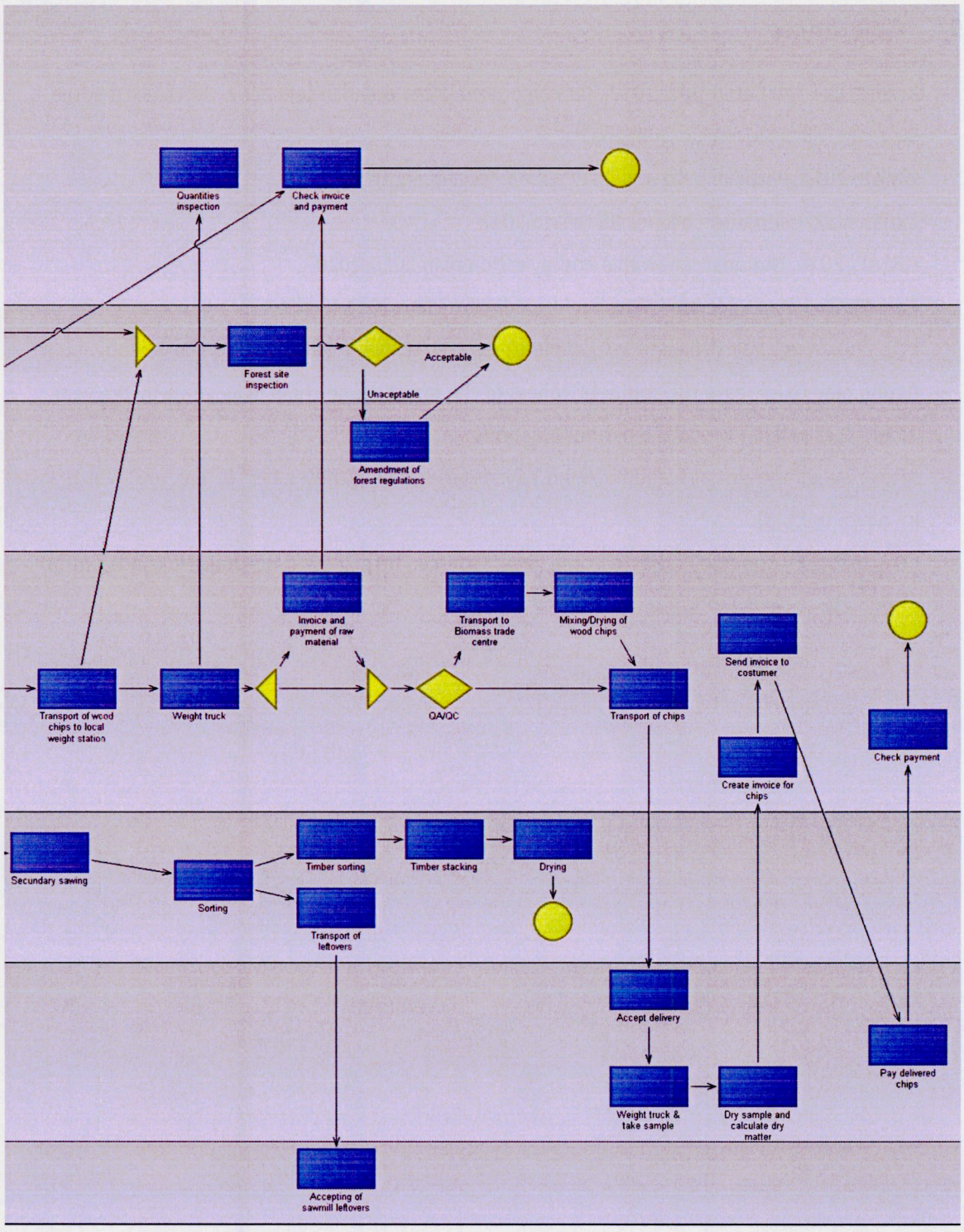
8.2 Annex 2: Process model in 3 parts



1/3


Manipulation supervision
Inform chipping company
Work site supervision
Forest regulations
Schedule trucks
Instruct driver
Manipulation
Load roundwood
Transport of roundwood
Create invoice and payment
Send invoice to FOA
Pay for roundwood
Drying at roadsite
Green wood chips
Extration of Logging residues
Schedule chipper
Chipping at roadsite into a container
Accepting of roundwood in Sawmill
Automatic qualification and quantification
Crosscutting
Debarking
Root collar reduction
Primary sawing

2/3


Quantities inspection
Check invoice and payment
Forest site inspection
Acceptable
Unaceptable
Amendment of forest regulations
Invoice and payment of raw material
Transport to Biomass trade centre
Mixing/Drying of wood chips
Send invoice to costumer
Transport of wood chips to local weight station
Weight truck
QA/QC
Transport of chips
Check payment
Create invoice for chips
Secundary sawing
Sorting
Timber sorting
Timber stacking
Drying
Transport of leftovers
Accept delivery
Pay delivered chips
Weight truck & take sample
Dry sample and calculate dry matter
Accepting of sawmill leftovers

3/3

9 References

- Krajnc Nike and Čebul Tina, 2012. Katalog proizvajalcev polen in sekancev. Gozdarski inštitut Slovenije, Silva Slovenica, Ljubljana.
- UMAR, 2012. Poročilo o razvoju 2012. Obnovljivi viri energije.
- EBRS, 2012. Energetska bilanca RS za leto 2012
- NREAP, 2010. National renewable energy action plan 2010-2020
- Poročilo Zavoda za gozdove Slovenije o gozdovih za leto 2011 (Source: http://www.zgs.gov.si/fileadmin/zgs/main/img/PDF/LETNA_POROCILA/2011_o_gozdovih.pdf)
- Action plan to increase the competitiveness of the forest-wood chain in Slovenia by the year 2020 – 'Les je lep' ('Wood is beautiful') (Source: http://www.mgrt.gov.si/fileadmin/mgrt.gov.si/pageuploads/DPK/3_Les_je_lep_naslovnica_kazalo_novo_pdf.pdf)
- LEA, 2013, LEA Spodnje Podravje Home Page, (Source: http://www.lea-ptuj.si/uk/index.html)