

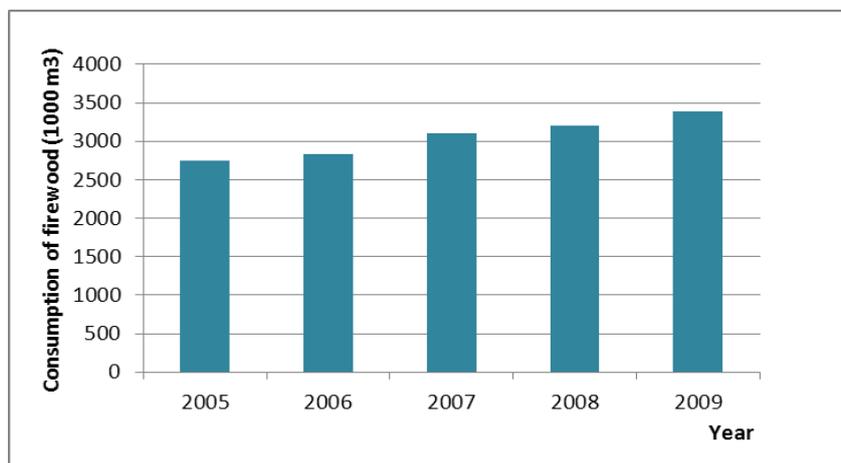
SLOVENIA

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39. Introduction

Wood is the most important renewable energy source in Slovenia. In 2009 more than 300,000 households used wood for heating and this number is still growing (picture 22). In Slovenia firewood is traditionally used for heating, in recent years also use of wood chips and pellets has grown. Use of wood biomass per year varies depending on the length of heating season and the lowest winter temperatures. In addition to the use of wood in households there is also increase of district heating systems. Most of the wood consumed for heating (80 %) comes from forests, while the remaining 20 % consists of other types of trees or roundwood from unwooded areas.



Picture 20. Display of firewood consumption for heating households in Slovenia from year 2005.

Statistical data on production and use of wood biomass are gathered at the national level because of small size county, as well as our estimates are made at the national level. That is why this report is for the entire country, not only for the selected region.

In Slovenia, the use of renewable energy is increasing; more than 80 % of it is from traditional sources, solid biomass and hydro energy. For year 2010 it is estimated that the share of renewable sources in electricity consumption was close to the target of 33.6 % (UMAR, 2011). Between 2009 and 2010 the production of renewable energy sources has increased by 8 %. Among those the highest increase was due to production of energy from biogas, for 80 % (Annual energy statistics, 2011).

For Slovenia it is determined that within the framework of EU objectives by 2020 should reach at least 25-percent share of RES (renewable energy sources) in gross final consumption. Based on this the Government accepted an Action plan for renewable energy sources for the period 2010 - 2020 in July 2010 (AN RES), which specifies the sectorial targets and measures for achieving the goals. Share of RES (including non-renewable industrial waste and hydro energy) in the year 2010 in final energy consumption, calculated according to EU methodology, was 19.4 %. The desired goal (25 % by 2020) will be difficult to achieve without a strong incentive to increase efficient use of RES (UMAR, 2011).

Increased use of RES brings many advantages to the country, because they are domestic energy sources that can help to reduce dependence on imported fossil fuels. In the process of exploitation in thermal power plants fossil fuels cause high pollution and environmental damage, which is far from the guidelines set by the EU energy and environmental policy.

Amongst renewable energy sources wood biomass represents 53 % and hydro energy 38 %. Most renewable energy sources (59 %) are consumed in heating purposes, the remainder for electricity production. Biomass is mainly used (95 %) for the production of heat, especially in households. The main problems are the conventional systems with out of date 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 the Action Plan for Renewable Energy for the period 2010-2020 it is projected for Slovenia that in year 2015 the supply of wood biomass from forests and other wooded land for energy production should be 1,302,000 m³ and 1,338,000 m³ in 2020. Based on the analysis of timber flows and roundwood balances in Slovenia (KRAJNC / PIŠKUR 2006, KRAJNC / PIŠKUR 2008) we can conclude that around a quarter of roundwood, which comes directly from the forest, is used for energy purposes, but primarily to cover the needs of households.

Slovenia wishes to promote and hasten, among other renewable energy sources, the use of wood for the production of electricity in the ensuing few years, therefore in 2009, the government adopted two regulations: the Regulation on supports for the electricity

generated from renewable energy sources (2009), which was amended in 2010 and 2011, and the Regulation on supports for the electricity generated in cogeneration with high efficiency (2009), which was amended in 2010 and 2011.

40. Wood biomass market

The market for all wood fuels in Slovenia is developing rapidly. The State has also contributed to this trend with co-financing the initial investments in modern boilers for central heating and support for the promotional projects. With the rising price of fossil fuels in recent years, wood as a domestic, renewable and affordable energy source become important again.

In Slovenia, all state owned forests are being certified with FSC certificate (244,000 ha) and also four major private forest owners with a total area of 15,600 ha have been certified through group certification. A total of 286,000 ha of certified forests, representing 21 % of all forests. Currently we do not have a national scheme or national brand for wood fuel.

An industry or wood fuel producers thinks that certification is expensive and complex process, but it is necessary to penetrate to foreign markets. 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. EnerLes is one of the major manufacturers of wood pellets in Slovenia, which already entered into the Gold pellets scheme, so their pellets can be marketed on the Italian market. There is increasing interest from wood fuel suppliers for laboratory analysis of quality of their wood fuel.

We estimate that the use of wood biomass in households has been slightly increasing, which is evident from the larger number of households using wood for heat production. Recent SORS data from 2011 shows that households consume 1,137,000 tons of wood fuels with a predominance of wood logs (1,100,000 tons). Households used about 1,500,000 m³ of roundwood in 2009 and 2010 for energy purposes (including bark). Around 80 % of roundwood comes from forests, while the remaining 20 % consists of other types of trees or roundwood from unwooded areas.

Our study showed that the actual production of wood chips in 2010 was around 850,000 nm³. According to data from the study in 2008 the production of wood chips increased significantly.

The production of pellets and briquettes has been relatively constant since 2006. According to data from the manufacturers of pellets and briquettes, yearly production amounts to about 55,000 to 60,000 tons. A new pellet production plant with smaller

capacities started operating in 2011, and another larger pellet production plant with a capacity of 50,000 tons is being planned.

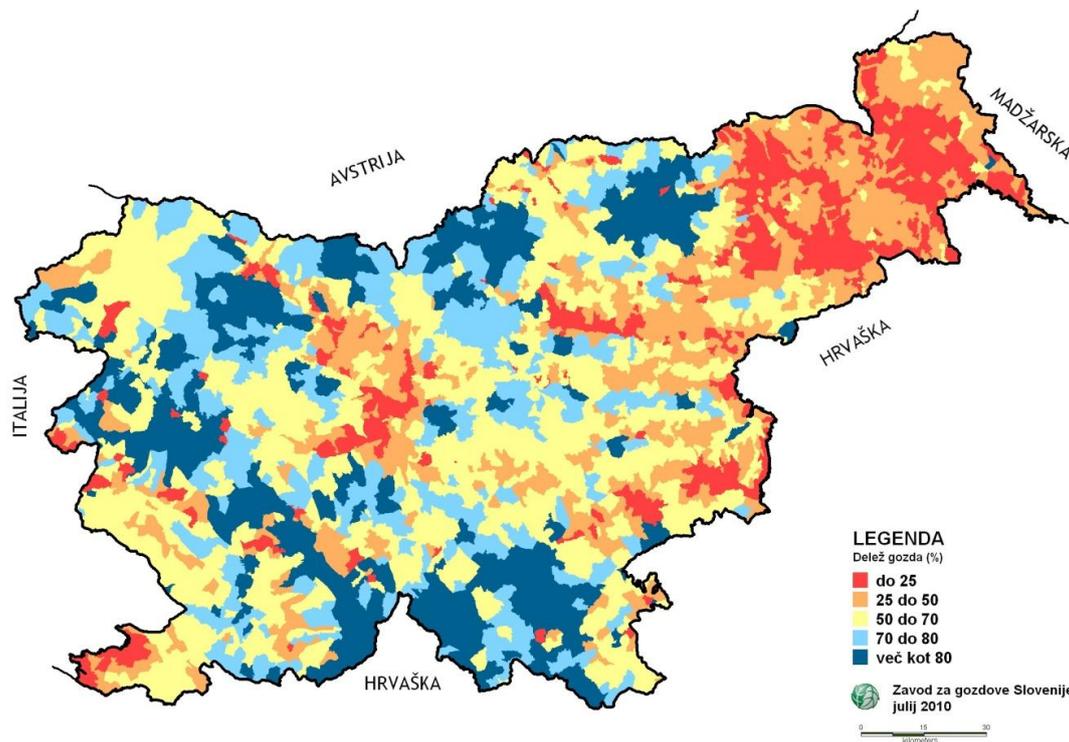
Wood fuel prices:

- Wood chips: P16 (M = 20 %): 56 €/t; P31,5 (M = 30 %): 57 €/t; P31,5 (M = 55 %): 9,5 €/t (green chips) (VAT not included).
 - o Wood chips sellers are adding 5 € per stacked m³ for transport in the range of 30 km.
- Firewood: L25: 115 €/t; L50: 115 €/t; L100: 105 €/t (VAT not included).
 - o Firewood are usually sold as dry (M = 20 %).
 - o Firewood sellers are adding 5 to 10 EUR per bulk m³ for cutting L100 in L 50, L33 or L25.
 - o Firewood sellers are adding 5 € per bulk m³ for transport in the range of 10 km.
- Wood pellets: 6 mm (loose) (M = 10 %): 189,6 €/t (VAT not included).
 - o Price for pellets from beech is 5 % higher.
- Wood Briquettes: loose (M = 10 %): 139,6 €/t (VAT not included).
 - o Price for briquettes from beech can be 60 % higher.

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 whole Slovenian wood chips production. According to external trade data (SORS), in 2010 278,400 m³ of wood fuel was exported and 113,300 m³ of wood fuel was imported.

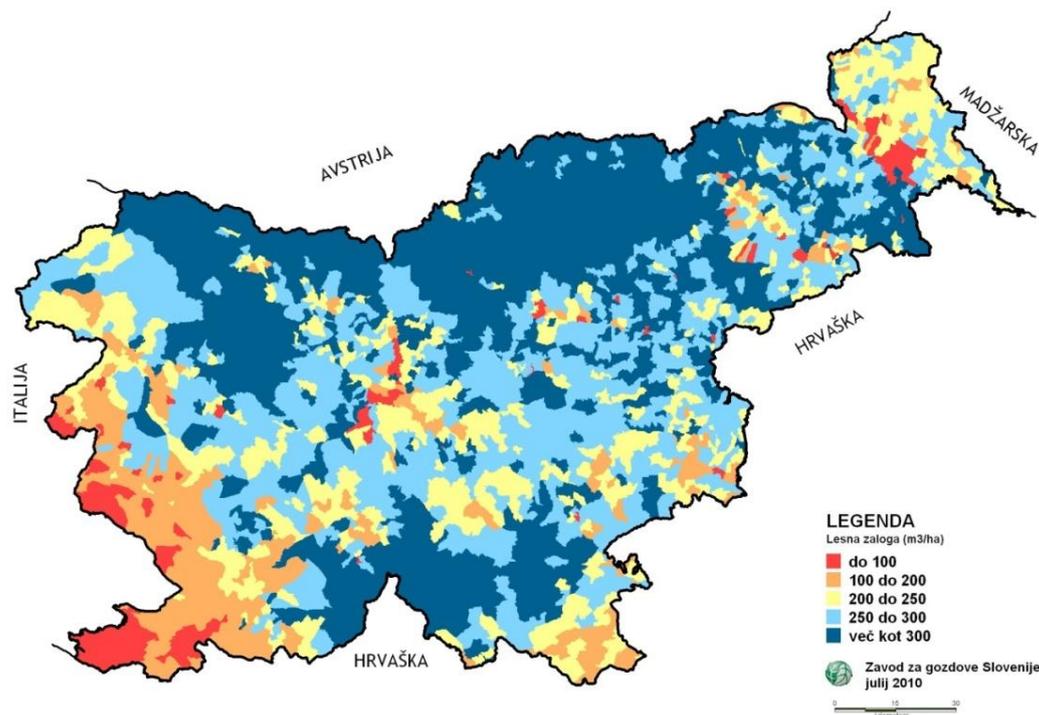
41. Forests and wood biomass production

Slovenia is among the most forested countries in Europe. We have 1,185,169 hectares of forest, which covers more than half of the country (forest cover is 58.5%) (SFS, 2010) (See picture 23).



Picture 21. The proportion of forest surface (in %) in Slovenia (SFS, 2010, WISDOM database)

Most of Slovenian forests are in the area of beech, fir-beech and beech-oak forests (70 %), which have relatively high production capacity. The growing stock in Slovenia is approximately 330 million m³, of which 46.43 % coniferous and 53.57 % non-coniferous. Average growing stock is 279 m³/ha (picture 24). Annually increment is about 8.1 million m³ (6,85 m³/ha), but in the last few years the annual cut was from 3.0 to 3.7 million m³, of which 60 % coniferous and 40 % non-coniferous (SFS, 2010). The difference in numbers shows that in Slovenia the potential of our forests is not optimal exploited and that there are still unused potentials.



Picture 22. Growing stock (m³/ha) in Slovenia (source: SFS, 2010)

Forest Act (1993) divides functions of forests into production functions, environmental functions and social functions. Criteria for evaluating the functions are prescribed in the Regulations on forest management and silvicultural planning (1998). In Slovenia we have all types of forest functions, but the dominated is timber-production function, followed by the environmental functions and social functions. Forest functions are evaluated with three levels of emphasis; 1st level says that function determines forest management, 2nd level says that function significantly affects forest management and 3th level says that function only partly affects forest management. Forest functions are defined in forest management plans.

Production of wood chips from forest residues is not a common practice, the main barrier for using forest residues are economics and harvesting technology. In the producing wood chips from forest residues an important question is economy of the production (transport of forest residues to skidding trails or forest roads, producing wood chips on a forest road or trail).

In Slovenia, the use of chainsaw for harvesting is still the most common way, followed by tractor skidding. With such techniques removal of harvesting residues is time-consuming and difficult. However, at present we do not possess our own time studies or total cost estimations for producing green chips with these technologies. 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 region).

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Measurements on test plots showed that we can produce up to 0,13 m³ of forest residues (for wood chips production) per each m³ of roundwood harvested. According to data from new forest management plans we can conclude that the theoretical potential of wood biomass from forests in this year will reach 1,4 million m³.

41.1 *Short rotation plantations*

One of the potentials for exploitation of wood biomass is 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 trees, both founded in 2009, one in Velenje and one in Trbovlje, with a total area of 6 ha. Since these are the first such commercial plantations in Slovenia, we are monitoring everything that is and will be done in these areas. Measurements on the plantation in Velenje show good production of wood biomass (figure 4), while growth of plantation in Trbovlje is worse. Tree yield in Velenje after two years of growth is satisfying and we assume that after 3 years rotation it will reach the values written in the literature. More correct results will be available in the end of year 2012, when we will measure the plantation before the winter cutting. But we must point out that that plantations of fast-growing trees in our country are not very important, because we have a lot of wood suitable for production of wood biomass in our forests, as well as we do not have enough suitable land for the establishment of these plantations.



Picture 23. Plantation of fast growing willows in Velenje, January 2012

42. Wood biomass production chains and wood biomass use

42.1 Wood fuels production

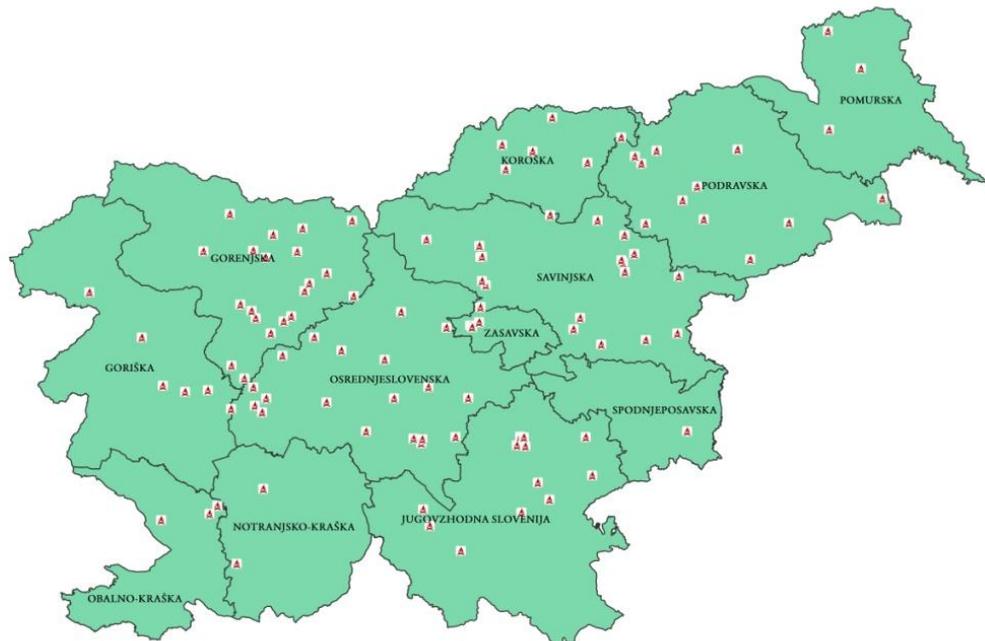
In July 2011 study about state of the art of wood chips and firewood production was performed within the project *Biomass Trade Centre 2*. In our database we have data about 122 wood chippers all around Slovenia and 125 firewood processors and wood splitters. Data gathered for the wood chips production reflects the situation in our country, while we were unable to include all producers of firewood in our study; therefore we present only the results of wood chippers.

We divided wood chippers in to 3 categories according to their power – small power wood chipper, medium power wood chipper and high power wood chipper. In Slovenia we mainly have middle size chippers (capacity from 5 to 50 loose m³/hour), according to our data there is 60 % of them. Large chippers represent 36 % and small chippers only 4 %. Most chippers are in osrednjeslovenska region, followed by gorenjska and savinjska region. Among the trademarks of small and medium chippers dominates domestic manufacturer Bider Bojan s.p. – Kmetijski stroji (picture 26) with 53 registered machines and Austrian manufacturer Eschlbösch 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.



Picture 24. Slovenian manufacturer of wood chippers- Bider Bojan s.p. – Kmetijski stroji

Despite the fact that by the number dominates 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 savinjska region, followed by osrednjeslovenska, jugovzhodna, pomurska, notranjsko-kraška and gorenjska region (picture 27). The result is logical given that these are the regions with a high number of large chippers with a capacity over 50 nm³/h. Production in other statistical regions is significantly smaller. The analysis also showed that the actual production of small chippers is negligible.



Picture 25. Statistical regions and recorded wood chippers in Slovenia

The data obtained in our study shows that the actual production of wood chips in 2010 was around 850,000 nm³. 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 nm³. So over the past four years the number of chippers highly increased (97 %), from 62 to 122 recorded chippers as well as the production of wood chips (for 85 %). In 2010, 31 % of the input raw material for production of wood chips presented low quality wood, while the remaining 69 % consisting of wood removals and wood residues from wood processing industry.

According to SORS and SFI estimates, some 180.818 tons of wood biomass, which is 30 % less than in 2008, were used for energy and heat production for larger energy systems in 2010. The main reasons for this decrease were 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 coming few years.

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43. Biomass and energy production

Despite 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 frame of it several district heating on the biomass were co-financed.

According the available data in Slovenia is installed more than 40 district heating systems in range of the 85 kW to max. 152 MW. 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.

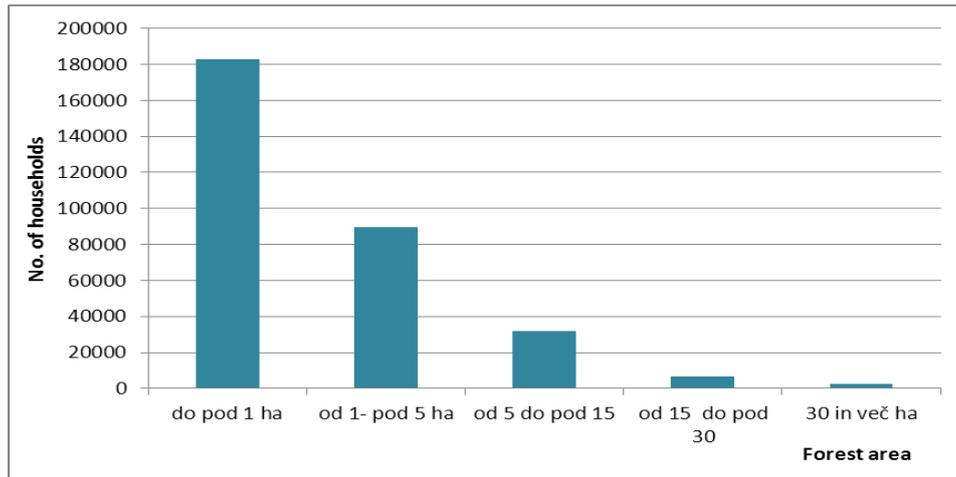
The biggest producer is TE-TOL Ljubljana with biomass power installed 152 MW. Its yearly production of the heat is 60 GWh/a, electricity production 31 GWh/a and with the wood chips consumption of 63,000 t/a.

Total wood chips consumption in Slovenia for the heat and electricity production is estimated at:

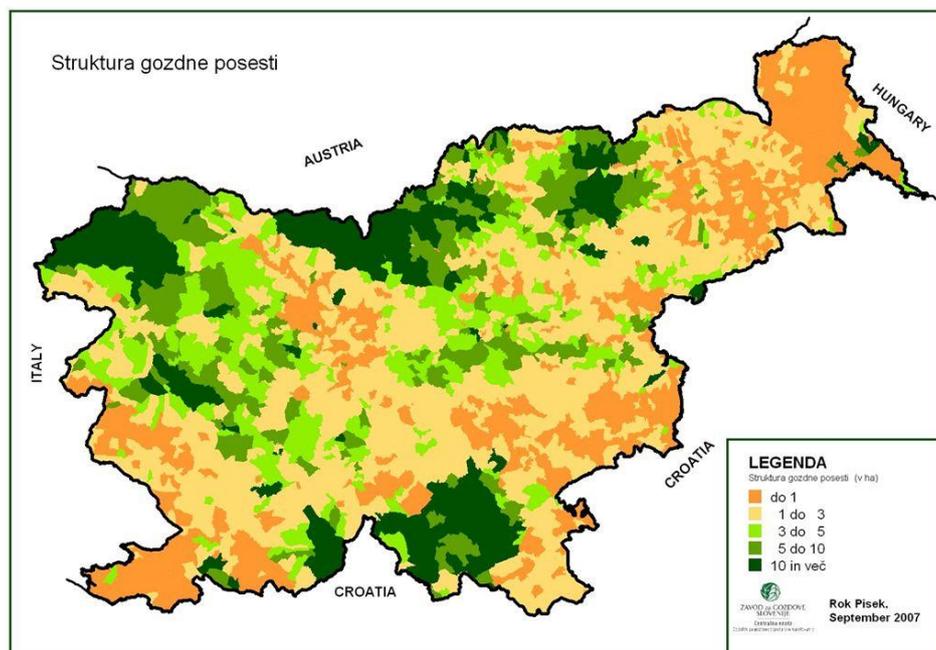
- 455,000 m³/a or
- 114.700 t/a

44. Socio-economic and others constrains

74 % of Slovenian forests are privately owned and 26 % 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 3 ha (picture 28) and even these are further fragmented into several separate plots (picture 29). 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 314,000 (with co-owners even 489,000) forest owners in Slovenia (SFS, 2010). The major fragmentation of forest property, the number of forest owners and co-owners, present a serious obstacle to professional work in private forests, to optimal timber production and utilization of forest potential.



Picture 26. Structure of the forest property (SOBIO, 2011)



Picture 27. Structure of the forest property (SFS, 2007)

The measures affecting trade in wood products and the wood products market also include individual measures from the Rural development Programme of the Republic of Slovenia 2007-2013. In the view of promoting the use of wood, the *following measures are most pertinent within the framework of Axis 1:*

111 - Training for persons engaged in agriculture and forestry, which may influence, indirectly through education of forest owners for safe forest work, the annual felling in privately owned forests.

121 - Modernization of agricultural holdings, which, among other things, enables co-financing of investments in renewable sources of energy for agricultural holdings needs.

122 - Improving the economic value of forests, which can have a positive effect on the wood products market, as it provides for co-financing of investments in modern forestry

mechanization and equipment as well as in reconstruction and construction of new forest tracks and roads.

123 - Adding value to agricultural and forestry products, which also foresees co-financing of investments in processing and marketing of wood.

Within the framework of Axis 3, the following measures are particularly pertinent:

311 - Diversification into non-agricultural activities, where support is given to investments in production of energy intended for sale.

312 - Support for the creation and development of micro enterprises, where among other options, the co-financing for setting-up of enterprises for the production and sale of energy is foreseen.

45. Existing policy measures (subsidy schemes)

The ECO Fund grants loans for environmental investments through public tenders within the scope of the programme for granting loans for environmental investments of natural persons and sole traders. 305 loan contracts with natural persons were signed in 2010 for the implementation of different investment schemes in the area of efficient energy use and use of renewable energy sources, which also included 21 boilers run on wood biomass fuel with a total power of 504 kW. The Eco Fund also carries out a programme for granting nonreturnable financial incentives to natural persons for measures adopted in the area of efficient energy use and renewable energy sources, and on the basis of the Regulation on energy savings ensured to final customers. The Regulation introduces a collection of resources to increase the efficiency of energy use through its contribution to improving the efficiency of electricity and heat additions to the price and the price of fuels to increase energy efficiency. The beneficiaries of the incentive who through public tenders completed their investments in a timely manner and submitted the appropriate documentation, received a total of EUR 7,009,081 of non-returnable funds in 2010, which were used to fuel 6,943 investments, out of which 407 investments were used for boilers run on wood biomass with a total power of 10,4 MW. In 2009, 561 investments into boilers run on wood biomass with a total power of 15 MW were given financial support. Apart from support given for installation of boilers run on wood biomass, incentives for installation of wooden outdoor builder's joinery during renovation on housing buildings are also important from the viewpoint of wood use. In 2009, 1,415 investments with a total area of 24,613 m² were supported, while in 2010, the number of supported investments amounted to 617 with a total area of 10,147 m².

The programme of co-financing of district heating systems and the installation of boilers run on wood biomass is run within the framework of the Operational programme for environmental and transport infrastructure development for the period 2007-2013; the development priority »Sustainable Energy« and the priority orientations of innovative measures for local energy supply. In 2009 and 2010, 13 projects for district heating systems run on wood biomass were supported; combustion engines run on wood

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biomass were installed into 10 of these systems while 3 of these existing systems were expanded without the installation of combustion engines. State aid in the amount of EUR 6 million was used for the installation of combustion engines run on biomass with a total power of 15,6 MW and more than 31 km of pipelines with 777 connections. The expected sales of heat from renewable sources are 54 GWh. In 2009 and 2010, 35 individual combustion engines run on wood biomass and 8 micro- district systems were co-financed. Financial incentives in the amount of EUR 3,6 million were used for the installation of combustion engines run on biomass with a total power of more than 38 MW, while the expected heat production from renewable sources is 90 GWh.

In May 2009, a new scheme in support of green electricity production came into force, with which the government wishes to promote and hasten, among other renewable energy sources, the use of wood for the production of green electricity in the ensuing few years. The renewed scheme includes the following two regulations: the Regulation on supports for the electricity generated from renewable energy sources (2009) and the Regulation on supports for the electricity generated in cogeneration with high efficiency (2009). The framework for this scheme in support of green electricity production is the EU Directive on the promotion of electricity produced from renewable energy sources in the internal electricity market (2001).

In the process of adopting the Climate Change Act and within the scope of the public debate surrounding it, a 3rd draft was presented in February 2011. It includes the basic choice for the transition into a low-carbon society and represents one of the bases for the preparation of the Slovenia's Development Strategy up to 2020, the sector strategies and the short-term measure programmes. The goal of the proposed Act is to establish a legal framework within Slovenia to enable an appropriate, transparent, comparable and credible use of the carbon footprint for organizations, products and services. Carbon footprint could be used as one of the criteria for public procurement of products and services.

46. Main barriers for further development

The further development of production and use of wood biomass in Slovenia is affected by:

- The principles of forest management in Slovenia (guidelines, measures, targets in forest management plans)
- Technology of harvesting and use of wood biomass (equipment and qualification of forest owners and forestry companies for biomass production)
- Low average private forest holding and very fragmented possession
- - The market of wood fuels (relationship between costs of production and price of biomass or individual forest wood assortments on the market)
- - Socio-economic situation of forest owners
- - Lack of knowledge on efficient use of biomass as fuel and

- - Lack of confidence in the sustained supply of quality fuel.

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