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Annex 9 of
Supply and Utilization of Bioenergy to promote Sustainable Forest management

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1. ANALYSIS OF THE MARKET AN MARKETING POSSIBILITIES IN UTILIZATION OF WOOD BIOMASS IN SLOVENIA

1.1. INTRODUCTION

Men have always been closely connected with wood as a raw material, which they have used to make weapons and tools, as a roof over their heads, to make furniture and often as a source of energy. In the last decades, wood has been substituted by other materials in many fields of utilization (construction, power supply). In Slovenia, which is markedly wooded, the process of substituting wood as a raw material started later but has been rather intense in the last twenty years. Substitution of wood in secondary industry and wood as a source of energy has several consequences. Among the most distinctive ones are pollution of environment because of increased utilization of fossil fuels and low realization of cut in forests.

Slovenia depends, to a great extent, on import of energy while CO_2 emissions are constantly growing, mostly because of increased traffic and industry. From the entire scale of possibilities which offer themselves as solutions of these problems, there's only one which remains the only realistic possibility for Slovenia, that is a more effective use of biomass where wood is by far the most important. In Slovenia wood is an important source of energy but the main characteristics of the prevailing use are the following: out-of-date technologies of preparation and utilization, low profits, high emissions and non-competitive prices of produced energy. In the last 10 years a trend of increased utilization of modern production technologies, processing and utilization of wood biomass is noticeable. The state has made its contribution to this trend by introducing the system of subsidies for initial investments into modern central heating boilers and support for promotional projects from the GEF, FAO, INTERREG III B, PHARE fund. With the introduction of modern technologies a demand for wood biomass has increased, which has influenced the market. The traditionally non-organized and extremely locally oriented market of wood biomass has started opening and expanding. The integration of Slovenia into the European Union (in continuation EU) has had a great influence on the market. We'll be able to analyze this influence after the first 5 year period of our membership in the EU.

Wood biomass market is a wide concept therefore we have undertaken the analysis in four steps. First we analyzed the present utilization of wood biomass according to different groups of users. In the next step we analyzed the offer of wood biomass on the market and prices on the market. In the third step we made a look at the offer of modern technology for production, processing and utilization of wood biomass. In the last step we made and estimation of future development of the areas of production, processing and utilization of wood biomass. An important part of the analysis is the analysis of import and export of wood biomass in the last 5 years.

The main objective of the analysis of the market and market possibilities is to determine the present state of wood biomass utilization in Slovenia, prepare a survey of tenderers of wood biomass on the market, tenderers of machines and equipment for production, processing and utilization and make, on the basis of these analyses, a scenario of future development.

Our basic hypotheses were

1. Wood biomass is an important source of heating especially in households and less in bigger systems like remote control heating systems of settlements, systems of simultaneous production of heat and electricity, industrial systems,
2. Utilization of wood biomass at individual users has decreased in the last 10 years, in spite of efforts of the state,
3. Data bases for the analysis of the present utilization of wood biomass are disorderly, incomplete and many times hard to get,
4. Prices of wood biomass on the market vary a lot,
5. In Slovenia there are few bigger producers and tenderers od wood biomass,
6. In Slovenia there are only a few domestic producers of machines for production, processing and utilization of wood biomass,
7. Because of incomplete information regarding past trends of wood biomass utilization in Slovenia the forecast of future development will be very difficult.

1.2. METHODS OF WORK

1.2.1. Present utilization of wood biomass

According to users, we divided the analysis of utilization of wood biomass in Slovenia in the following groups:
- utilization of wood biomass by individual users (in households)
- utilization of wood biomass in district heating systems and micro systems,
- utilization of wood biomass in systems for heating and electricity production
- utilization of wood biomass for industrial heat production
- utilization of wood biomass in public buildings

1.2.1.1. Individual users of wood biomass - households

Data about present utilization of wood biomass were obtained from the Statistical Office of the Republic of Slovenia. Data were gathered in the Count of the population, households and dwellings in the Republic of Slovenia in 2002 (in continuation Census 2002). Data of the Census 2002 were gathered on the critical day of the census, which was March 31st, 2002 at 24.00 hours. The basic census questionnaires (annex 1) from which data were obtained, are the following:

- Census questionnaire for the building P-1;
- Census questionnaire for the apartment P-2.

For the first time, in the Census 2002, Statistical Office included the building as the independent census unit. On the basis of the data from the questionnaire about the apartment (P-2) and answers to the question nr. 26: "Way of heating in the last heating season " (form P-2) we got information about buildings with apartments where wood was used for heating. According to source of heating we determined four groups:

- Dwellings where wood was the only source of heating;
- Dwelling where wood was the main source of heating;
- Dwellings where wood was a secondary source of heating;
- Dwelling which did not use wood for heating.

The number of dwellings in the census includes all the dwellings except those which are used only for business purposes and other occupied places and collective dwellings.

Profile of wood biomass users

The profile of wood biomass users was made in the basis of data from the Statistical Office of the Republic of Slovenia. The basic census questionnaires from which data were obtained were:

- Census questionnaire for the building P-1,
- Census questionnaire for the apartment P-2,
- Census questionnaire for the person P-3;

To make the profile of wood biomass users we extracted, form census questionnaires, the population of those who stated in their answers to question nr. 26: " Way of heating in the last heating season " that wood or wood residues were the only or the main source of heating. For reference persons of these households we obtained data about age, education and activity status.

Family farms

In 2002 the census of agricultural economies[1] was done as well. In 2003 another inquiry was performed on a sample of agricultural economies. Both censuses (complete and partial) were made by the Statistical Office of the Republic of Slovenia. From the census of agricultural economies data regarding utilization of wood at family farms were obtained and an outline of utilization or consumption of wood at these economies was made.

1.2.2. Big consumers of wood biomass

As big wood biomass consumers we regard district heating systems, systems for simultaneous production of heat and electric energy, systems in industry (wood processing plants) and systems in public buildings.

Data about big heating consumers were obtained from different sources. Data regarding district heating systems were obtained from the Statistical Office of the Republic of Slovenia and some other sources. Data about plants for simultaneous production of heat and electricity were already gathered within the framework of the international project BIOCOGEN. We obtained data about the use of wood biomass in industrial systems from the REMIS base. Unfortunately we were unable to get information about utilization of wood biomass in public building and this is a task which remains open for future investigations.

[1] Agricultural economy is organizationally and economically rounded up integrity of farm lands, forests, buildings, equipment and work force, occupied with farming production and has a unified management. Agricultural economies are divided into agricultural enterprises and family farms (Census of agricultural economies 2000)

1.2.3. Producers and tenderers of wood biomass on the Slovenian market

We made the list of producers and tenderers of wood biomass on the basis of different sources: internet, PIRS (business directory of the Republic of Slovenia), printed media (Salomonov oglasnik, ...), registers of the Chamber of Commerce and Industry of Slovenia and the Chamber of Craft and others. This is how we managed to gather 40 addresses. For 9 of the tenderers (pellets) we had already had the corresponding data. The remaining 31 were called by phone to verify the correctness of information and to inform them about our work. At the same time we prepared a corresponding memo and a questionnaire (annex 2) which were later sent on to all producers and tenderers of wood biomass from our list (annex 3). 15 questionnaires were sent by e-mail and 16 by classical mail. We visited some of wood biomass producers at the Agricultural and Food Fair in Gornja Radgona (the ones that were present) and had conversations with them.

1.2.4. Tenderers of machines and equipment for production, processing and utilization of wood biomass

The list of producers and distributors of machines and equipment for production, processing and utilization of wood biomass was made on the basis of different sources: internet, printed media, International Agriculture and Food Fair in Gornja Radgona, International Trade Fair in Celje and others. For all tenderers as well as producers and distributors we had prepared a questionnaire with corresponding questions (annex 4) and at the end their answers were analyzed. At this moment the list of producers and distributors of equipment and machines contains 20 addresses (annex 5).

1.2.5. Prices of wood biomass

Prices in Slovenia

The analysis of different types of wood biomass was made by telephone conversations with tenderers on the market and by means of a survey among the producers of wood biomass (annexes 2 and 4) where one of the questions (B.2) was the price of wood biomass. We made telephone conversations with small-scale tenderers of wood biomass which addresses we obtained from different newspapers (ads in daily newspapers, ads in the Salomonov Oglasnik, offers on the internet). From these sources 16 tenderers of logs were obtained.

1.2.6. Export and import of wood biomass

We obtained information regarding export and import of wood biomass from the Chamber of Commerce and Industry of Slovenia. Data about export and import of wood biomass were gathered for the period from 1996 to 2003. According to these information, wood biomass can be classified into two customs tariffs, that is as:

- saw dust,
- waste and residues.

1.2.7. Future development of the area of production and utilization of wood biomass and market possibilities in Slovenia

The analysis of future development of wood biomass was made in three parts. The survey among producers of wood biomass represents the first part of the analysis of future development of production and processing of wood biomass. The questionnaire also contained a question about the extent of production in the next 10 years (question B.5). This is how we got an insight into the expectations of wood biomass tenderers and producers. A similar question was made to producers and distributors of machines and equipment (question B.6 Annex 4). We asked producers and distributors of machines and equipment about the extent of sales in the last five years. From answers obtained we calculated a sales trend for these machines in the past and made a forecast of the future trend.

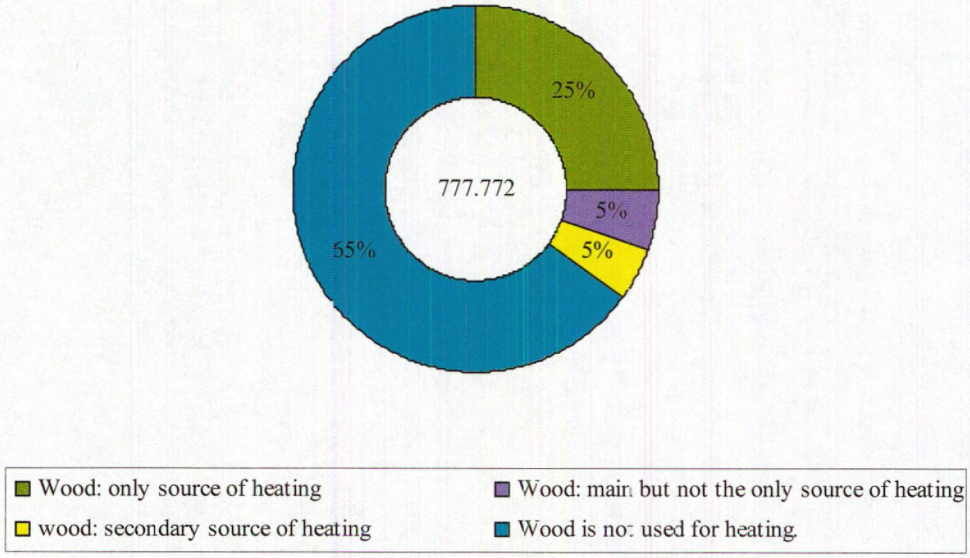
The second part of scenario of future development and analysis of market possibilities was made by means of workshop where we invited experts from different institutions, dealing with the field of wood biomass. Preliminarily we prepared a questionnaire, made up of three independent parts. For the analysis of the future development and market possibilities only the third part of the questionnaire is relevant (annex 6). This part contains 4 key questions. With the answers to these 4 questions we wantd to get the opinion of experts about the future development in different sectors or according to different consumers (households, industry, general consumption, etc.) and the opinion about the meaning of different types of wood biomass in Slovenian households.

1.3. RESULTS

1.3.1. Present utilization of wood biomass

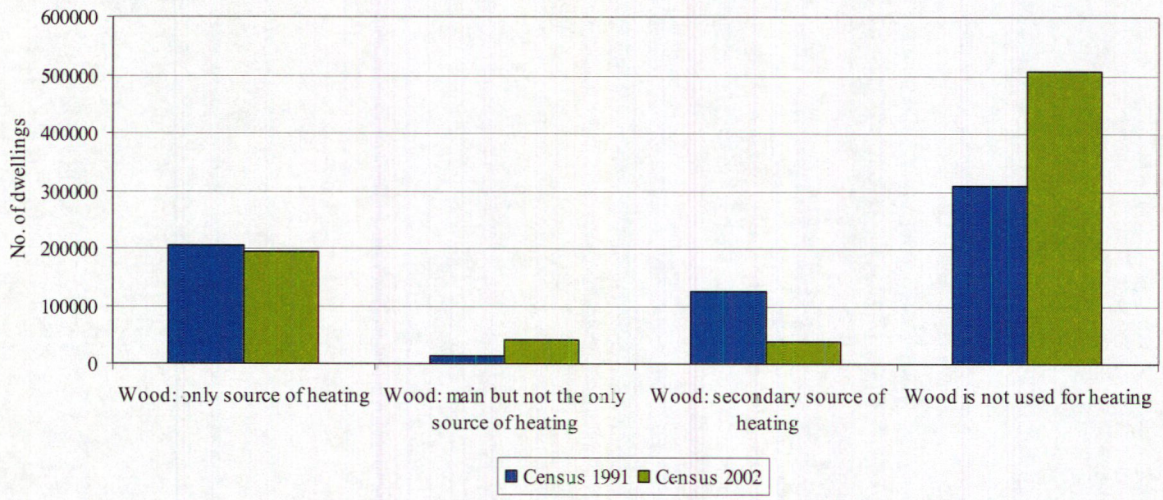
1.3.1.1. Individual users - households

In Slovenia there are 777.772 dwellings (Census 2002). Analysis of dwellings, according to the source of heating shows that 25% of dwellings in Slovenia are heated with wood biomass as the only source of heating. Moreover, wood biomass is used for heating in additional 10% of dwellings, however in this case wood biomass is not the only, but the main (5%) or secondary (5%) source of heating. More than half of dwellings (65%) are not of heated with wood. Among the most important sources of heating are fuel oil and gas.We got a very similar ratio, when we compared the size of dwellings or number of occupants in these dwellings.



Picture 1. Dwellings according to source of heating (Census 2002)

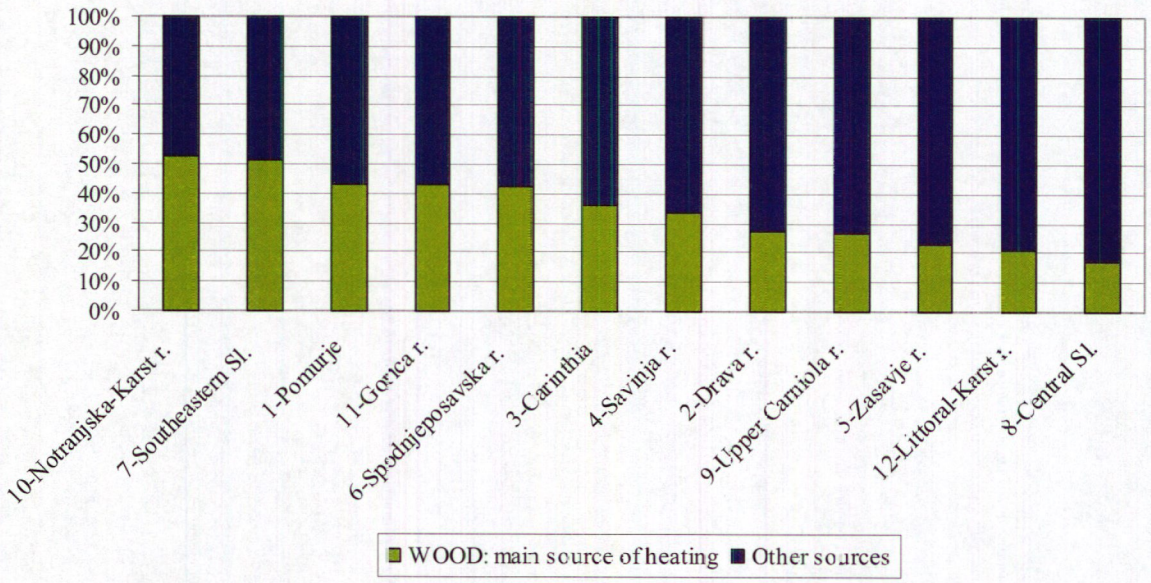
The 1991 census contained also a question about the use of fuel for heating. A comparative analysis of the conditions in 1991 and 2002 shows a decrease of use of wood as the only source, from 204.543 dwellings in 1991 to 194.836 dwellings in 2002, which means 9.707 dwellings less (picture 2).



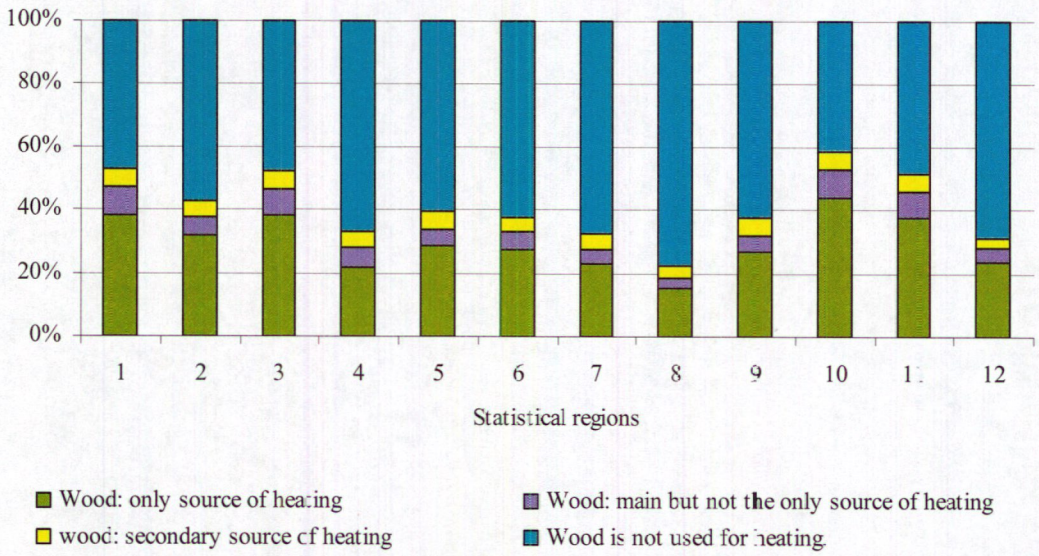
Picture 2. Dwellings according to way of heating – comparison between data of censuses 1991 and 2002

In the period from 1991, when according to the data of the census, there were 652.422 dwellings, to 2002 the number of dwellings has increased for 125.350 units. The number of dwellings which do not use wood for heating has increased for 197.346. On the other hand, the number of dwellings where wood is used as the main but no the only source for heating has increased substantially (for almost 25.000). The number of dwellings where wood is used as a secondary source of heating has decreased a lot, above all because of giving up coal as a heating source in dwellings.

Slovenia is divided into 12 statistical regions: 1-Pomurje, 2-Drava region, 3-Carinthia, 4-Savinja, 5-Zasavje, 6-Spodnjeposavska, 7-Southeastern Slovenia, 8-Central Slovenia, 9-Upper Carniola, 10-Notranjska-Karst, 11-Gorica, 12-Littoral-Karst. Data about the utilization of wood biomass were compared also on the level of these 12 statistical regions.



Picture 3. Comparison between the share of dwellings where wood or wood residues represent the main or the only source of heating according to all the flats in statistical regions (source: Statistical Office of the Republic of Slovenia, Census 2002).



Picture 4. Dwelling according to source of heating and individual statistical regions (source: Statistical Office of the Republic of Slovenia, Census 2002).

The comparison of heating of apartments with regard to source of heating between individual statistical regions shows, that the share of dwellings which use wood and wood residues as the main source of heating is the smallest in Central Slovenia (17,4%), Littoral-Karst region (21,2%), Zasavje region (22,6%) and in Upper Carniola (26,5%) and the biggest in Notranjska-Karst region (52,4%) and in Southeastern Slovenia (51%).

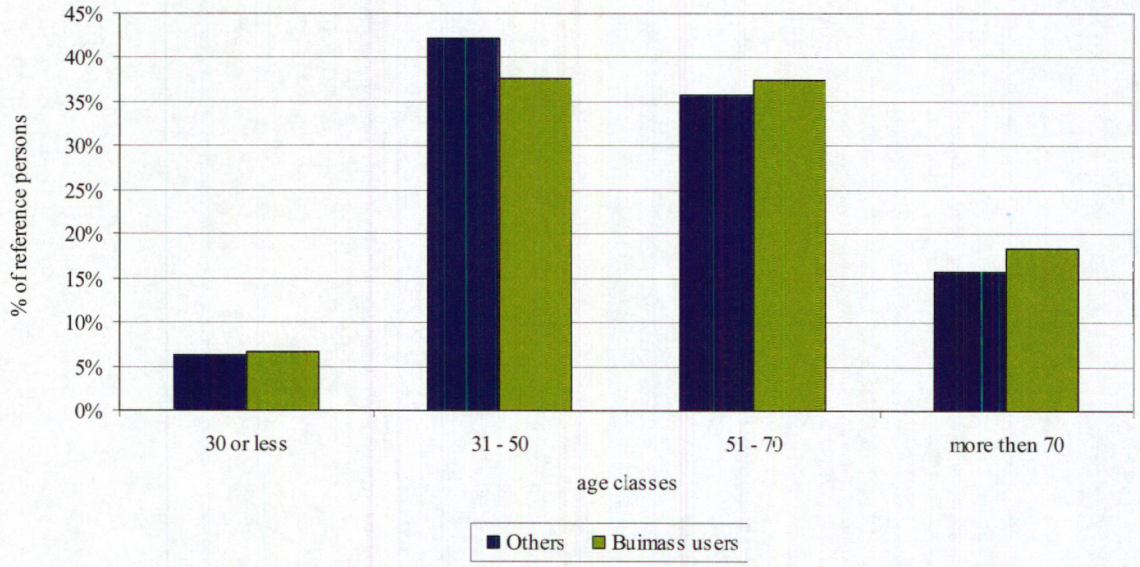
Profile of wood biomass users

To make the profile of wood biomass users we extracted, from census questionnaires P-2, the population of those who in their answers to the question No. 26: »Way of heating in the last heating season« stated wood and residues as the only or the main source of heating. For reference persons of these households we got the data about age, education and activity status. In 234,898 dwellings, for which they stated that the only or the main source of heating were wood and wood residues, dwelled the total number of 197.420 households. These households determined a reference person in the census form P-3 for whom the profile was made on the basis of the collected data.

The number of all households in Slovenia was 684,847. From these 197.420 (29 %) used wood biomass for heating, either as the only or as the main source of heating. In every household a reference person was determined at the time of the census. The profile of wood biomass users, shown in continuation, is made for the reference persons in households from the Census 2002.

Age structure of reference persons in households where wood or wood residues were used as the only or the main source of heating in the last heating season.

The first indicator analysed in making the wood biomass users' profile, was the age of reference persons. The smallest share of WB users was in the age category of 31-50 years (26,5%) and the highest in the age category of over 70 years (32%). The differences in shares of WB users and the entire population according to age categories are very small.



Picture 5. Age structure of wood biomass users and other reference persons in Slovenia

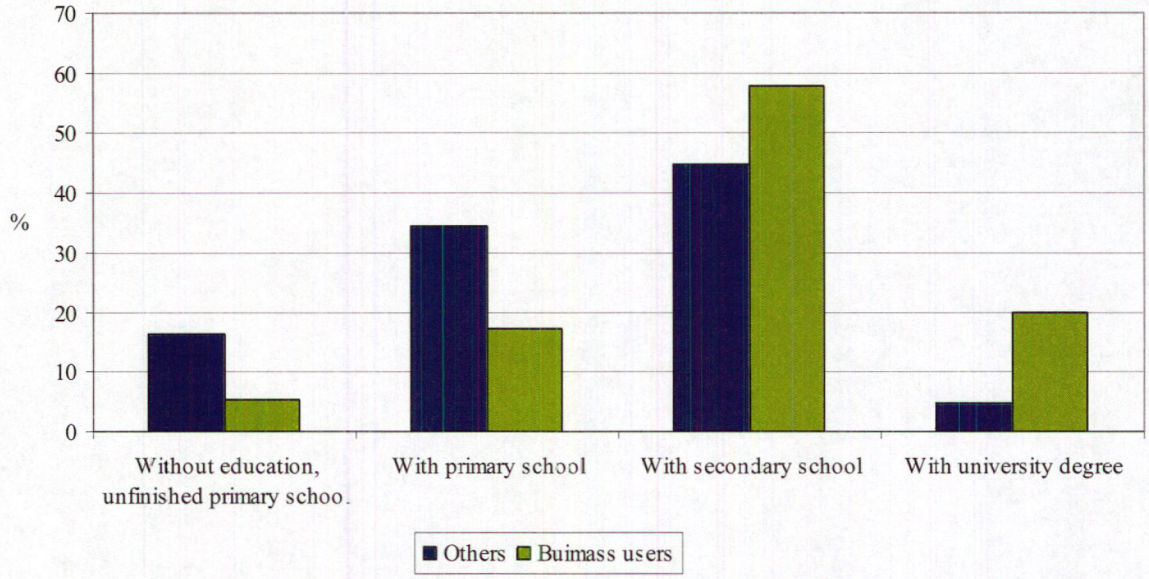
Education structure of reference persons in households where wood biomass was used as the only or the main source of heating in the last heating season.

Education is the highest achieved officially acknowledged education, that the person acquired at the end of education:

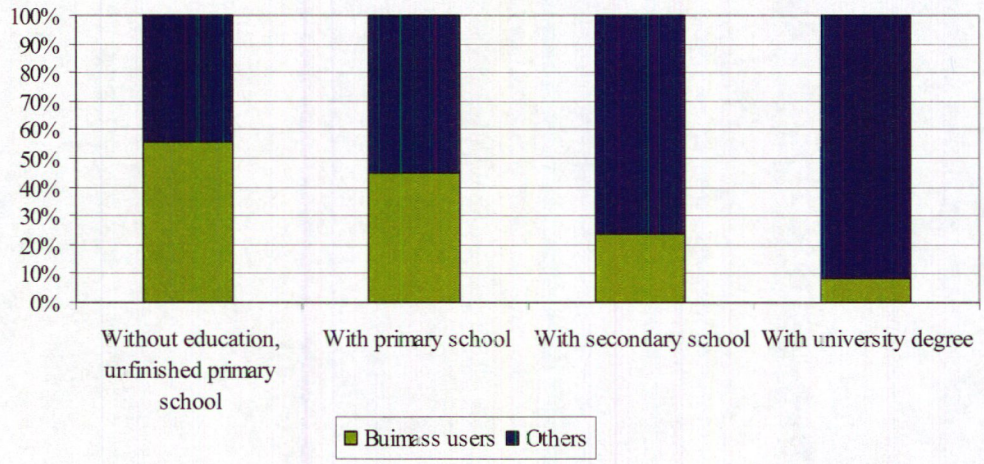
- according to officially acknowledged programmes at the regular school;
- at schools which substitute regular schools (training at work, distance training, etc.), with courses, exams or some other way, according to regulations which determine the acquisition of officially acknowledged education.

The highest achieved officially acknowledged education is provable with an official document (school-leaving certificate, diploma, etc.).

The majority (88.439 or 45 %) of all WB users have finished secondary school followed by those who have finished elementary school (67.698 oz. 34%). The share of users with higher or university degree of education is the lowest (5%).



Picture 6. The structure of wood biomass users compared to the entire population of reference persons according to degree of education.



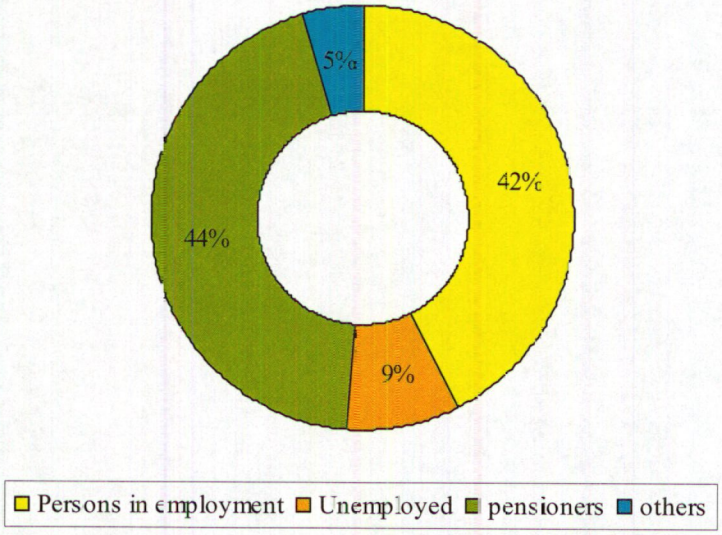
Picture 7. Share of wood biomass users in the structure of reference persons according to degree of education

Picture 7 shows that the share of wood biomass users is linearly falling with the increasing of education level. This can be explained with the fact that persons with a higher degree of education live in urban settlements, where heating with fossil fuels prevails. Persons with the lowest education are concentrated in the countryside where wood and wood residues are more often used for heating.

Activity status of reference persons in households in which wood biomass was used for heating in the last heating seascn.

Analysis of reference persons with regard to their activity status showed, that the biggest share among them are working (51%), pensioners follow (40%), unemployed (7%) and others

(2). The picture is slightly different if reference persons, who use wood biomass for heating, are compared by their status.

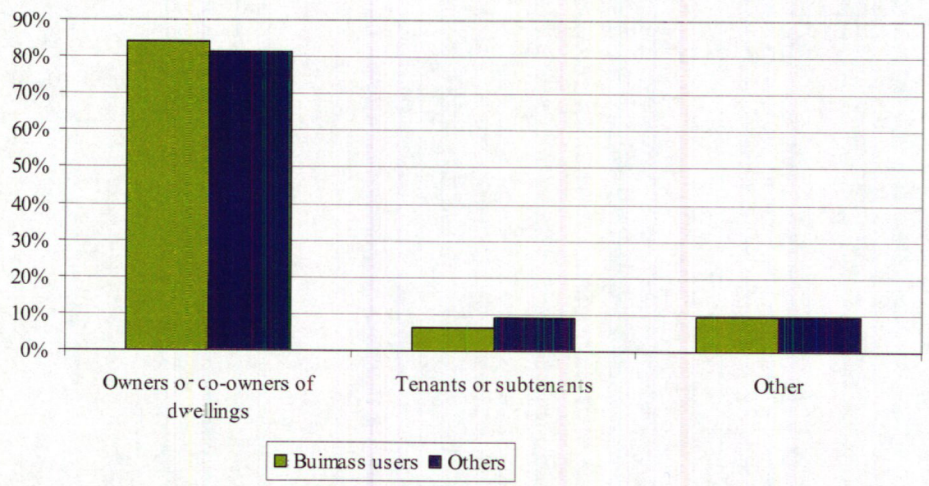


Picture 8. Wood biomass users according to activity status.

Picture 8 shows that pensioners (44%) and working people (42%) prevail among wood biomass users. The ratio approximately corresponds to that ratio which shows the structure of the entire population of reference persons in households.

Proprietorial structure of reference persons in households where wood biomass was used for heating in the last heating season.

In Slovenia the majority of reference persons (82%) are owners or co-owners of dwellings, only 9% are tenants or subtenants. The ratio is similar also among users of wood biomass. Of all users as many as 84% are owners or co-owners of apartments and only 6 % of them are tenants.



Picture 9. Proprietorial structure of wood biomass users and the entire population of reference persons

The proprietorial structure of wood biomass users shows that owners or co-owners prevail among them, which corresponds also to the proprietorial structure of the entire population.

The aim of making the users profile is to find a target group for the promotion of wood biomass. According to the analysis of the collected data regarding reference persons of households (from Census 2002) the average wood biomass user is 53 years old, active worker and has finished elementary or secondary school.

Family farms

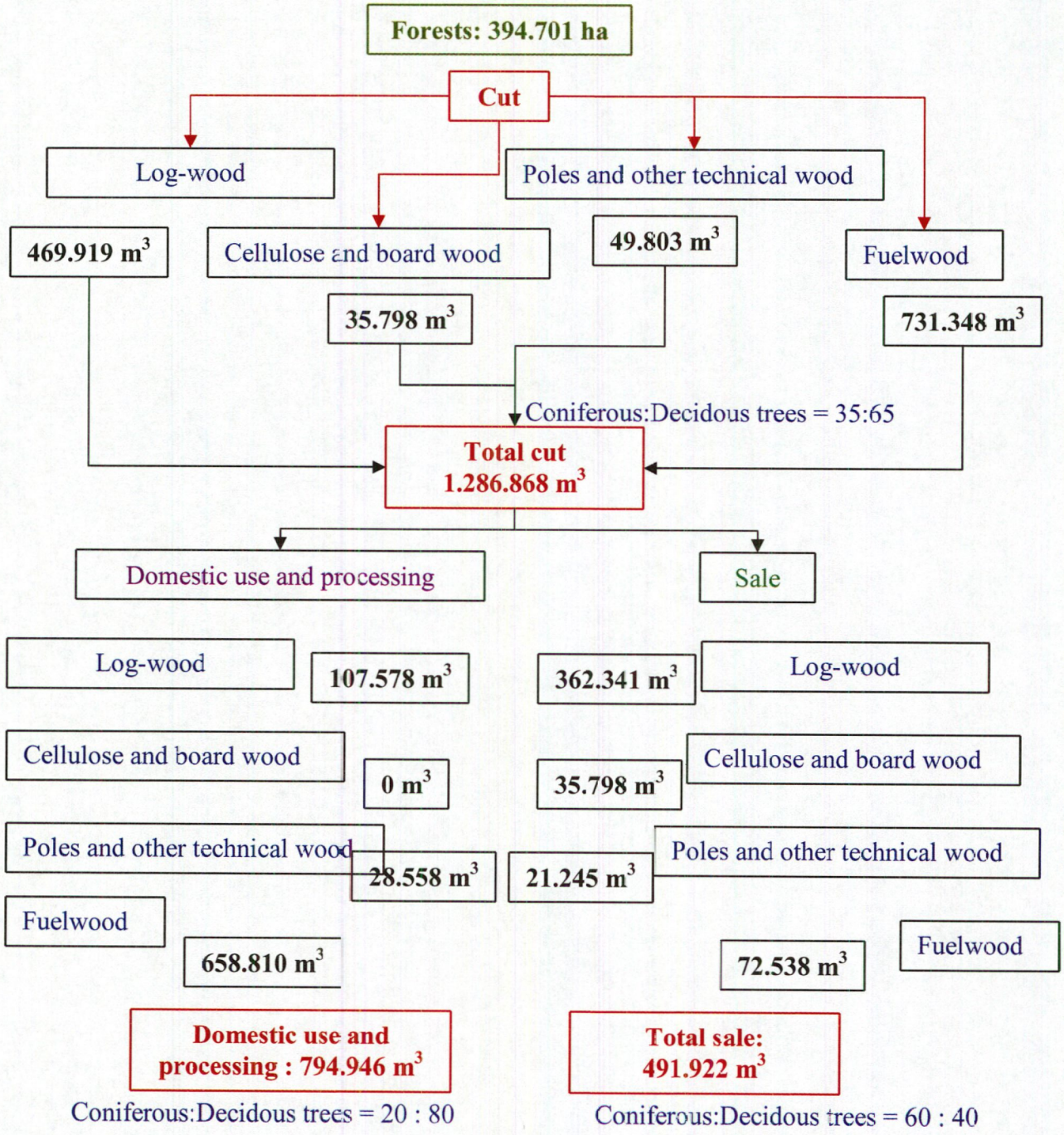
In the year 2000 a census of agricultural economies[2] was made as well. At the time of the census in Slovenia there were 86.336 family farms which suited the criteria of European comparable farms[3]. All members of these farms (323.178) represent as much as 16 % of the entire population. The total number of lands in use of family farms is 918.908 ha (Census of agricultural economies 2000). Forests cover 43 % of all lands in use of family farms. So 394.701 ha of forests or 34 % of all forests in Slovenia are in the possession of family farms. From those family farms which possess forest (76.670) 67% (51.571) were performing cutting in the period from 1.6.1999 to 31.5.2000. The total cut on these farms was 1.286.868 m3 (in average 3,3 m3/ha)[4]. A smaller share of wood (38 %) was sold while 62 % of wood was used or processed at home as wood for heating or as technical wood. In the reference year (from 1.6.1999 to 30.5.2000) 731.348 m3 of wood were cut for firewood at 47.991 agricultural economies. They used most of the firewood alone. According to the data from the census of agricultural economies (Statistical Office of the Republic of Slovenia 2000) 10 % of firewood was sold. The cut for firewood represented as much as 57 % of the entire cut.

Data from the Census of agricultural economies enable a more precise analysis of cutting as well as analysis of further utilization of wood (picture 10). Even though family farm make less than one third of private forests owners in Slovenia, certain ratios can be used in the evaluation of potentials or evaluations of present utilization of wood biomass.

[2] Agricultural economy is organizationally and economically rounded up integrity of farm lands, forests, buildings, equipment and work force, occupied with farming production and has a unified management. Agricultural economies are divided into agricultural enterprises and family farms (Census of agricultural economies 2000).

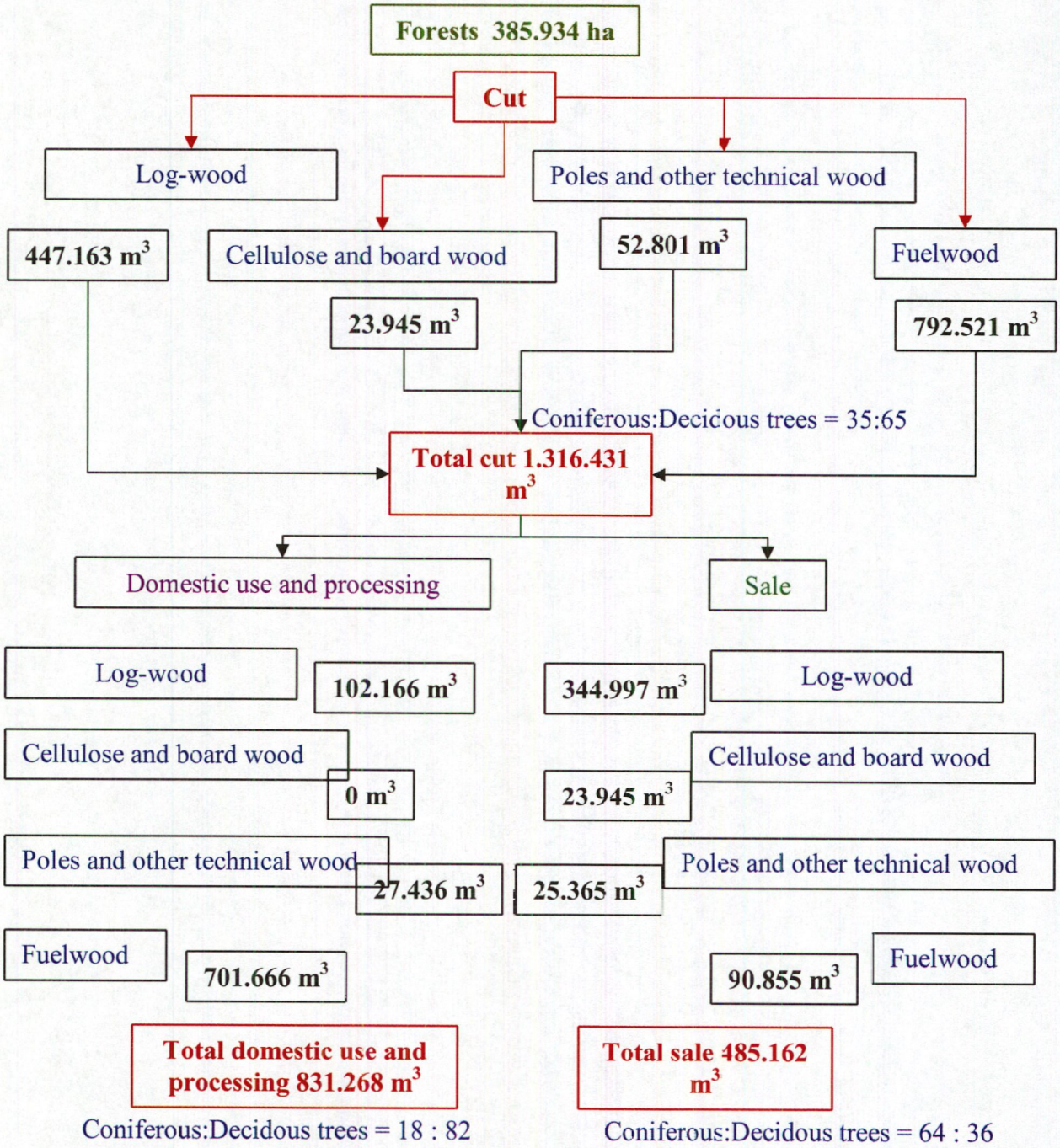
[3] European comparable farms are agricultural economies which have in use at least 1 ha of farmlands and of those which have in use less than 1ha of farm lands the following: those with at least 10 a of farm lands and 90 a of forests or at least 30 a of vineyards or orchards or 2 or more head of big cattle, or 15 to 30a of vineyards and 1 to 2 head of big cattle or more than 50 bee-hives or produce vegetables for sale (Census of agricultural economies 2000).

[4] Sometimes total amounts of cut do not correspond to amounts according to individual categories because of data conficentiality (covering of information in case when in a certain category there are less than three data).



Picture 10. Utilization of wood on family farms in Slovenia (Source Statistical Office of the Republic of Slovenia 2000)

In 2003 Statistical Office of the Republic of Slovenia made an equivalent inventory of the situation in agricultural economies but the inventory was made only on a selected sample. Data, collected on a sample were calculated for the entire population of agricultural economies in Slovenia.



Picture 11. Picture 11. Utilization of wood on family farms in Slovenia (Source Statistical Office of the Republic of Slovenia 2003)

Comparisson of the data for the years 200 and 2003 gives the following conclusion:

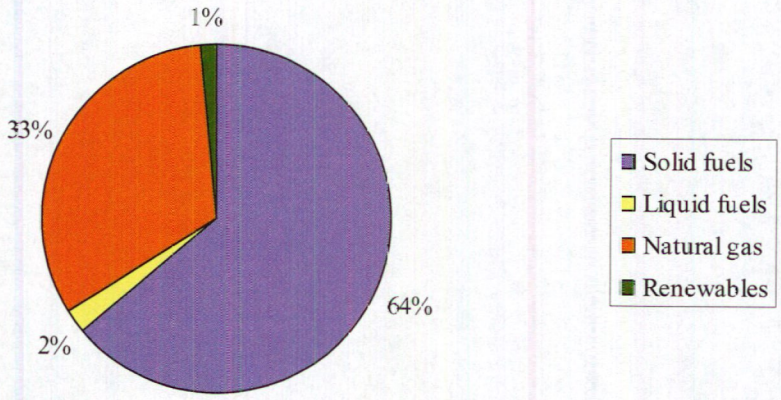
- total cut has increased (za 3 %),
- cutting for fuelwood has increased (for 61.173 m^3 or 8 %),
- sale of wood has slightly increased,
- the share of sales of fuelwood has increased for 1 % only (89 % of fuelwood is still used at home)
- cut for fuelwood represented as much as 60 % of the total cut which is 4 % more than in the year 2000.

The comparison of both consequent inventories at agricultural economies leads us to the conclusion which says that in this population the importance of fuelwood is not decreasing, on the contrary, it is gaining its significance.

1.3.1.2. Big consumers of wood biomass

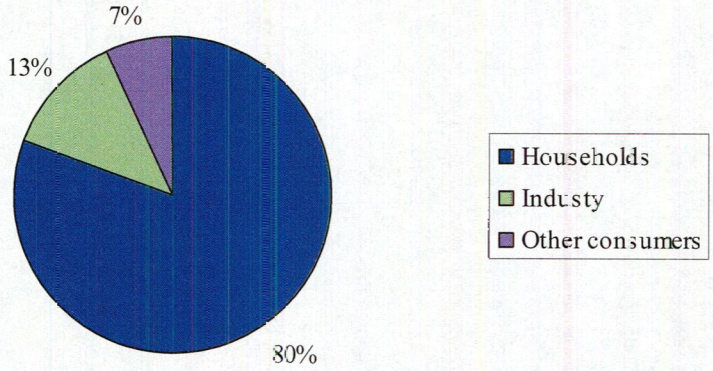
District heating systems

Analysis of fuel utilization structure in district heating systems in TJ shows, that solid fuels (coal, lignite) represent the biggest share (65%) while wood biomass represents only 1% of all fuels. (source: Statistical yearbook of energy economy of the Republic of Slovenia 2002)



Picture 12. Fuel utilization structure in district heating systems

From the entire quantity of district heat, used up in Slovenia, most of it (80%) is used in households, industry follows (13%), public expenditure is at the last place (public buildings) with 7%.



Picture 13. Consumption of district heat according to different consumers

According to data of the statistical yearbook of energy economy of the Republic of Slovenia from the year 2002 there are 20 big district heating systems in Slovenia and if we considered smaller systems the number would be even bigger.

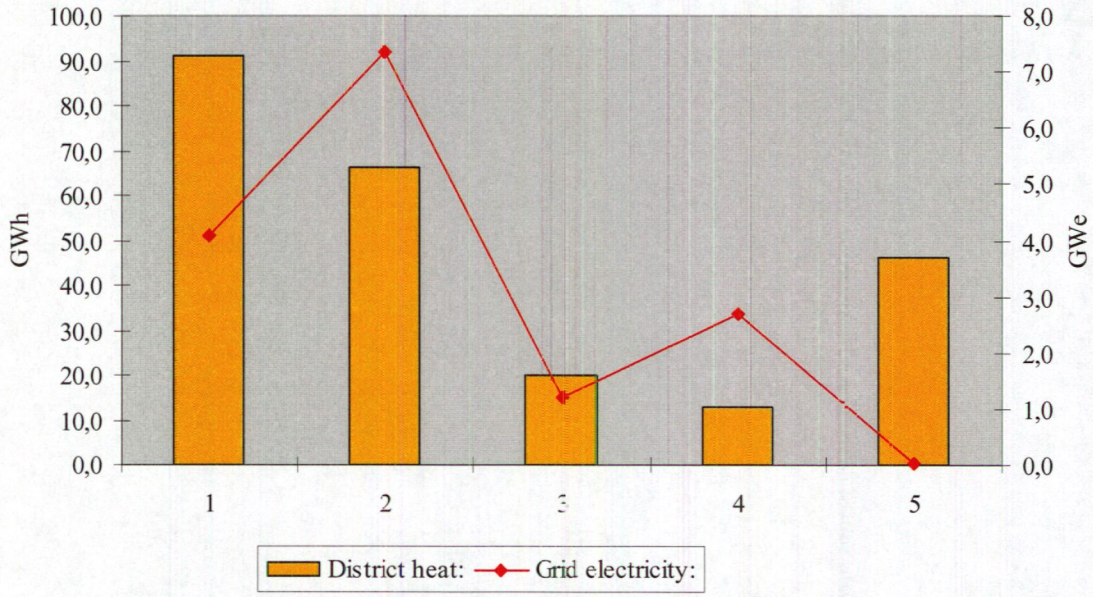
Only two of the big systems use wood biomass (KO Železniki and KO Zagorje). In 2002 KO Železniki consumed 4.570 tons of wood and produced 54.8 TJ of heat while KO Zagorje consumed 3.874 tons of wood and produced 46,5 TJ of energy. The rest of district heating systems together consumed 1.209 tons of wood and produced 14,5 TJ of heat. All the other small scale district heating systems, like Gornji Grad, Preddvor, Logarska dolina, Nazarje consume, all together, a little less than 30.000 m^3 wood bimass a year.

Plants for simultaneous production of electricity and heat (CHP)

According to the available data (Ministry of Environment, Spatial Planning and Energy, RACI)at the moment there are 5 plants for simultaneous production of heat and electricity in Slovenia. Four systems are installed in wood-processing industry. One plant used to form part of a wood-processing company and with its breakup it was sold to a private company which now produces and sells energy to smaller companies in the vicinity. Only one of the systems emits surpluses of the produced electricity into the national grid. All plants use out-of-date technology.

All plants use wood residues from wood-processing industry. Three of them use exclusively residues from their own production while two of them buy wood residues also from different suppliers.

Installed electric power of all these 5 plants is 5,2 MW. Average annual production is 15,4 GWh of electric energy and 190,5 GWh of heat.



Picture 14. Production of heat and electricity in 5 systems of simultaneous production of heat and electricity in Slovenia (BIOCOGEN 2002)

Industry

According to data, gathered within the framework of the project UNOPS, in 1997 78 biomass systems for the production of processed heat were in function. The data base of boilers in industry is now being kept by the Ministry of Environment, Spatial planning and Energy. The database, which is the base for determination of the CO2 fee, is called REMIS. In 2003 only 24 biomass systems were indicated. These systems use up 136.150 t of wood biomass anually. New data from the REMIS database will be accessible in autumn 2004.

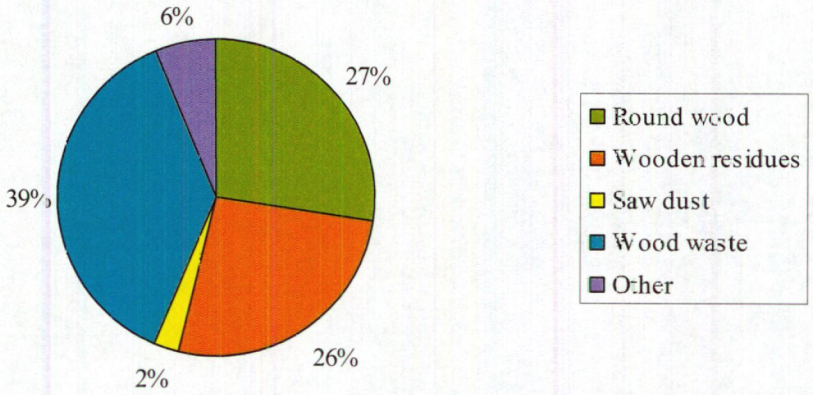
1.3.2. Producers of wood biomass in Slovenia

Producers of wood biomass in Slovenia can be, regarding the type of biomass they produce, divided into:
- producers of logs (firewood)
- producers of wood chips
- producers of briquettes
- producers of wood pellets

The inquiry captured 31 producers of wood biomass (Annex 3), from which 13 filled out and returned the questionnaires. Two of the inquired stated that they were producing logs, 9 produced wood chips, 2 of them produced pellets and 3 briquettes. Besides that, we also included 12 producers or tenderers of wood briquettes, which were captured and analysed in the term paper »Wood briquettes« (Pisek 2004).

The total annual quantity of entry raw materials of the inquired producers of wood biomass is 113.035 m3. Within the structure of entry raw materials waste wood represents (37,6 %), round wood is at the second place (27,4 %) followed by piece wood residues (26,3). The

structure of different shapes of entry raw materials which the mentioned producers consume are shown in picture 15.

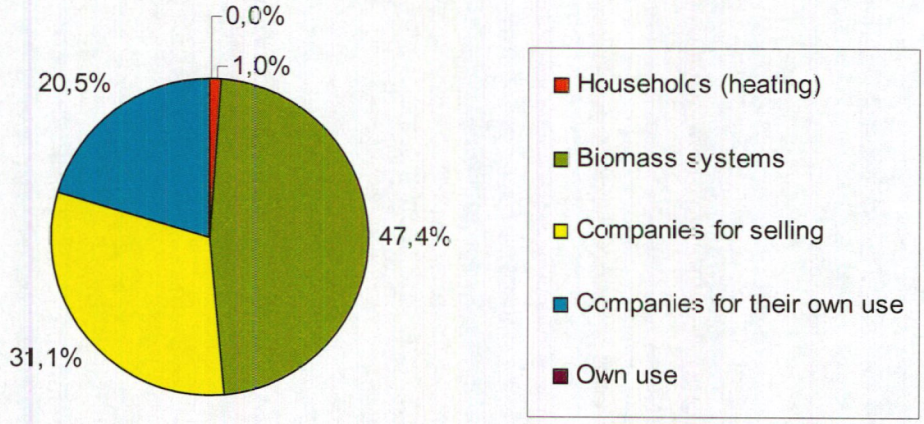


Picture 15. Quantities and shares of different shapes of entry raw materials at analysed producers of wood biomass.

All inquired producers of wood biomass produce annually 13.500 m3 of logs, 80.456 stacked m3 of wood chips, 35.000 t of pellets and 2.373 t of briquettes.

According to data gathered in the previously mentioned term paper (Pisek 2004) the production of wood briquettes in Slovenia in 2002 was about 2.000 tons. The biggest producers were the following: LIP Bled (800 tons), LIPA Kostanjevica d.o.o. (800 tons) and Šmihel - Pivka (200 - 250 tons).

The analysis of the consumption of logs and wood chips, captured by the inquiry of wood biomass producers in Slovenia showed that the biggest share of biomass, produced by the inquired producers is consumed by biomass systems (47,4%) followed by companies for further sale (31,3). The share of households is only 1%, which confirms our hypothesis, that the majority of wood biomass is produced by forest owners to cover their own needs while surpluses are sold on the so-called grey market - without records and without issued invoices.



Picture 16. The Structure of the consumption of logs and wood chips according to consumers

The analysis of further use of briquettes has shown that the majority of briquettes (80%) is sold to companies for further sale and a smaller share (20%) to companies for their own use. Quantities, sold to other consumer are negligibly small (less than 1 %).

Wood pellets are practically entirely sold to companies for further sale only a small share is foreseen to be sold to biomass systems. At the moment, the biggest share of wood pellets is exported.

1.3.3. Tenderers of equipment and machines for production, processing and utilization of wood biomass

On the Slovenian market producers as well as sales representatives of foreign producers of machines and equipment for production, processing and utilization of wood biomass have been appearing. When we talk about machines for production and processing of wood biomass the word is above all about stamping and cleaving machines while under equipment for utilization of wood biomass we talk above all about boilers for central heating of residential surfaces. The analysis captured 20 tenderers of technologies from whom 12 filled out and returned the questionnaires.

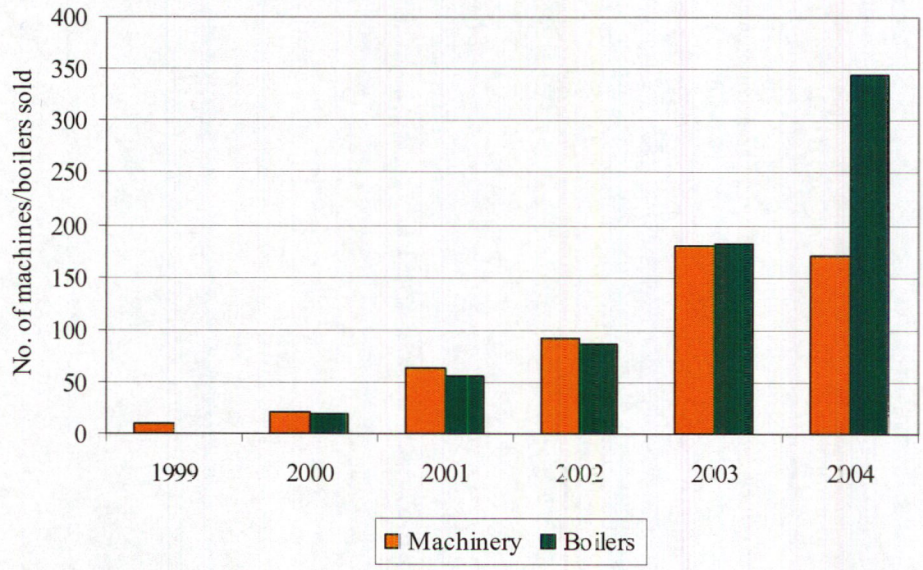
The inquiry shows that the offer of machines for production, processing and utilization of wood biomass is rather limited. The number of tenderes according to type of equipment is given in table 1.

Table 1. Tenderers of equipment and machines for production and processing of wood biomass, who filled out the inquiry questionnaire

Type of machine	Number of tenderers
Stamping machines	3
Cleaving machines	3
Cleaving-log making machines (processors)	2
Boilers for central heating using:	
a) logs	5
b) wood chips	5
c) pellets	4

Four of the inquired tenderers answered that they were producing equipment, 7 were selling the equipment (represented producers from abroad) and 1 of them was producing and representing the equipment. The majority of them started with the production or agency in the year 2000 or later which means that the market of this technology is relatively young and is still developing.

Ten tenderers answered the question about sales quantities in the last years. All of them have stated a very clear and distinctive trend of growth in the last 5 years (Picture 17) and most of them expect growth also in the folllowing years.



Picture 17. Sales of equipment and machines for production and processing of wood biomass in the last years

The majority of the inquired (71 %) believe that their production or sale in the next 10 years shall increase by more than 50 %, 29 % of them think that the production shall increase up to 50 % and nobody thinks that the production shall remain the same or even reduce.

Analysis of equipment buyers' structure showed that stamping machines are almost entirely sold to households or individual buyers for their own use. As a rule, they are farmers who own some forest and need the stamping machines to make wood chips for their own needs.

The same goes for cleaving machines and cleaving-log making processors. Looking in numbers, more than 90% are sold to households or individual buyers for their own use.

The picture is very similar when we talk about boilers for heating only the share of sale to biomass systems (DSO, CHP...) and companies for their own use is slightly bigger.

1.3.4. Prices of wood biomass

Prices in Slovenia

Prices of wood biomass on the Slovenian market (for autumn 2004) were gathered from different sources. In our analysis we wanted to capture prices of a less organized market as well. These prices were gathered on the basis of telephone conversations with tenderers of wood biomass in different advertisements. The sources of data about tenderers of (mostly) logs were daily newspapers, Salomonov oglasnik and internet. Prices of registered tenderers of wood biomass on the Slovenian market were obtained by inquiry questionnaires for producers of wood biomass (Annex 2). We got the majority of log tenderers through publications of small ads in Salomonov oglasnik. We called 13 tenderers and asked them about prices.

The lowest price of logs was 5.000 Tolars/vol m (21 €/vol m) and the highest price was 11.250 Tolars/vol m (47 €/vol m). Thus the average price of logs on the Slovenian grey market was 8.310 Tolars/m^3 (or 32 €/m^3). There is a problem regarding these prices, namely the cost of transport is sometimes included in the price and sometimes not. Incorporation of transportation costs, however, essentially influences the final price which oscilates a lot. Likewise undetermined is also the quality of logs (size, dryness, tree species). Among small ads we couldn't trace tenderers of other types of wood biomass, like wood chips, briquettes and pellets.

Moreover, we checked the prices of logs of big tenderers (companies, dealing with different types of fuels) where prices were a bit higher. The lowest price for logs was 9.200 Tolars/vol m (50 €/vol m) and the highest 11.950 Tolars/vol m (45 €/vol m). Thus the average price was 10.790 Tolars/vol m (45 €/vol m). In average, the price of these tenderers was higher by 2.480 Tolars/vol m.

We obtained prices of different types of wood biomass in Slovenia from the answers to the question B.3 of the previously mentioned questionnaire for producers of wood biomass. The only problem was that most of the inquired did not wish to pass the prices of wood biomass, that is why we obtained prices from only 9 of the inquired producers of wood biomass.

Table 2. Prices of wood biomass in Slovenia (August-September 2004)

	€/t	€/vol m	€/ stacked m^3
Logs	45	40	
Wood chips	13 - 25		5 - 21
Briquettes	62 – 166		
Pellets	117 - 186		

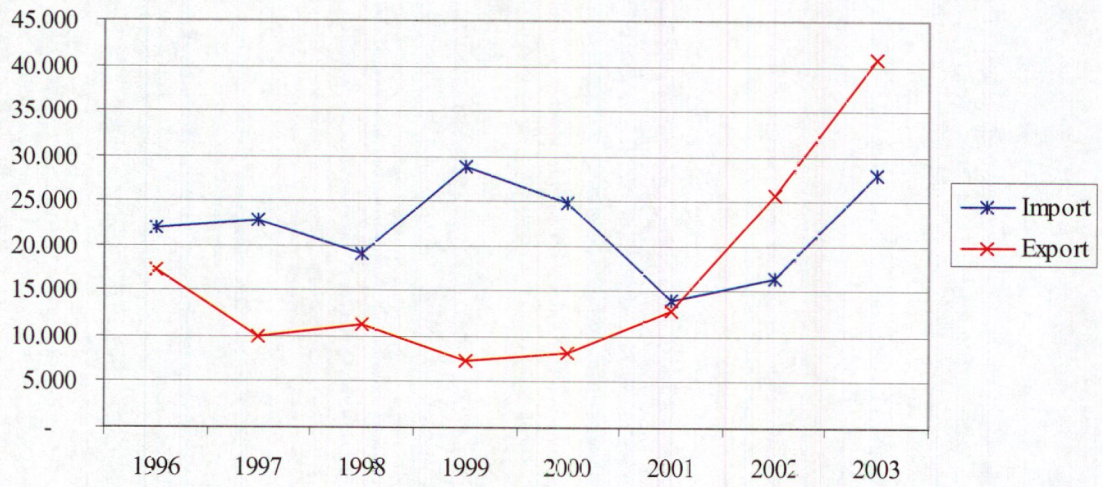
The problem regarding the analysis of prices is a relatively small number of prices that are available and their oscillation which depends on the quality, form and composition of the fuel as well as on the way of charging transportation costs (producer – buyer).

1.3.5. Import and export of wood biomass

Data regarding export and import of wood biomass were obtained from the Chamber of Commerce and Trade of the Republic of Slovenia which has at its disposal the databases of the Customs Administration of the Republic of Slovenia. Data for individual customs tariffs were obtained for the years from 1996 to 2003. After the examination of customs tariffs we found out that wood biomass can be classified into two groups, namely:

440130100 Sawdust, agglomerated or non-agglomerated
440130900 Waste and residues, agglomerated or non-agglomerated

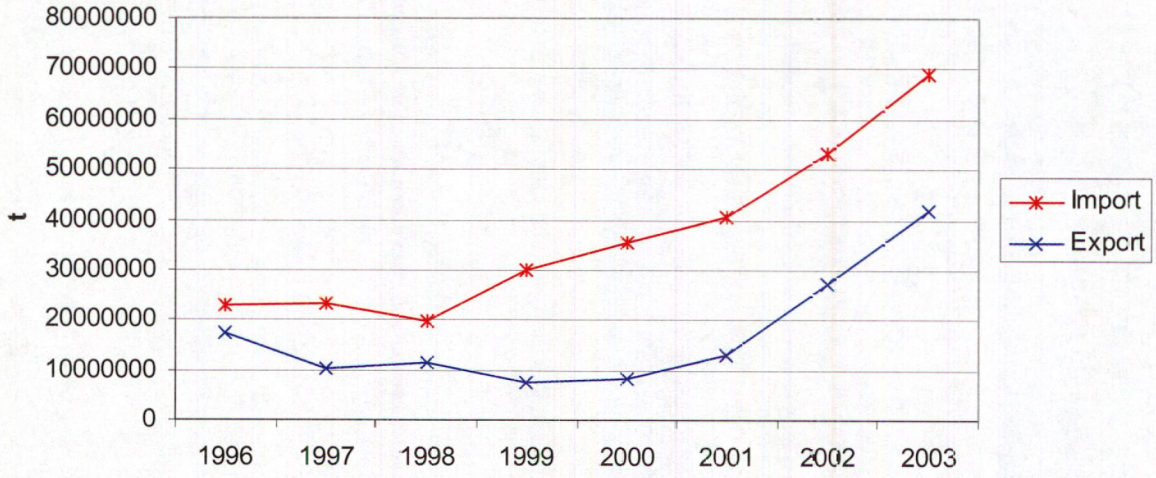
These two groups do not include data about import and export of low quality round wood or other thin round wood which comes directly from the forest. They only contain data about wood residues and waste wood.



Picture 18. Import and export of wood biomass in the period from 1996 to 2003 (for all countries)

Analysis of the obtained data has shown that the import was relatively high, in spite of different expectations, and surpassed the export in both groups. Increased import can be noticed only in the last years (after the year 2000) (Picture 18).

We obtained data for separately for import and export into the European Union countries (Picture 19). There is a substantial difference only in the second category (waste wood and residues) where export is importantly higher than import.



Picture 19. Import and export according to Customs tariffs to and from the countries of the European Union (for the period from 1996 to 2003)

Comparison of pictures 18 and 19 shows that sawdust, wood residues and waste materials are imported form the countries that are not members of the European Union. As to members of the EU, we export more wood residues and waste than we import from them. In fact we can expect that the quantity of import and export of wood biomass will change essentially when we include the year 2004 into the analysis which is when Slovenia became member of the European Union. These data will be available in the first half of the year 2005.

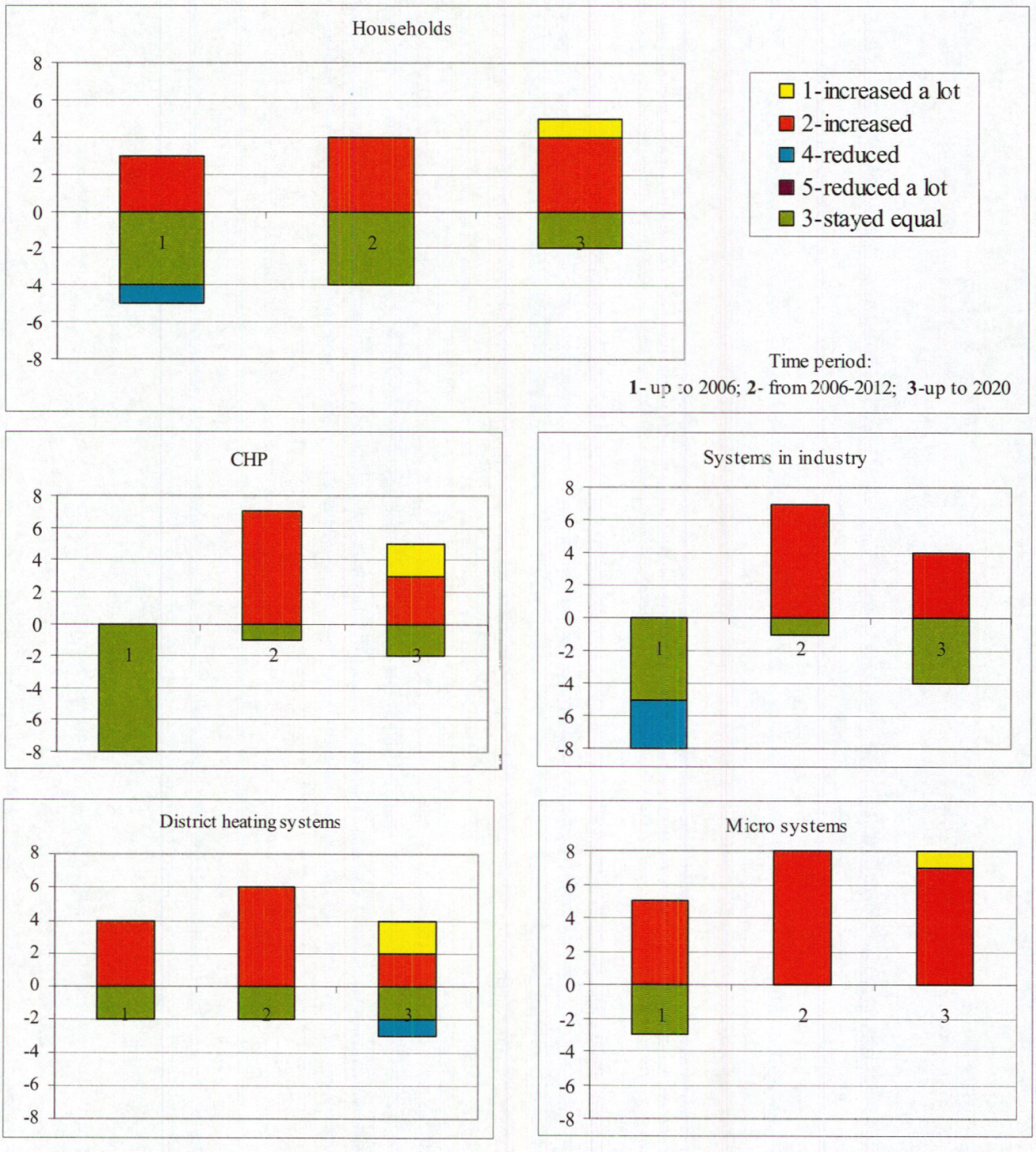
As a supplement to official data of the Customs Administration of the Republic of Slovenia we, in the inquiry questionnaires (Annexes2 and 4), asked the producers of wood biomass, producers of machines and equipment for the production, processing and utilization of wood biomass about their shares of export. The analysis of answers to question B. 4 (Annex 2) and B.5 (annex 4) showed that 5 of 12 producers of wood biomass export it. We got equal result (42 %) from tenderers of equipment for the production and utilization of wood biomass. Both expect to export also in the future.

In the inquiry questionnaire (annex 6), a group of experts also took into consideration the future export of wood biomass in Slovenia. A general conclusion (87 % inquired) was that in the next years (until 2012) export will keep increasing by up to 50 %.

1.3.6. Future development of wood biomass in Slovenia

At the moment, importance of biomass in Slovenia is rising and the same trend is to be expected also in the future. A very direct evidence of that are also projections and expectations of wood biomass tenderers and tenderers of technologies for utilization of wood biomass. A rising trend of sold quantities in the past years is evident from their answers to the questions in the inquiry questionnaire and both expect growth of sales in the future.

We wanted to obtain an opinion regarding future development of the area of production, processings and utilization of wood biomass in Slovenia also from a group of experts. We asked them what their judgement was about future use of wood biomass at individual groups of users. The entire inquiry questionnaire for the group of experts is in annex 6. Similarly as producers of wood biomass and tenderers of equipment and machines optimism can also be felt from answers of experts. Most of them believe that until 2020 the number of systems (boilers for central heating of houses and dwellings) will be increasing in households and at other users (picture 20).



Picture 20. Future utilization of wood biomass at different users (expert evaluation)

For each group of consumers the intreviewees reflected about the future use of wood biomass in three time periods, namely:
1-short-term period: from 2004 until 2006
2-medium-term period: from 2006 until 2012
3-long-term period: from 2012 until 2020.

Picture 20 shows frequency distribution of answers of individuals according to different time periods (abscissa axis: 1,2,3). Within different time periods individuals rated future utilization of wood biomass on a five grade chart, namely:
1-increased a lot (for more than 50 %)

2-increased (up to 50 %)
3-stayed equal
4-reduced (down to 50 %)
5-reduced a lot (for more than 50 %)

For a graphic display of results we marked the answers from 3 to 5 with a minus and answers under 1 and 2 with a plus (picture 20). According to the results of the inquiry we can make the following conclusion:
The biggest (relative) rise can be expected in micro systems (district heating systems of heating of residential houses or public buildings).
·The number of households which use wood for heating will rise in the meduim and long-term while the rise in number in a short-term will be smaller. Most of them even believe that in the short-term period the number of households will remain the same or shall even reduce.
·The number of district heating systems can be expected to rise only in a medium and long-term period.
·The number of systems for simultaneous production of heat and electricity is not expected to change in the short-term period while in the long-term their development is still unclear.
·The number of systems in industry is expected to reduce in the short-term as a consequence of the present conditions in the wood processing industry where the majority of these systems are now in function. In the meduim and long-term period the number of these systems is also expected to grow.

The number of answers is not very high, nevertheless they reflect certain trends and represent an evaluation of a group of experts who come from different spheres of work and have been professionally engaged in this kind of problems for years.

1.3.7. Market possibilities

Production of machines and equipment for production, processing and utilization of wood biomass

The research regarding present production of machines and equipment has shown that there are only a few producers of modern equipment and machines in Slovenia. They are, above all producers of cleaving and cleaving-cutting machines and some producers of contemporary boilers. A more intense development of domestic producers is restricted by a very strong competition of Austrian and Italian producers of contemporary boilers and machines. According to our estimation, such a situation will remain the same also in the future, even though it essentially reduces positive social-economic impacts of utilization of wood biomass. The fact is that many indirect, direct and induced jobs result from the production of machines and equipment for the production and utilization of wood biomass.

Utilization of biomass in households

The interviewed experts stated that in households, at the moment, logs are most frequently used which will remain so in the entire meduim-term period. The next most frequently used type is wood residues from wood precessing. In the future, this will be the raw material, destined above all to bigger - industrial biomass systems. As a consequence of increased demand, however, we can expect also the rise of prices of the mentioned raw material. Wood

chips will enforce especially where the needs for energy are large (farm tourism, sports facilities, crafts workshops). We can also expect increased consumption of wood pellets and quick development of the market with this raw material.

Utilization of biomass in big biomass systems

If we wish to enlarge the share of wood biomass in primary production of energy, we must stimulate the use of biomass in big systems. Among big systems we place district heating systems as well as systems for simultaneous production of electricity and heat (in continuation CHP), thermo power plants and heating plants in industry. At the moment, there are only a few of these systems in Slovenia. Out-of-date systems prevail. In the future we can expect an increased number of CHPs. This rise can be expected above all on the basis of adequate prices of green electricity. However, the state should, with corresponding measures, stimulate modernization of biomass systems and wood-processing industry which, on one hand has great needs for heat (drying of wood) and on the other hand it also produces usable wood residues. Stimulating the utilization of wood biomass in wood-processing industry we can contribute to the reduction of production costs on one hand and on the other hand we can produce energy surpluses which we can sell to the grid (heat or electric).

Development of wood biomass district heating systems is problematic because of high initial investment costs. A problem, that is appearing is also the supply of systems with wood biomass. This problem is a consequence of a small number of big suppliers of wood biomass. At the moment there are only a small number of big producers of wood biomass in Slovenia. With adequate measures, the state should stimulate the production of wood biomass also in forests. Through the height of subsidies it could influence the consumption in district heating systems, namely it could introduce more favourable subsidies for systems which are provided with the majority of wood biomass from local sources, where forests must prevail. This means that every district heating system makes contracts with forest owners for the supply of wood biomass from forests. With such measure we stimulate utilization of domestic sources of wood biomass, which augments positive social-economic impacts in the region. At the same time we can ensure better exploitation of forests - better realization of cutting and performing silvicultural and other necessacry protectional works in forests.

Production of wood biomass

At the moment, production of wood biomass is bound above all to the disorderly and unclear market with logs (sale of logs to households, export of logs to Italy). The market with wood chips has only just started to develop. At the moment, wood chips are produced above all from wood residues and only partly from wood biomass from forests. The problem is a small number of big producers of wood chips on the market and a proportionally large number of small producers who only cover their own needs. At the moment, wood chips are being made for some district heating systems (even though most of these systems have their own stamping machines), for individual users and for export to Italy and Austria.

New is the market with wood pellets. In 2004 we got the first big producer of pellets and we are expecting the run of another pellet-plant. With domestic production the market with pellets in Slovenia should make a quick progress. Both big producers are planning to export most of their production to the neighbouring countries.

A new market niche, which in Slovenia has only started to develop in the past two years, are micro systems. The word is about joint heating of several buildings. It is important that big energy consumers, like public buildings, are included: schools, kindergartens, hospitals, community buildings. With a development and decrease of prices of technology we can expect also a quick growth of micro CHP systems, which will supply their micro systems with heat and electricity. In this way a practical self-supply with energy would be ensured. Such systems could also help to increase the share of biomass in the production of primary energy, which is essential on a macro level.

2. ECONOMICS OF WOOD BIOMASS PRODUCTION

2.1. INTRODUCTION

One of the most important restricting factors in the production and processing of wood biomass are production costs. In continuation we will focus only on the costs of production of wood biomass from forests because in this case costs are the highest. In the case of wood residues and waste wood we can only talk about manipulation costs, chiping costs and costs of transport. In the case of wood biomass from forests, on the other hand, the costs comprehend the entire production chain, that is, cutting, skidding, transport and make of a desired form of wood biomass (logs or chips). Technology of production and processing of wood biomass determines total direct costs.

2.2. WORKING METHODS

Based on the data we got from producers and some other suppositions we made a calculation of direct costs for the entire foreseen mechanization (chain saw, adjusted agricultural tractor, chiping machines, firewood processor) which include costs of fuel and lubricants, costs of periodical spare parts, amortization costs as well as regular maintenance and insurance costs. We obtained data about purchase prices and prices of spare parts from producers of machines, while suppositions for calculations were taken from previous researches. On the basis of the gathered data we calculated direct costs of cutting, skidding, makings of wood chips and making of logs. Direct costs of a unit of the end product were calculated (final form of fuel wood in m3, vol m or in stacked m3).

At the calculation of time consumption for a unit of a final form of fuelwood we took into account data from producers' data regarding efficiency of some machines and journal entires from model farms. Costs were calculated only for production of fuel wood from round wood (part of regular annual cut) from forests and not from other types of wood biomass (cutting residues, other tiny wood biomass, wood residues, etc.).

2.3. TECHNOLOGY FOR PRODUCTION AND PROCESSINGS OF WOOD BIOMASS FROM FORESTS

Adequate choice of technology for production of fuelwood is the conditionon on which depend:

- the quality of fuelwood,
- economics of the production.

The selected technology is only efficient when it enables a maximum profit from energy accumulated in wood against minimal costs of making of a unit of the product.

Technological process for preparation of fuelwood can be divided into two parts: the part that goes on in the forest (cutting, skidding, sawing up, cleaving, drying) and the part that goes on outside the forest (transport, sawing up, cleaving, drying). Sawing up, cleaving and drying can be done in the forest or outside the forest, in a warehouse or the end user's backyard.

2.3.1. Cutting and skidding

The beginning of the technological process of preparation of fuelwood is cutting, followed by skidding of wood to the forest road. In Slovenia, cutting is mostly done with a chain saw and skidding with a tractor. In some cases (above all at thin assortments) making of wood chips would be more efficient at the skidding trail but because of possible damage to the floor and to trees making of wood chips or any other form of fuelwood is more acceptable at the forest road or at the auxiliary warehouse.

2.3.2. Preparation of the final form of fuelwood

Generaly speaking, we can make a final or intermediate form of fuelwood already at the forest road or at the auxilliary warehouse. The final forms of fuelwood are logs of a desired length and suitably large wood chips. Among intermediate forms we place meter billets or split logs.

Technology of preparation of logs

There are many combinations of preparation of individual forms of fuelwood (split logs, billets, classic logs) and the way of drying. The following working phases are always neccesary, though: cutting, skidding, sawing up (to 1m or to 25-30 cm), cleaving, drying and stacking piles. Only the location and sequence of individual operations change.

For preparation of classical logs, above all, uncovered deciduous trees are useful. This technology is known for a large consumption of time, work is slow and phisically hard. Beacuse of this and because of out-of-date heating technology, logs have become less interesting for many people. With the possibility of fuelwood preparation automation and use of contemporary boilers using logs (POGACNIK, KRAJNC 2000) things have changed in this area, too.

Technology of preparation of wood chips

Technology of wood chips preparation depends on the characteristics of the stamping machine and on the characteristics of wood biomass. Technology of wood chips preparation from cutting residues, brushwood and tiny tree mass essentially differs from the technology of wood chips preparation from wood residues (side pieces, offcuts) or from round wood (uncovered). To make wood chips, uncovered and other forest assortmnets of low quality

should be used. The technology of preparation of wood chips from cutting residues and thin assortments (diameter up to 10 cm) from early thinnings differs above all in the preparation of the raw material.

As final form of fuel wood we can regard only air-dry wood chips. Utilization of non-dry wood chips for heating is possible but not recommendable because of very bad utilisation rates and other negative side effects (malfunction of boilers, more soot and tars, greater emission).

Picture 21. New technology of fuelwood preparation

2.4. DIRECT COSTS OF PREPARATION OF FUELWOOD

Among direct costs of fuelwood preparation there are direct costs of machines used for cutting (chain saw), skidding (tractor) and preparation of the final form of fuelwood (stamping machine or log-making processor).

Direct costs of individual machines per unit comprehend costs of fuel, lubricants and regular spare parts, depreciation (depends from purchase price of the machine and from depreciation period), costs of regular maintenance and insurance of machines and interests on paid-up capital.

For the needs of the project we have prepared an MS Excell programme which enables a clear calculation of material costs of individual machines. It also enables a selection of individual machines and in the final instance it calculates cost prices for individual machines. Cost price includes labour price. As labour costs of companies and private forest owners are essentially different, two different labour prices were considered. Every user can decide which one to use.

2.4.1. Direct material costs of individual machines

Direct costs for the chain saw are calculated on the basis of calculations for the chain saw, where the following items were considered:

Variable material costs	577 SIT / working hour
Purchase value	179,900 SIT
Depreciation period of	10 years (for a private forest owner)
Interest	7 %
Insurance	3 %.

In this case, into variable costs we include: costs of fuel, lubricants and spare parts, like: chain, chain-saw blade and driving wheel. Purchase price and prices of spare parts don't contain value-added tax. Prices were obtained from a distributor of such equipment in June 2004. Direct costs of the chain saw are 442 SIT / hour. If we say that owners in their forests cut down, in average, 0,8 m3 per hour (the average is calculated from the data which farmers of sample farms wrote daily into their working journals - data still unpublished), direct costs of the chain saw at cutting are 552 SIT / m3.

Direct costs of the tractor were calculated with the help of calculations for the tractor (annex 8). We gathered the necessary data for 17 different tractors. For the model calculation we chose the adjusted agricultural tractor, where the following suppositions were observed:

Variable material costs	1107,6 SIT / hour
Purchase value	9.500.000 SIT
Depreciation period of	15 years (for a private forest owner)
Interest	7 %
Insurance	3%.

As variable costs we consider costs of fuel, lubricants and regular spare parts, like: tyres, chains, ropes, slings and sliders.

Most tractors have a lifespan of 15 years, supposing that they don't only work in the forest but also on other agricultural surfaces. We believe that in any case. a tractor is in use, even if we use it to make wood chips, 100 days a year. We calculated, in average, 8 working hours a day. Direct costs of the tractor are 3.411,4 SIT / hour. With the assumption, that the effect is 5,5 m3 / hour, direct costs of this tractor are 2006,7 SIT / m3. Besides that we have to consider the costs of the winch which are 187,6 SIT/hour (three-point winch UNIFORST).

As to some characteristics (chapter 7.3.2.1) we divide chippers into three goups. Important differences are, above all, in their efficiency. in the biggest diameter of wood we can still process and in purchase prices. Because of big differences in purchase prices we will calculate material costs for four different types of chippers, namely:

1. Light chipper, driven by a tractor over the cardan joint
2. Medium chipper, driven by a tractor over the cardan joint
3. Medium chipper with self-propulsion.
4. Heavy chipper with self-propulsion

For the calculation of direct material costs we took as an example two chippers from the group of medium chippers. There is an essential difference between the chosen chippers in the drive. Self-propulsion makes a big difference regarding the purchase price and variable costs.

Table 3. Technical data of the chosen chippers

MODEL		Chipper 04 TPS	Chipper 06 TTS	Chipper 05 MTS	Chipper 10 MTS
GROUP		Light	Meduim	Medium	Heavy
Propulsion - type		tractor	tractor	diesel engine	diesel engine
Required engine power	kW	25 kW	50 kW	31 kW	140 kW
Max. diameter of wood	cm	15	22	22	30
Size of wood chips	mm	10 - 13	10 - 13	10 – 13	8 - 13 – 18
Number of knives	nr.	3	3	3	4
Cardan speed	rev/min	540	1000	-	-
Length/Width/Height	cm	185/90/230	292/190/210	300/180/170	515/235/245
Weight	kg	320	750	1200	3400
Efficiency	m^3/h	5	12	12	30
Price	SIT	1.200.000	2.800.000	3.700.000	9.520.000

For tractor driven chippers we added up also direct costs of the tractor, however reduced for some regular spare parts (sliders, chains, slings). Direct costs of the chipper depend on the annual utilization of the chipper (graph 4), that is why two different calculations have been made for each type of chipper. In the first case we anticipate that the chipper is used 100 days a year. As this surpasses one's own needs, we suppose that the owner of the chipper makes, in average, from 80 to 90 days annually as as service to others.

Table 4. Material costs of individual machines

All costs are in SIT/hour	Brand	Material costs	Work performed by: (choose)	Labour costs	Cost price
Chain saw	Husquarna 365	442	Private forest owner	3.396	3.837
Tractor			Private forest owner		
Adjusted agricultural	ZETOR 6340	3.411		3.396	6.807
Forestry (4x2)	ZETOR 6320	1.827		3.396	5.223
Forestry (4x4)	IMT 577 4WD	2.214		3.396	5.609
Chipper			Private forest owner		
Light		302,50		3.396	3.698
Medium		663,83		3.396	4.059
Medium-self propelled		2335,47		3.396	5.731
heavy – self propelled		7625,60		3.396	11.021
Log-making processor		379,37	Private forest owner	3.396	3.775
Winch	UNIFOREST 4E	187,60	Private forest owner)	3.396	3.583

Table 5. Efficiency of individual machines

	Unit	Efficiency m^3/h
Chain saw	m^3	1
Tractor	m^3	2
Light chipper (tractor connection)	stacked m^3	2
Medium chipper (tractor connection)	stacked m^3	4
Medium chipper (self-propelled)	stacked m^3	4
Heavy chipper (self-propelled)	stacked m^3	10
Log-making processor (tractor connection)	vol m	4
Truck (25 km, 22t)	m3	10

Considering the efficiency from the above table we get the costs of production and processings of wood biomass from forests. As we mentioned in the beginning of this chapter the key factor regarding costs of production and processing of wood biomass is the selection of technology. Selection of technology is determined by heating devices and customers for whom fuelwood is made.

In continuation only a few possibilities for the calcualtion of total costs of production and processings of wood biomass from forests are presented:

1. For cutting we need the Husquarna 365 chain saw, for skidding the adjusted agricultural tractor brand ZETOR 6340, we make wood chips at the customer's warehouse that's why we transport round wood on a distance of 25 km in one direction and with a truck with load capacity of 22 ton. To make wood chips we use a medium power chipper with the capacity of 20 stacked meters / hour, driven by a tractor. In this case total direct costs are 45 €/m3 or 15 €/stacked meter. These costs include labour costs, which are costs of a professional forestry worker (cutter, tractor driver, truck driver). Considering that the works are done by the forest owner alone, the costs are lower, and they are: 32 €/m3 or 12 €/stacked meter.
2. For cutting we need the Husquarna 365 chain saw, for skidding, a specialized forestry tractor IMT 577. We make wood chips at the customer's warehouse that's why we

transport round wood on a distance of 25 km in one direction and with a truck with load capacity of 22 ton. To make wood chips we use a medium power self propulsion chipper with the capacity of 30 stacked meters / hour. In this case total direct costs are 34 €/m3 or 11 €/stacked meter. These costs include labour costs, which are costs of a professional forestry worker (cutter, tractor driver, truck driver). Considering that the works are done by the forest owner alone, the costs are lower, and they are: 29,3 €/m3 or 9,8 €/stacked meter.

3. For cutting we need the Husquarna 365 chain saw, for skidding, a specialized four wheels drive forestry tractor SAME DORADO 75 DT. We make wood chips at the customer's warehouse that's why we transport round wood on a distance of 25 km in one direction and with a truck with load capacity of 22 ton. To make wood chips we use a heavy self propulsion chipper with the capacity of 45 stacked meters / hour. In this case total direct costs are 32 €/m3 or 11 €/stacked meter. These costs include labour costs, which are costs of a professional forestry worker (cutter, tractor driver, truck driver). Considering that the works are done by the forest owner alone, the costs are lower, and they are: 29 €/m3 or 10 €/stacked meter.
4. For cutting we need the Husquarna 365 chain saw, for skidding, the adjusted agricultural tractor brand ZETOR 6340. We make logs at the customer's warehouse that's why we transport round wood on a distance of 25 km in one direction and with a truck with load capacity of 22 ton. We make logs with a tractor driven cleaving – cutting machine with a capacitiy of $5m^3$/hour. In this case total direct costs are 33 €/m3 or 11 €/vol m. These costs include labour costs, which are costs of a professional forestry worker (cutter, tractor driver, truck driver). Considering that the works are done by the forest owner alone, the costs are lower, and they are: 30 €/m3 or 10 €/vol m.
5. For cutting we need the Husquarna 365 chain saw, for skidding, a specialized two wheels drive forestry tractor IMT 577. We make wood chips at the customer's warehouse that's why we transport round wood on a distance of 25 km in one direction and with a truck with load capacity of 22 ton. We make logs with a tractor driven cleaving – cutting machine with a capacitiy of $5m^3$/hour. In this case total direct costs are 37,0 €/m3 or 12,3 €/vol m. These costs include labour costs, which are costs of a professional forestry worker (cutter, tractor driver, truck driver). Considering that the works are done by the forest owner alone, the costs are lower, and they are: 34 €/m3 or 11 €/vol m.

Total production costs depend on the selection of technology and above all on the utilization rate and capacity. Comparing given costs with the prices of wood biomass on the market, we can find out that total direct costs of logs do not surpass present prices on the market which, according to our analysis range from 20,8 € /vol m at smaller producers to 49,5 € /vol m at big tenderers of logs on the market. Direct costs of wood chips production and processing are also lower than the present market price. However, differences here are substantially smaller and in some cases total direct costs already surpass the lowest price of wood chips on the market. Considering, that wood chips of the lowest quality, made of waste and disused wood, have the lowest price on the market, the height of cost is not critical yet. Prices of wood chips range from 5 to 21 €/stacked meter and calculated costs from 14,9 to 9,6 €/stacked meter.

Total direct costs for individual fuelwood production technology depend on the final shape of fuelwood. For unambiguous comparison of direct costs the production of individual final shapes of fuelwood, the following table presents quantity equivalents of individual shapes of fuelwood.

Table 6. Quantity equivalents of individual types of fuelwood

	Units	Goli	Logs (1m) (stacked)	Logs (30 cm) (stacked)	Logs (30 cm) (stacked)	Wood chips (<5 cm)
Unit		m^3	Vol m	Vol m	stacked m^3	stacked m^3
Goli	m^3	1	1,4	1,2	2	3
Logs (1m) (stacked)	Vol m	0,71	1	0,85	1,4	2,1
Logs (30 cm) (stacked)	Vol m	0,83	1,2	1	1,67	2,55
Logs (30 cm) (stacked)	stacked m^3	0,5	0,7	0,6	1	1,5
Wood chips (< 5 cm)	stacked m^3	0,33	0,46	0,40	0,66	1

3. INSTITUTIONAL ASPECT OF WOOD BIOMASS UTLIZATION IN SLOVENIA

3.1. INTRODUCTION

The fact is that there are very few institutions in Slovenia which are engaged to a great extent in the area of wood biomass. Wood biomass, as a renewable source of energy, is important for Slovenia however this area is unregulated also from the institutional point of view which probably originates in the present conditions on the legislative area.

3.2. METHODS OF WORK

Analysis of the present institutional regulation of the area of production, processings and utilization of wood biomass was made on the basis of our expertise regarding conditions in Slovenia and on the basis of discussions with experts from different professions. The scheme of institutional conditions was made according to the Ven diagram method where the size, position and color of circles represent the importance and the role of an individual institution. We presented the completed picture to a group of experts from different professions and institutions. On the basis of discussions and comments we adjusted the picture.

With the inquiry questionnaire (Annex 6) we examined the present roles of different institutions. All inquired experts marked the present role with a three-degree scale.

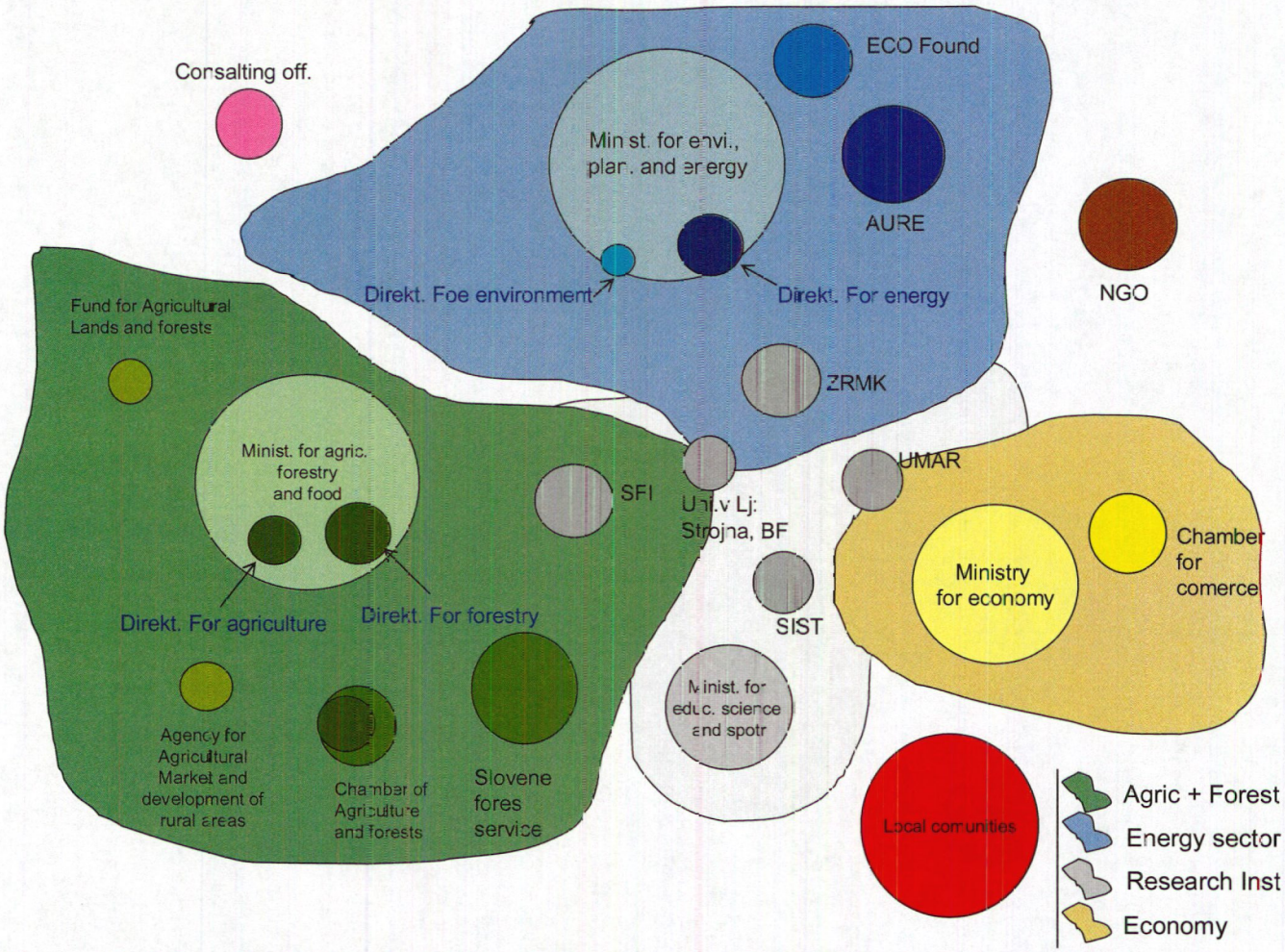
3.3. RESULTS

3.3.1. Analysis of the situation

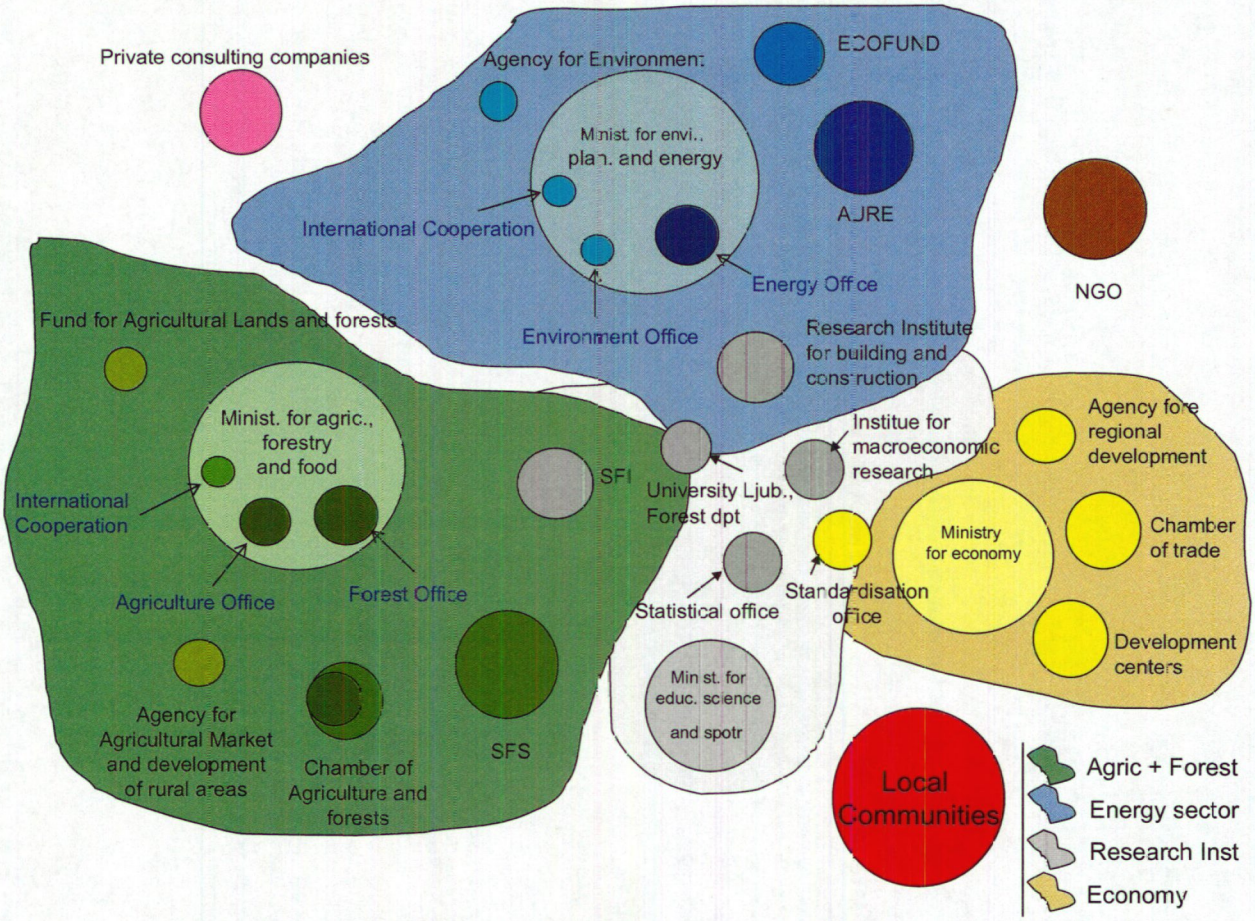
On the basis of analysis of existent literature and our expertise of the situation in Slovenia we made a Ven diagram which illustrates the importance and the role of individual institutions in Slovenia. We divided these institutions into four basic groups. Groups are determined according to sectors:
1. Forestry
2. Energetics
3. Economy
4. Science and education
5. Other.

Every sector has its own typical color. Size, place and color define the importance of individual institutions (picture 22).

Circles that are bigger and deeper in color mark those institutions which have, or are supposed to have a more important role in the area of production, processings and utilization of wood biomass in Slovenia. The ssecond, improved version of Venn diagram was made on the basis of remarks of experts.



Picture 22. Roles of individual institutions in the area of production, processing and utilization of wood biomass – first version

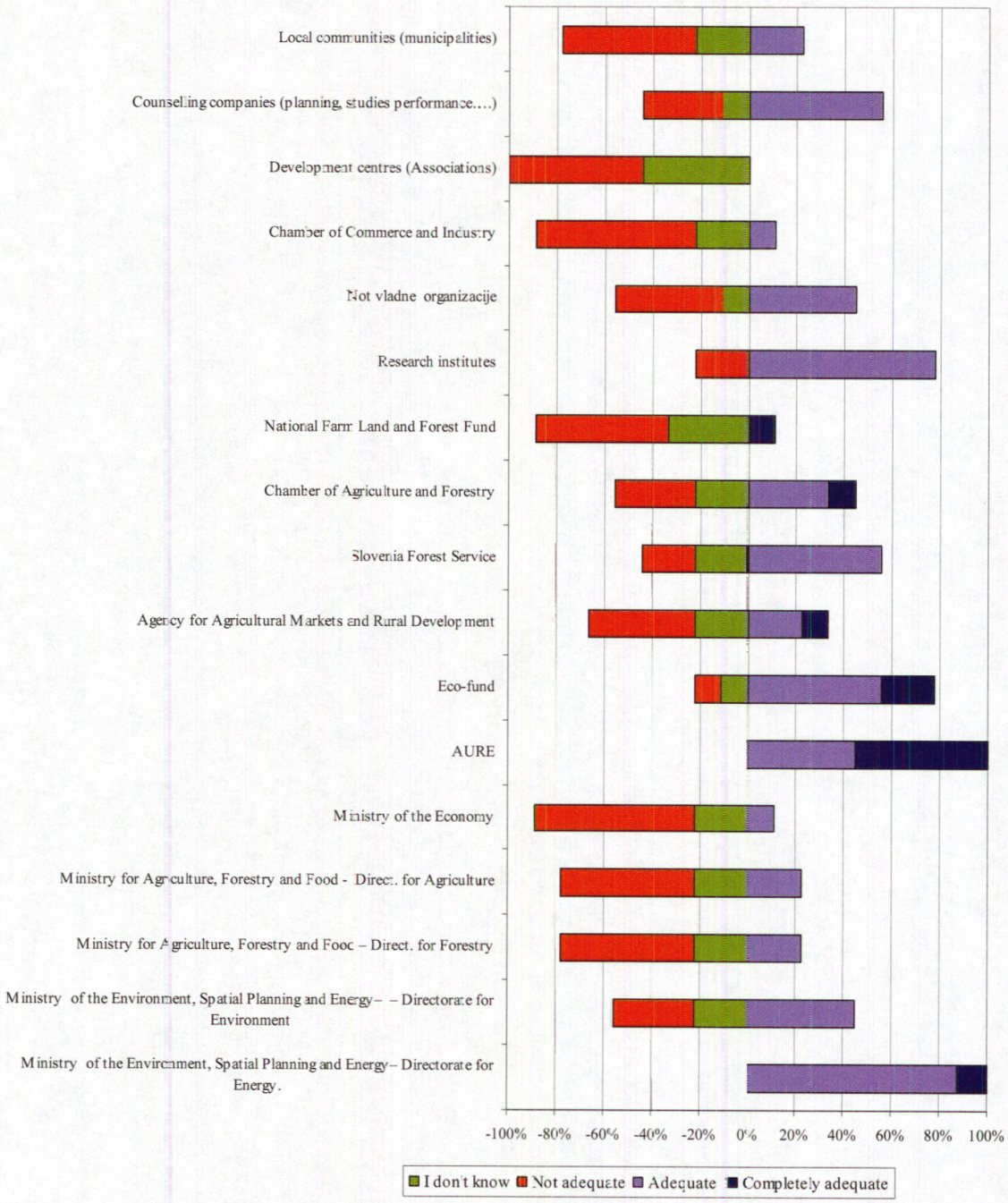


Picture 23. Roles of individual institutions in the area of production, processing and utilization of wood biomass – second version

From the presented Venn diagrams it is evident that on the state level two ministries, namely Ministry of Agriculture, Forestry and Food (in continuation MAAF) and Ministry of the Environment, Spatial Planning and Energy (in continuation MASE), play the most important roles. Local communities are the next most important and their roles are reflected on local and regional levels. The role of non-governmental organizations is supposed to be important from the aspect of informing and promotion. Besides MAAF and MASE two other ministries are also important and these are Ministry of the Economy, which until 2001 had the area of energetics in its scope and with the transfer of energetics to Ministry of the Environment, Spatial Planning and Energy in 2001, this ministry completely lost its role in the area of production and utilization of wood biomass. The role of Ministry of Education, Science and Sport is just financing or co-financing scientific and research projects in the area of production, processings and utilization of wood biomass.

The Venn diagram (picture 23) shows an ideal situation in Slovenia. The actual situations reflected in the answers of experts who marked the present roles of individual institutions with a three-degree scale:

1. completely adeqaute
2. adequate
3. not adequate
4. I don't know.



Picture 24. Present role of individual institutions in Slovenia

Because of a clear presentation we marked answers "I don't know" and "not adequate role" with a negative sign and thus separated them from answers which estimated the present role of institutions more positively (adequate and very adequate role). We placed the »I don't know« answers among negative ones because this was an inquiry of experts, who basically have a very good knowledge of Slovenian conditions and in if they don't know what the role is, we can conclude that the present role of these institutions is irrecognizable.

Picture 3 shows that the best estimated are the present roles of those institutions which work in the area of energetics, namely MESE - Directorate for Energetics and Agency for Efficient Use and Renewable Sources of Energy, followed by the Ecology Fund of the Republic of Slovenia and different research institutions. Institutions from the area of agriculture and forestry were generally worse estimated. According to opinions of the interviewees the roles of different directorates within the MAFF were unrecognizable (answer "I don't know") or not adequate. Still worse was the estimation of the role of the MInistry of the Economy and other institutions form the area of economy. Among the most worrying was a very badly estimated role of local communities and nongovernmental organizations.

All interviewees had the opportunity to present their own ideas for improvement of the roles of individual institutions and above all to give proposals for improvement of co-operation and connection between institutions.

Among the most interesting answers are the following:
1. Formulation of a long-term, intersectoral national programme of utilization of wood biomass in Slovenia with defined roles of individual institutions.
2. Regulation of legislation in this area;
3. Clear intersectoral connection of all the involved;
4. Foundation of a permanent consulting - expert council with a broad spectrum of representatives;
5. Definition of a nucleus institution - institution for development of the area of production, processing and utilization of wood biomass;
6. Enable total control over the activities of different institutions;
7. Establishment of better connection key factors: MAFF, MESE and ME;
8. Foundation of an inter-institutional council for coordination of this area;
9. Enlargement of the role of the agricultural and forestry sector;
10. To review the roles of all institutions and to find sectors within them which could assume stronger roles in the promotion of wood biomass utilization;
11. Foundation of a group for preparation, realization, control of EU projects from this area.

3.3.2. Present and future role of the Slovenia Forest Service in the area of production, processings and utilization of wood biomass

In the above mentioned inquiry, the role of the Slovenia Forest Service was estimated in 5 cases as adequate, in two cases as not adequate and in two cases the interviewees didn't know what the role was (answer "I don't know"). These are above all opinions of outside judges of circumstances in this area. The question is what the estimation of employees of Slovenia Forest Service would be. The views of the employees could be different however we don't have these data.

The fact is that in the past 5 years SFS has been very passive in this area. It has cooperated with the Chamber of Agriculture and Forestry in the organization of some presentations of contemporary equipment and machines, but the majority of activities were left over to foresters on local levels (for example organization of lectures for forest owners).

Measures necessary to intensify the role of SFS in the future:

1. Active co-operation in the preparation of the national programme of utilization of wood biomass in Slovenia (preparing of evaluation of wood biomass potentials, evaluation of possibilities of future development of production of wood biomass from forests),

2. On the national level SFS should get a mandate for co-operation in the preparation of regulations which will define the areas where analysis of the possibility of the use of biomass in district heating systems is obligatory. Preparation of such regulations is foreseen in the Resolution about the National Energy Programme (ReNEP) among environmental measures for the achievement of goals and as one of groundworks for the formulation of obligatory local energy concepts. These are supposed to be obligatory for all urban municipalities and municipalities with more than five thousand inhabitants. SFS should take part in the evaluation of potentials in municipalities and in the choice of criteria for placing individual municipalities to the list of those where analysis of the possibility of the use of biomass in district heating systems is obligatory. It would be important for the SFS to get a mandate for examination of all local energy concepts in the part where they deal with the possibility of the use wood biomass.

3. An important role of SFS is also to pass on information to forest owners and to counsel. SFS already, successfully, performs education in the area of safe work and silvicultural and protectional works in forests and education could be expanded also to the area of production and processings of wood biomass;

4. SFS should cooperate more actively with energy sector, above all with the Agency for Efficient Use and Renewable Sources of Energy and MESE. Cooperation in the preparation of complete legislation for the area of production, processings and utilization of wood biomass would be crucial.

5. SFS should take an active part in the preparation of the new Programme of development of forests and in the programme to ensure also an adequate place for wood biomass.

6. For efficient inter-institutional connecting and transfer of information, also inside SFS, a coordinator for this area should be appointed as well a special expert group.

7. Guidelines for a technological development of production of wood biomass from private forests should be made to serve as groundwork for education of forest owners in this respect.

8. SFS should play an important role in cases when conflicts arise among different users of place or users of wood, especially wood biomass.

4. LEGAL ASPECTS OD PRODUCTION, MARKETING AND UTILIZATION OF WOOD BIOMASS FOR ENERGY PURPOSES

4.1. INTRODUCTION

The area of production, marketing and utilization of wood biomass (in continuation PMUWB) for energy purposes represents a network of production chains which satisfy one of the fundamental needs of contemporary society - the need for energy. Legal aspects of PMUWB capture a broad spectrum of areas, from forestry, agriculture, industry, energetics and protection of environment, in the widest sense they indirectly touch also public finance and even international relations. Besides tradition and trends, legal aspects determine the level of utilization of wood biomass for energy purposes. They set limit conditions for execution of the activity and they prepare the climate for economic processes which are directly or indirectly connected with this area.

The goal of the analysis of legal aspects of PMUWB in the present expert valuation is:

1. To make a survey of valid relevant legislation in Slovenia in the area of production, marketing and utilization of wood biomass.

2. To make orientations for changes of legislation related to production, marketing and utilization of wood biomass to stimulate strategically suitable ways of energy use of wood biomass in Slovenia.

In the analysis of legal aspects we limited ourselves to strategic documents (strategies, resolutions, programmes) of the Republic of Slovenia (RS), valid laws and executive regulations (rules, directions, regulations, orders). We did not pay regard to proposals of strategic documents and legislative regulations for the purpose of our expert valuation.

4.2. METHODS OF WORK

4.2.1. Evaluation of legislation connected to production, processing and utilization of wood biomass

The source of strategic documents of the Republic of Slovenia is the Official Gazette of the Republic of Slovenia (http://www.uradni-list.si/index.jsp), which is, for the period from 1994, completely accessible on the internet. In the period from April 2004 – August 2004 we followed, on a weekly basis, the regulatory part of new editions of the Official Gazette of the Republic of Slovenia.

The basic way for the identification of legislation for PMUWB was the web portal IUS-INFO (http://www.ius-software.si). For the access to the closed sections of the portal we acquired access and participated in the course for advanced search of documents.

Additional way of identification of relevant (especially indirect) legislation for PMUWB were AURE web sites (http://www.aure.si) and the base of valid regulations from the area of

forestry, civil engineering and protection of environment which the Slovenian Forestry Institute maintains for the needs of forestry civil engineering.

In June and August, 2004, we made a series of thematic inquiries on the web portal IUS-INFO. In the first step we made a list of regulations which contained, in the roots of key words, in titles and in texts of laws and regulation acts, the following words:
- wood,
- biomass,
- renewable sources of energy.

In the second step we made a list of regulations which in their titles contained words: energetics, energy, forest, forestry, protection of environment, sustainable development. We joined both lists and made a selection of regulations which in our opinion touched the matter of production, processing and utilization of wood biomass in Slovenia. After that we arranged the chosen regulations according to a degree of impact (direct, indirect) and according to the main chapters of the IUS-INFO register.

4.2.2. Development of legal bases for stimulation of energy use of wood biomass

On the basis of the selected regulations we prepared a draft orientation for priority tasks at changing of the existent legal bases for stimulation of the use of wood biomass for energy purposes. We presented the draft orientation, together with the summary of legislation survey, at the workshop attended by selected experts from the area of wood biomass, where we also made an inquiry regarding legal or of production, marketing and utilization of wood biomass (PMUWB) in Slovenia (annex 1).

Based on the opinions and remarks of participants we prepared orientations for the change of legal bases and appointed carriers of tasks for key proposals.

Based on our expertise of the area we also made recommendations for concessionaires, forest owners and representatives of forest owners.

4.3. RESULTS

4.3.1. Identification of relevant legislation

In Slovenian legislation term *'biomass'* appears for the first time in 1986 (Long-term plan of the Republic of Slovenia for the period from 1986 to 2000). The term 'wood biomass' (WB) appears for the first time in Slovenian legislation in 1998 (Open tender of the Development fund of the Republic of Slovenia, d.d., Ljubljana, for subsidies of local infrastructure). The expansion of the use of the term WB follows after the year 2002 in program documents of the Parliament of the republic of Slovenia and in the proclamation part of the Official Gazette of the Republic of Slovenia.

The search term 'biomass' gave 14 regulations in force, and the combination of the root of words wood, biomass and renewable sources of energy (basic terms) gave additional 34 regulations. The results of the search captured the whole spectrum of activities, from forestry to the monitoring of emissions of heating devices and even to public finance, but did not

enable access to numerous acts, which according to our experience, affect the conditions for the production, processing and utilization of wood biomass for energy purposes.

After introduction of additional key words and their combination with basic expressions we got a list of 231 acts. We added acts from the area of protection of environment and spatial planning and civil engineering, which according to our opinion, indirectly affected the production of WB and we got about 300 acts. On the basis of titles of acts and according to our expertise of the area we reduced the extensive list to 45 acts (table 1) which in our view importantly affected the treated area. The selected documents are kept in the archives of the head of the project.

From 45 selected documents, 36 indirectly touch the area of production of wood biomass, 14 deal with marketing of WB and 20 of them deal with its utilization for energy purposes. The selection of regulations as well as classification of impact was relatively subjective, as in most cases it is hard to determine the actual degree of impact to PMUWB. Inclusion of 'indirect acts, important for forestry', was more detailed than those for agriculture, industry and energetics.

Table 7. Number of collected acts which directly (dir.) or indirectly (ind.) affect PMUWB

	TOTAL	PRODUCTION		MARKETING		UTILIZATION	
AREAS		dir.	ind.	dir.	ind.	dir.	ind.
State regulation of the RS	1		1		1		1
Field of law	0						
Public finance	3		3		1		1
Commercial-legal order	0						
Economic activites	22	6	15	2	7	7	4
Technical regulations and quality	0						
Non-commercial activities	2		1		1		2
Spatial planning and protection of environment	15	10	14	4	3	3	10
Labour law, health, social protection							
International law	2	2	2		1	2	2
Together	45	18	36	6	14	12	20

Besides valid regulations, the following list of published program documents of the Parliament of the Republic of Slovenia or Government of the Republic of Slovenia which deal with PMUWB, was made and studied:

- National program of protection of environment
- Forest Development Program
- Program of Energy Utilization of Wood Biomass in the Republic of Slovenia for 2001-2010
- National Energy Programme resolution
- Unified program document of the Republic of Slovenia for the period 2004-2006

- Strategy and short-term action plan of TGP emissions reduction
- Decree about Strategy of spatial Development
- National Program of statistic researches

4.3.2. Review of relevant legislation in light of the new energy programme

Resolution about national energy programme (ReNEP, May 2004) places WB among renewable sources (RSE). First, it deals with it in the context of energy balance of the Republic of Slovenia, where in 2001 it occupied 3,9 % in the primary energy balance. Further, it mentions it in the chapter about energy infrastructure (chapter about heat) and in the chapter about organization of supply with thermal energy. RSE and WB are mentioned also in chapters about European dimension of Slovenian energetics and long-term energy balance of the Republic of Slovenia. In the chapter about the strategy of future supply with energy RSE and WB are firmly positioned within the strategy regarding the supply with electric energy (economically justified use of RSE for co-production) as well as in the strategy regarding supply with heat. Increase of the existing share of WB in the ReNEP is evidently defined among the goals of energy policy of the Republic of Slovenia until 2010 in the area of reliability of supply with energy and goals from the environmental sphere.

The majority of regulations connected with PMUWB date in the period before the publication of ReNEP, therefore it is clear, that numerous regulations need to be updated and coordinated with ReNEP. And not only regulations, entire programmes and sectoral strategies need update. In the area of concrete measures, ReNEP is very general, and there is grounded risk that in spite of fundamental readiness to augment the use of WB for energy purposes, nothing will happen in practice. ReNEP can be a real springboard for a systematic work at stimulation of production, marketing and utilization of WB or only another dead regulation. With ReNEP, hard work only begins, because in the area of inter-institutional and intersectoral cooperation in the introduction of RSE and especially WB, so far in Slovenia we could note down nothing but defeats. It won't be enough to just ammend a few regulations, a long-term consistent formulation and execution of a number of mechanisms in differnt sectors will be necessary.

4.3.3. Inquiry regarding legal order of PMUWB

Within the project we made, on September 14, 2004, an inquiry among selected experts from the area of PMUWB. 8 representatives from the following institutions were invited to the meeting:

- Slovenia Forest Service
- Head of the GEF project
- AURE
- MOPE
- MKGP
- GIS
- ZRMK-EnSVET
- KGZS

Seven participants fulfilled the inquiry directly at the meeting, two of them afterwards. We can unite the results of the inquiry in the following findings:

- The majority of the interviewees believe that the area of PMUWB in Slovenia is relatively well arranged on the programme (principal) level while it is deficient on a legal and very bad on the executive level.
-The prevailing opinion among interviewees is that the majority of strategic and programme documents connected with PMUWB (see list in chapter 3.1) are principally non-harmonized.
-Interviewees are badly acquainted with the programme of development of forests and the Unified programme document of the Republic of Slovenia, while the prevailing opinion regarding the national programme of protection of environment is that it obstructs PMUWB.
- Assessment of the importance of valid legislation showed that the range of relevant legislation is too wide even for experts from individual areas of WB; foresters didn't know energy regulations and vice versa.
-The majority of interviewees believe that we need additional regulations for stimulation of PMUWB (tax concessions, biomass as fuel, taxation of private forests whit no cut, biomass act, RSE act,...)
-The interviewed experts who are well acquainted with the problems of PMUWB in Slovenia gave the following suggestions regarding legal aspects of PMUWB:

- immediate coordination of regulations in the area of RSE and WB with regard to ReNEP
- development of new a system of subsidising of green electricity from co-production and investments in microsystems using WB
- harmonized stimulation of utilization of WB from forests with programmes of utilization of wood residues
- immediate modernization of Programme of development of forests
- ammendments of Personal Income Tax Act in direction of relieves for users of WB
- harmonization of executive regulations for workers in energetics, foresters, environmentalists

4.4. STATEMENTS AND CONCLUSIONS

On the basis of review of legal sources dealing with PMUWB, our expertise of problems of PMUWB, study of literature and inquiry we made the following proposals for development of the legal aspect of production, marketing and utilization of wood biomass for energy purposes in Slovenia:
1. The term wood biomass must be introduced into legislation whic covers the area of forestry, agriculture, spatial planning, protection of environment and energetics.
2. Because even after 10 years of stimulation of energy use of WB this area is a domain of all and of no one it is necessary to establish a permanent non-project, intersectoral and interinstitutional body - a council for development and promotion of wood biomass (or RSE) - for coordinatinof activities in the area (in continuation Council). The initiator for the foundation of the council is the energy sector and the founder is the Republic of Slovenia. A member of the council is also one representative of the Ministry of Finance.
3. On the programme level the priority task is modernization of Programme of development of forests. MKGP must have a permanent representative from bodies in its structure for WB - even if it is a representative of the agricultural sector.
4. On the legal level there is a difference, regarding the position of PMUWB, between laws accepted or ammended after or before year 2000 - the Council must take part in the updating.
5. Environmental protection legislation is a potential braking force for the production of WB from forests (protected areas, new technologies, infrastructure) - coordination between MOPE

and MKGP in the preparation of regulations (especially executive) which can restrict production and also utilization of WB for energy purposes is essential.
6. The area of direct financial stimulations for investments into the utilization of WB needs to be upgraded with a system of indirect sectoral stimulations (e.g. use WB for heating of public institutions, tax concessions, co-financing of forestry mechanization and constructions, support for integration of forest owners,.....).
7. The council forms a strategy of annual activities at OPRLB, makes concepts and brings into practice a consistent policy of preparation of executive regulations which will stimulate WB production in private forests through a longer period.
8. On the level of implementation of the accepted legislation co-operation of experts from relevant ministries and communities of interest of different categories of forest owners, wood industries and energy professionals will be enecessary. Especially stimulated is the joining of economy and development-research sphere (so called clusters).

We recommend the Fund of Agricultural Lands and Forests of the Republic of Slovenia and concessionaires for utilization of state forests to follow open tenders and to get involved in delivery chains for supply of district heating systems with wood biomass and to compete for tenders for reduction of costs of wood production (machine cut, contemporary cable devices, construction of forest roads). Through their own organizations (Chamber of Economy) they should support such government programmes.

To families and private forest owners we recommend co-operation in delivery of wood for microsystrems on a local level and active joining, which can esentially reduce costs of production of WB (concentration of work, specialized executants, organised marketing).

5. MACRO IN MICRO SOCIAL-ECONOMIC VIEWPOINTS OF UTILZATION OF WOOD BIOMASS

5.1. INTRODUCTION

Energy, produced from wood, is a man's permanent companion in his development. Wood was present in restricted quantites. Where it was excessively exploitted survival was no longer possible. Wood ensured existence but not exceptional development of civilization. A great developmental swing started only with the exploitation of fossil energy products.

Similar as everywhere else in the world was the situation in Slovenia. As long as wood was an important energy source (until mid sixties) in Slovenia a lot of wood was used for energy purposes and consequences in forests were corresponding because forests were intensely exploited. 50 years ago wood stock was only 140 m3/ha, today it is once as higher.

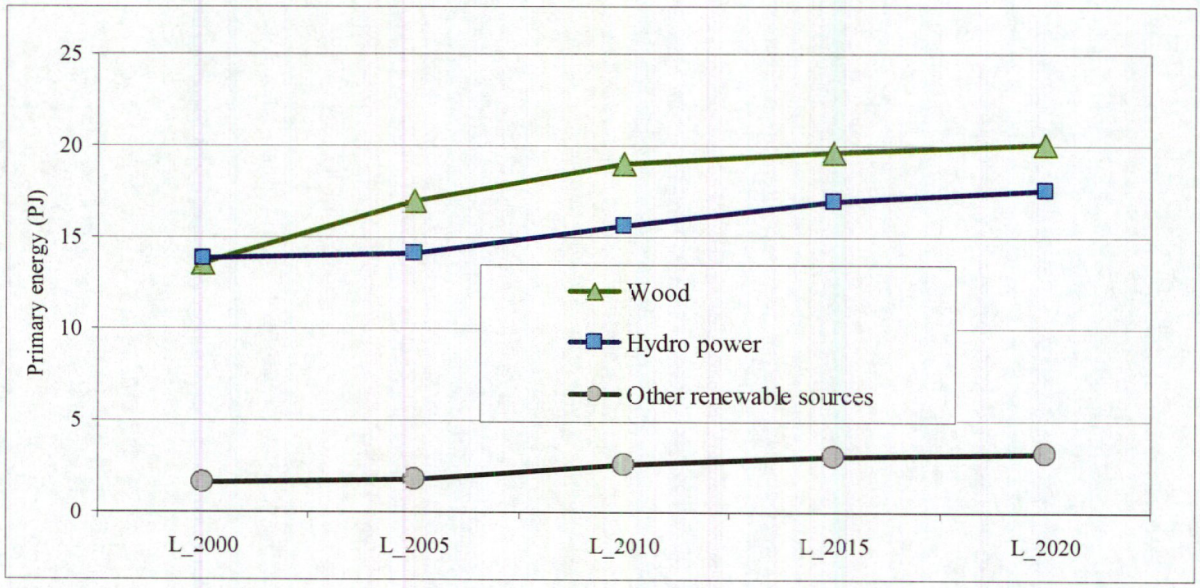
The purpose of this work was to analyse some of the most important circumstances which directly or indirectly affect the possiblity of utilization of wood from Slovenian forests. We can consider this part of the analysis also as a micro-social viewpoint of wood biomass utilization. Main influential factors were studied also on a national level in a longer time period, which can be defined as a macro-social viewpoint of wood biomass utilization in Slovenia.

Macroeconomy is defined as a study of behaviour of economy as a whole while **microeconomy** studies individual prices, quantities and markets (Samuelson & Nordhaus 2002). As broader aggregate impact of forestry is not known enough and basic data are deficient we have focused our analysis above all on influential factors which, according to our opinion work as braking forces or as incentives on future use of wood biomass in Slovenia. For the purpose of clearness we analyzed some pointers which refer directly to forestry and at the end we tried to estimate the impact of wood biomass utilization to economy in a wider sense. A more detailed macroeconomic scenario will be possible only when we have more reliable data at our disposal. Partly we tried to define a macroeconomic and social impact of wood biomass utilization with a calcualtion of the increase of the number of direct and indirect workplaces.

Let us first look at strategic plans of the use of renewable sources and within this frame also the use of wood biomass in the Republic of Slovenia.

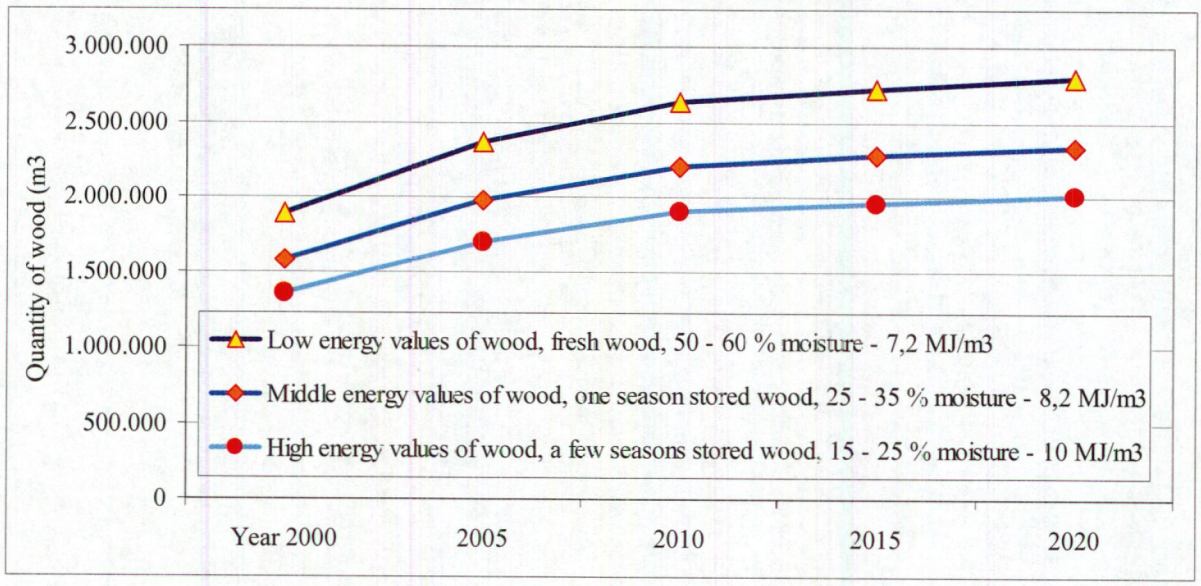
In the energy balance of the Republic of Slovenia for the year 2003 (MOPE 2003) energy produced from wood represents 4,1 % (11,97 PJ) of the necessary primary energy. Total needs in Slovenia are 267,48 PJ of primary energy. From its own sources Slovenia covers 49,8 % (133,2 PJ) of the primary energy.

Apart from the results in the energy balance for 2003 another document (National Energy Programme resolution, MOPE 2004) speaks about higher use of wood in primary energy and also about the projection of use until 2020. Picture 25 shows the structure of use of renewable sources of energy (RSE) from the year 2000 until 2020.



Picture 25. Structure of primary energy from renewable sources of energy (RSE) in Slovenia – situation of the year 2000 and a projection by the year 2020 (Source: Resolution about a national energy programme - MOPE 2004)

For the production of 1 PJ of energy, produced from wood, we need from 100 to 140 thousand m3 of wood, depending from the sort of wood, moisture and specific weight. Picture 26 shows the total quantity of wood necessary to ensure the planned primary energy in Slovenia until 2020. Three different energy values of wood were considered in that (1 m^3 of wood contains 7,2, 8,6, or. 10,0 MJ of energy).



Picture 26. Quantity of wood required for primary energy according to different energy values

In the introduction we are presenting also a comparison between Austria, as a highly developed country in the area of utilization of wood biomass for energy purposes and Slovenia, which is only in the stage of planning of a bigger development in this area.

5.2. WORKING METHOD

We used methods of analysis and a method of synthesis. For analyses we used official data of statistic researches and data from historical sources as well as from our own researches after 1990. For data processing we used methods of statistic analysis of data (trends, time types) and comparative methods. We checked different findings with a method of logic cross checks. With a method of synthesis we checked our assumptions and explained the main statements of the studied viewpoints of utilization of wood.

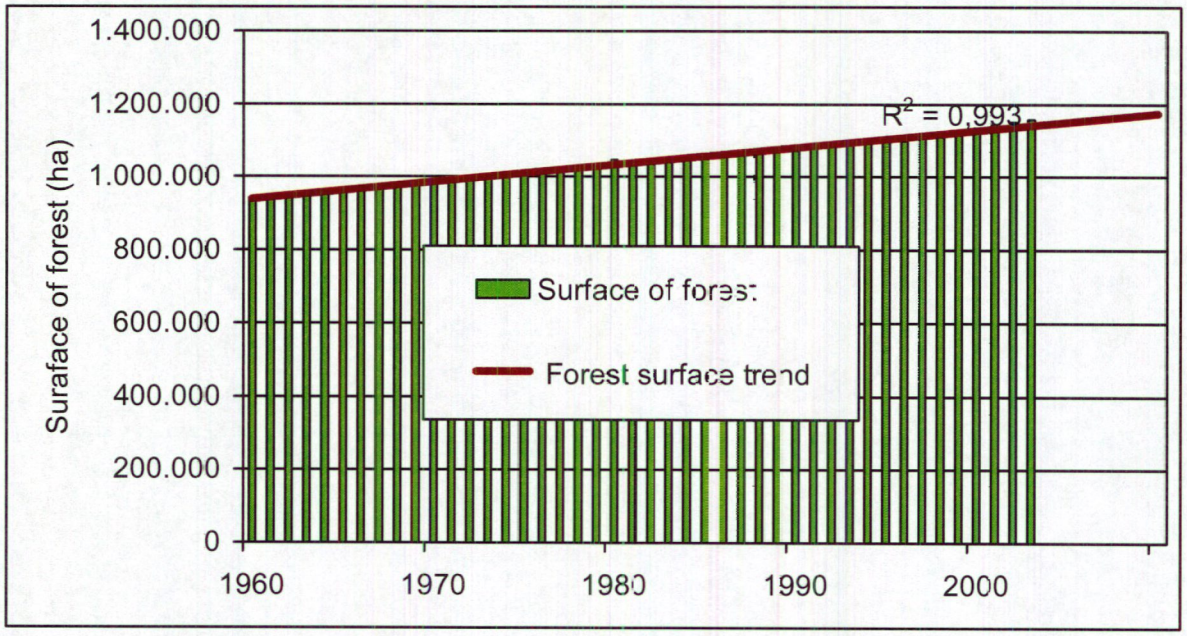
Assumptions:
· Surface of forests in Slovenia is growing which means, that the potential for the production of wood biomass is increasing.
· Forest funds in Slovenia are rising
· Intensity of wood production is low
· Forestry communication infrastructure restricts the use of wood biomass
· Social-economic restructuring of population and forest owners points to a quick decline of agricultural economies
· Proprietorial and estate structure of Slovenian forests, private owned above all, is very unfavourable and is getting worse.
· Comparison between the use of wood according to national statistics and the real use of wood in households shows that the numbers are not harmonized. The statistics regarding use of wood for energy purposes are deficient and underestimated.
· The use of a domestic energy product gives numerous positive effects for the home environment as well as for management of natural sources, in economy and in households.
· In Slovenia it is hard to make an integral estimation of macroeconomic effects of the use of wood for energy purposes because multiplication effects of intertwining of economy from the viewpoints of a private forest owner, gray economy and enterprise economy in the production of the same market goods - wood biomass and indirectly energy - are hard to compare.

5.3. RESULTS

5.3.1. Forest surface in Slovenia – basis for the production of wood biomass

In Slovenia forests represent the most important base for utilization of wood as a renewable source of energy. Regarding the fact that we practically don't have plantations of fast growing trees and bush types and the fact that wood from the remaining non-forest surfaces represents the essentially smaller, but no irrelevant source (Veselic 2004) it is very difficult to define the surface with forestry pointers.

After1950 forest surface is constantly growing so that Slovenia, according to the share of forest density, occupies the third place in Europe. In the period from 1960 to 2003 the total forest sufrace increased by 23%, which represents the average annual growth of 0,53%.

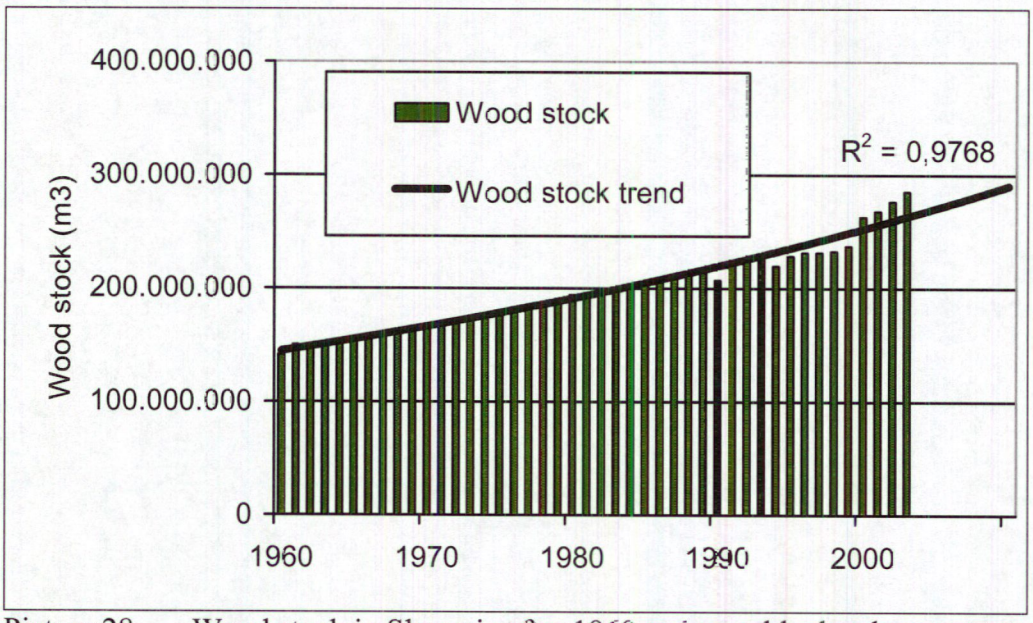


Picture 27. Surface of Slovenian forest after 1960 and possible development trends

Every additional hectare of forest represents also additional annual potential for utilization of wood biomass. In younger forest stages the share of wood which is directly useful for energy purposes is higher. With age and development of the forest the share of wood for further processing grows. With trends, similar as shown in the past peiod, in thirty years, forest can cover two thirds of the Slovenian surface.

5.3.2. Wood stock

Due to careful and planned forest management after World War II Slovenian forests have become stronger and with their high wood stocks they represent an important natural wealth especially because of a relatively high level of preservation of their natural structure.

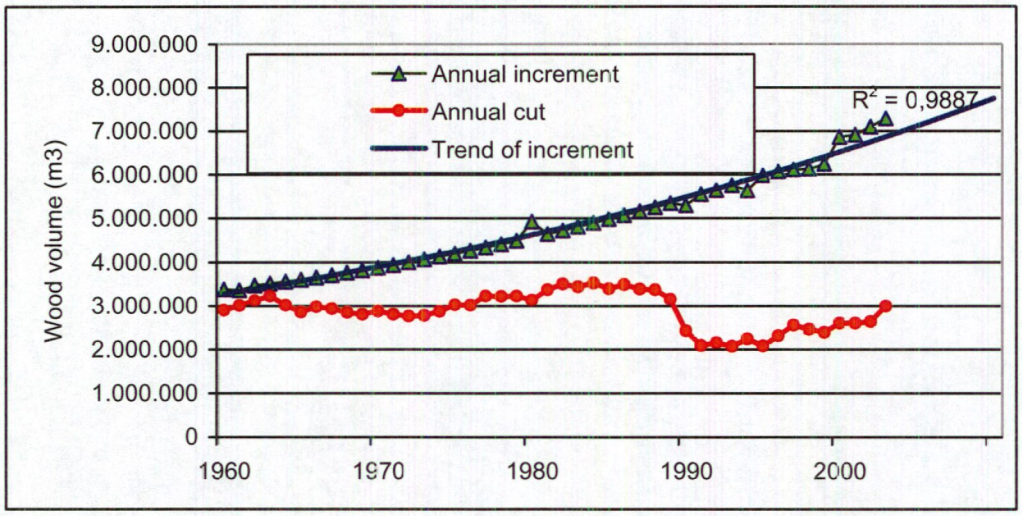


Picture 28. Wood stock in Slovenia after 1960 and possible development trends

In the period from 1960 to 2003 wood stock grew for 102 %, which represents the average annual growth of 2,37 %.

4.3.1 Cutting intensity

Cutting intensity is expressed with a relation between total annual cut in forests and total annual increment of all forests (international index). In the year 2002, annual increment of Slovenian forests already exceeded 7 mio m3. In 2003 the recorded gross cut, after fourteen years, again reached 3 mio m3. So the intensity of cut in 2003 was only 41.2% which was among the lowest in Europe. According to total amount of cut (in m3/ha) only Cyprus, Greece, Spain and Italy have lower realization than Slovenia with a cut of less than 2m3/ha. All other members of the EU cut more than Slovenia if we calculate quantity per hectare (Kovac 2004). It is emphasised in this analysis, that with annual setback of cut we loose not only quantity of wood but also quality, which means less income.

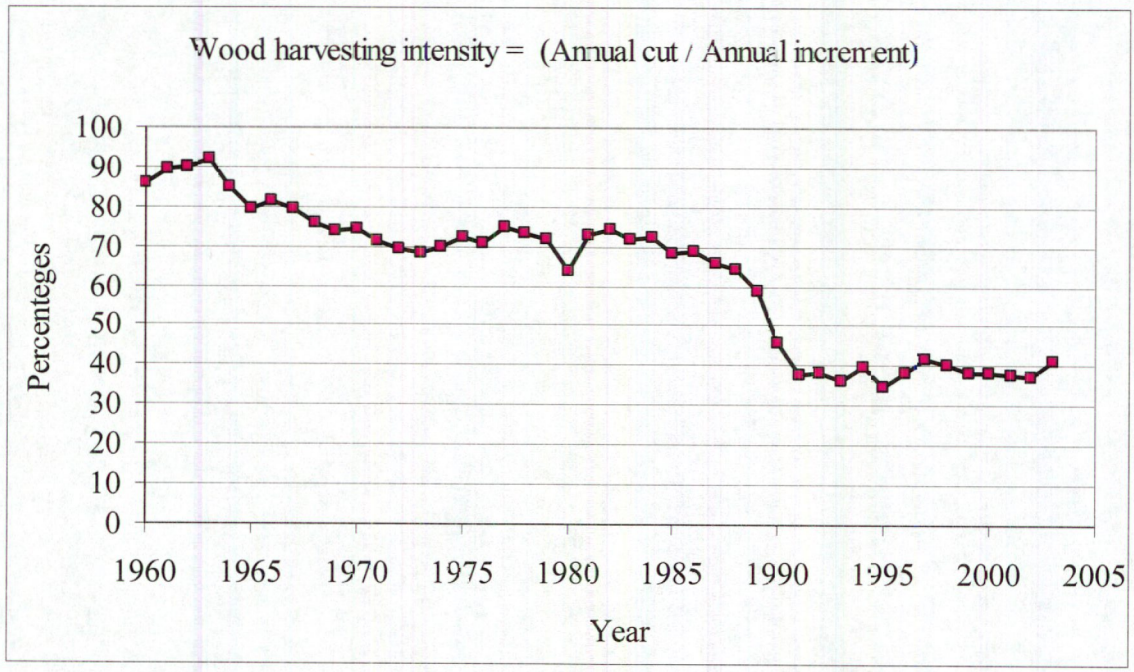


Picture 29. Comparison of increment and cut in Slovenian forests after 1960 and possible increment development trends

With a continuous rising trend, the quantity of annual increment would reach 10 million m3 already around the year 2025. According to the projection of development of forest funds of Slovenian forests (Veselič, Matjašic 2002), increment in forests where cutting is possible will overcome 8 mio m3 in 2030 and ten years later already 8.7 mio m3. These evaluations are based on the assumption, that the intensity of cut is 61 %, which means roughly, in average, about 4.5 mio m3 annually. Cutting intensity after 1960, until 2003, is shown in picture 30.

The relation between annual cut and annual increment reflects the intensity of forest management. Cutting intensiy was the highest in the beginning of the analysed period until 1965. After that, cutting intensity oscilated between 70 and 80 % until mid eighties. With the approach of transition, intensity began to fall drastically until it achieved the lowest point in 1995 with hardly a third of the cut increment. It is very hard to predict cutting trends. Extreme efforts will be necessary to achieve growth of energy self-provision from wood biomass because social-economic changes in the society change interests for forest management

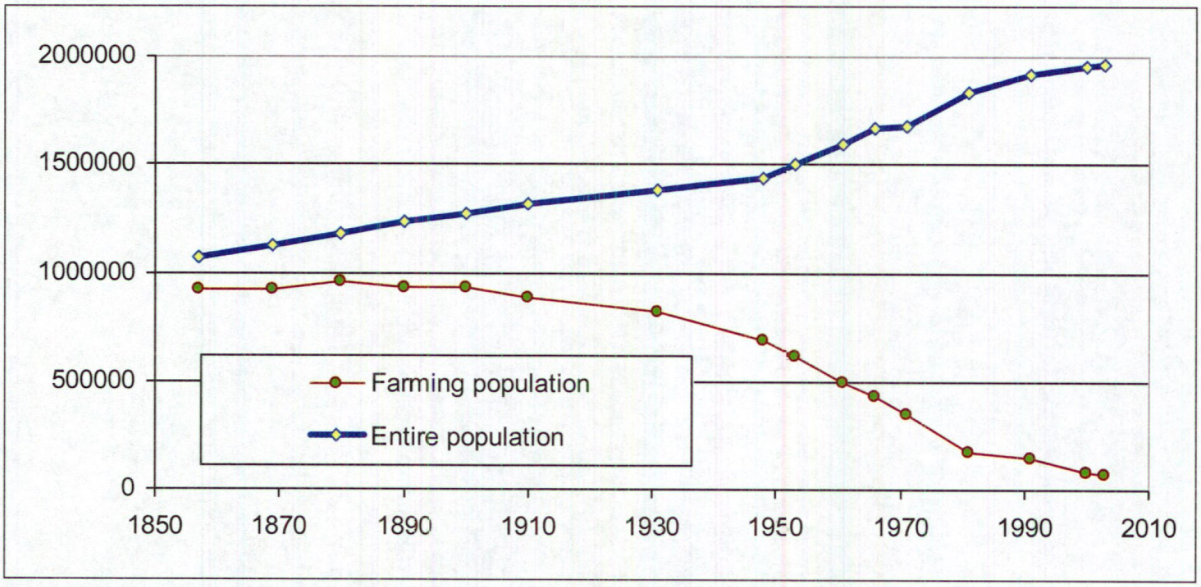
extremely quickly. From all possible measures the best one, of course, will be a high price of energy which will cause also the growth of prices of wood for energy purposes.



Picture 30. Comparison of increment and cut in Slovenian forests after 1960 and possible development trend

4.3.2 Social-ekonomic restructure of population and forest owners

Probably the most important process after the second World War, which other countries have faced as well and has influenced forest management too, are demographic changes and the structure of forest owners' population (deagrarization of the population). In Slovenia, the share of farming population was gradually falling from 73,3% in the beginning of the 20th century by 0,5 % annually until the middle of this century. After this period we witnessed a large decrease (1,3 % annually) until 1981, when there were only still 9,5 % of farming population and it calmed down until 1991 with a negative degree of 0,16% annually (picture 31). After this period the Statistical Office of the Republic of Slovenia no longer follows the share of farming population, therefore, in the last data, we considered the number of family farms even though methodologically this isn't completely comparable with the former data.



Picture 31. The number of farming and entire population in Slovenia after 1857

Together with a decline of the number of farming population, the number of forest owners with a status of farmers is decreasing as well. According to the census of familiy farms in 2000, only 76.653 farms (SURS) still owned forests. Three years later, a sample census was made and gave the estimation of 68,959 farms which still owned forests. This means that during this period the status of family farms with forest was dissapearing at the speed of 7farms/day. The sole status of a family farm does not mean that farming is such a family's basic activity. However, a trend of decrease of the number of farms evidently shows how quick the restructuring of the Slovenian countryside is. In the year 2000 family farms owned 394.000 ha of forests and in 2003 still 386.000 ha which means that small scale owners with properties of barely a good ha large estates dropped out. Thus in average, the property of family farms has increased slightly (5.6 ha), while non-farming forest property became even more dispersed (1,7 ha). The property structure of private owned forests in Slovenia and the analysis for the year 2000 is precisely described in the following chapter.

4.3.3 Property structure of Slovenian private forests

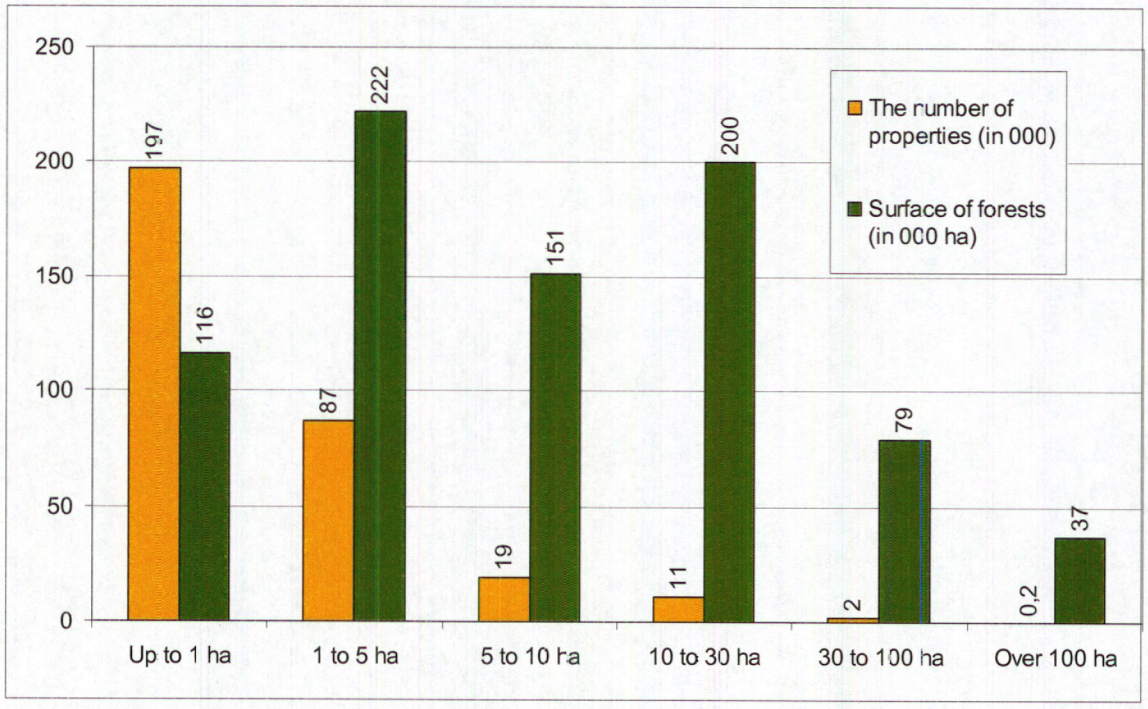
According to the census of agricultural economies in the year 2000, 76.653 family farms (88.8 % of the inventoried) owned 393.370 ha of forests (SURS 2002). The average size of a forest estate in the property of family farms is 5.13 ha.

The total surface of private forests in Slovenia is 806.240 ha (Forest-management plans - FMP for all forest-management districts - FMD, 2001-2010) which means that 412.870 ha of private forests are owned by non-farming households (51.2 %). Among these »non-farming« households we also place those farms which don't comply with the criteria of EPK. The number of all Slovenian households which own forests is not known. According to the data of FMP-FMD, there are 314.569 forest estates in Slovenia (Medved 2003) (in average 2.56 ha) which cannot be entirely equated with the number of households which owned forests. According to data (FMP - FMD) the number of (co)owners of Slovenian private owned forest has risen up to almost 499.000.

The actual number of co-owners is probably lower because for now, records don't enable the insight into joint ownership in other administrative and forest district units. So the average forest estate per (co)owner is only 1.62 ha (Medved 2003).

The consequence of a decrease of number of farming households and above all denationalization, which has been going on from 1991 and of almost unlimited inheritance, is further dispersion of private forests. In 1971, there were 43,9 % of estates in the category of up to 1 ha and twenty years later already 54.7 %. In 2001, the share of this category increased up to 62.5%. In the estate category from 1 to 5 ha, only in the last decade the number of estates has reduced for about 13.000 and in 2001 represented only still 27,6 % of private forest estate. Comparisons in the remaining estate categories are not possible because of the modified structure of estate categories of forest estate in the last plans with regard to the former ones. With the denationalization, the private forest estate of mountain farms in NW Slovenia increased and above all the number of large non-farming forest owners.

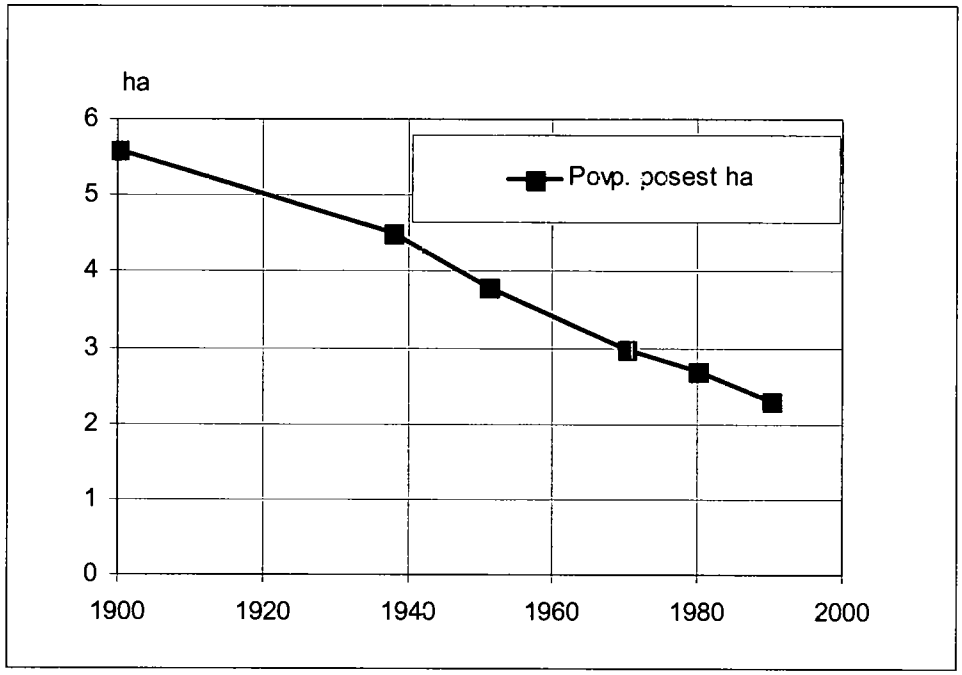
Estates, larger than 30 ha are owned by 0.1 % of forest owners and encompass 14,4 % of the surface. According to total surface it is equal to estate categories of up to 1 ha, only that it is owned by 62,5 % of owners. The described estate categories (of up to 1 ha and over 30 ha) own barely a good quarter of Slovenian private forests, therfore we can say that in Slovenia, the most important estate categories are those between 1 and 30 ha. In the category from 1 to 5 ha there are a good quarter of all estates according to number and forest surfaces. Only about 6 % of estates in the category from 5 to 15 ha cover a little less than a fifth of private forests. Only 3.5 % of estate in the category from 10 to 30 ha occupy a quarter of forest surfaces. Picture 32 shows the structure of estate and and surfaces of private forests according to estate categories.



Picture 32. Structure of private forest property till 2000 (Medved 2003)

Beside general small scale estate structure, regular forest menagement is made difficult also by the spatial dispersion into different forest complexes (Medved 200).

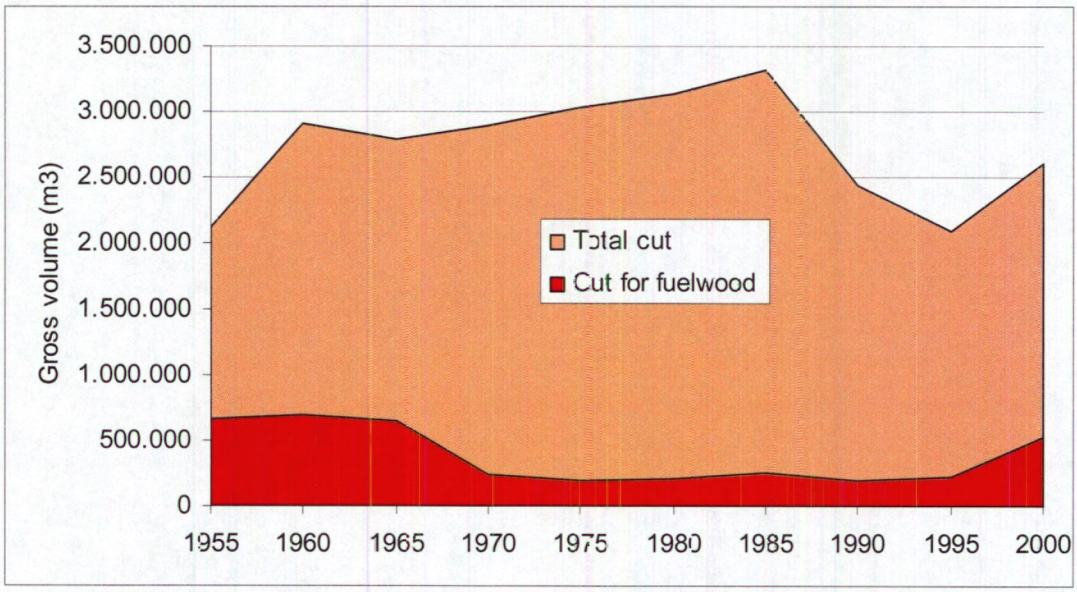
The trend of decline of the average private forest estate in Slovenia is worrying because it shows almost linear functional dependence (r2 = 0.99) from 1900 until 1990. We can predict that the negative trend will settle partly because of denationalization and above all because of objective reasons, namely division of forest plots will no longer be possible. Partly our expectations have become true, which was demonstrated with the analysis of district plans (Medved 2003), as the average estate in the year 2000 was 2.56 ha if we ignore co-owner relationships. If we consider also the latter the average forest owns only still 1.62 ha of forest.



Picture 33. Decrease of the average private forest estate after the year 1900

4.3.4 Wood from the forest – source of energy in Slovenian households

From the report regarding potentials of available sources of wood biomass utilization (Veselič 2004, Trosero 2004 and Drigo 2004) the structure of possible cuts of wood in Slovenia in the period 1991 - 2000 and estimated consumption of wood for energy purposes are evident. We reviewed the data of some records of national statistics for the census of family farms and assortment structure of cut, followed by the Statistical Office of the Republic of Slovenia.



Picture 34. Structure of cuts of family farms between 2000 and 2003

The average amount of annual cut at family farms in this period has risen for a good tenth, from 25 m3/farm to 28 m3/farm. In 2000, the quantity of cut by order in non-state forests, recorded by the Slovenia Forest Service, was 39 m3. This is actually the average for the category of forests, which includes all types of property except state owned forests. This year, 41 thousand orders (B and C orders together) were issued for these forests.

Many years' statistics, made by the Statistical Office of the Republic of Slovenia, point to a much lower share of cut of fuelwood from what we have got from the census of family farms.

Picture 35. Quantity of cut for fuelwood and total cut from 1955 until 2000

50 years ago, the share of fuelwood represented almost a third of the total amount of cut (1955), it fell down to a quarter in 1965 and after 1970 it represented less than a tenth of the total cut which remained so for two decades. In the last years this share has increased again to one fifth (picture 35). Of course, the actual consumption of wood for heating, which does not come only from direct cuts, essentially surpasses the quantities presented in picture 16. This is why the estimation of consumption of wood for energy purposes is extremely demanding and problematic, which has already been demonstrated in the previous chapters of this report. Irrespective of this, great quantites, found out by the census of family farms, are surprising, namely here logs already surpass the total consumption of logs from the national statistics. Because of such disparities in the structure of consumption, two years ago we have suggested an introduction of a new statistic research which would determine consumption and the structure of consumption as well as production of wood in all private forests and not only at family farms .

4.3.5 Macroeconomic aspects of wood biomass utilization

The use of a domestic energy product gives numerous positive effects in a domestic environment with active management of natural sources, so in general economy as well as in individual households. In Slovenia, general macroeconomic impact of utilization of wood for energy purposes is hard to determine because multiplication impacts of domestic economy, grey economy and enterprise economy in the production of the same market goods - wood biomass, above all fuelwood and indirectly energy - are hard to compare.

Based on work efficiency of all phases of production (cutting, skidding, processing and transport) we have claculated time consumption for the production of 1m3 wood chips (converter 3 steres = 1 m3 of wood) and for the production of 1 m3 of split logs (converter: 1,4 volume meter = 1m3 of wood). With different combinations of machines of different efficiency rates, productiviy differs, too. For the simplification of the calculation of workplaces we will, for further analysis, consider the average productivity of our enforced technologies for the production of individual types of energy products (from stump to consumer). The considered model time consumption for the production of wood chips is 2,3 hour/m3 and 3,3 hour/m3 for logs. We did not make a calcualtion of indirect and induced workplaces because our calcualtion considers the actual necessary time consumption with a determined productivity and is not derived from the profit that should be made with the production of biomass.

Table 8. Direct workplaces in the production of logs and wood chips

Final Product / Quantity of wood	Time consumption from stump to consumer (h/m^3)	Direct workplaces * for 100.000 m^3 (N)	Productivity	
			(m^3/h)	(m^3/worker/year)
Wood chips / 100.000 m3	2,3	151	0,43	661
Logs / 100.000 m3	3,3	217	0,30	461

*(one worker = 1520 h/year)

Production of logs and wood chips is and extremely laboure-intensive activity. That is why in the field of »pure enterprise« economy only few are engaged in it. This is also evident from a many years' statistics where in a determined time period less than 10 % of fuelwood is recorded. The fact is that the area of fuelwood production and its sale represents an extensive part of the grey economy.

There is a question, whether in Slovenian conditions of wood production in private forests, real and clear economy can be established. It is known, that in many places grey economy is even useful as it ensures the existence of wood production for energy purposes. However, the biggest share of work in Slovenian private forests is done within the scope of traditional amateur and recreational activities, yet preparation of fuelwood for one heating season doesn't represent a particularly large stake of an individual. Such approach to work, of course, has also several negative consequences, among which is a great number of accidents at work.

Macroeconomic importance of forestry as a profitable economic branch, with respect to the share of gross domestic product, is minimal and lower than 1%. Forestry and wood get their

real roles only with respect to the integral treating of branches which are bound to wood in the aspect of raw materials as well as with integral treatment of wood as a traditionally extremely important raw material for the production of energy.

The use of wood biomass in Slovenia plays a very important social-economical role in the supply of people with a domestic renewable source of energy. The increase of the use of wood biomass, based on enterprise principles of work, will be a difficult and a very hardly realizable vision without strategic support of the state in the restraining of high production costs. That is why, for the production of 20 PJ of energy from wood in 15 years, which is the ambition of the National energy programme resolution, a great input of human energy will be necessary.

5.4. EXPERT ESTIMATION OF DEVELOPMENT FACTORS OF UTILIZATION OF WOOD FOR ENERGY PURPOSES

Within the frame of the workshop organised on September 14. 2004, through opinions of experts, we made an additional check of how certain key aspects influenced the development of production, utilization and marketing of wood for energy purposes. There were three possible answers: breaking factor, factor with no impact and development stimulating factor. In table 9, we have classified them from the most problematic ones to the most stimulating ones. We treated the answer "breaks" as the value -1, and the answer "stimulates" as +1. In the case of equal number of points we treated the answer "no impact" as more important in comparison with the answer "I don't know"

The results of the expert evaluation correspond well to the results of preliminarily analysed influential factors of development of wood biomass utilization.

Table 9. Importance of influential factors for the production, utilization and marketing of wood biomass for energy purposes

Rank	Factors according to groups	Number of answers				Total sum
		Breaks	No impact	Stimulating	I don't know	
	Braking factors prevail	☹ -1	😐 0	☺ +1	X	
1-2	High initial investment costs	8				-8
1-2	Properta structure of private forests	8				-8
3-4	Costs of wood biomass production from forests	7	1			-6
3-4	Restrictions in the utilization of economy forests (natura 2000, protection of water sources, urban forests)	7	1			-6
5	Non-organized market (unclear market of producers and tenderers of WB)	6	1		1	-5
6	Negative impacts of production on forests	3	4		1	-3
7	Qualification (people who work in private forests)	4	2	2		-2
8	Opennes of forests with forest roads	4		3	1	-1
9	Information	4	1	3		-1
	Stimulating factors prevail					
10	Lack of raw materials on the market	2	4	2		0
11	Price of WB	3		5		+2
12	Consciousness of people regarding ecological impacts	1	2	5		+4
13	Introduction of new, modern production technologies			8		+8

The most important breaking factors are high costs of initial investments intoto modernization, but they will be easier to resolve than the unfavourable property structure of private forests.

An important breaking factor for greater development swing of wood biomass utilization are production costs and also equally emphasized restrictions dictated by continuous new and more complex demands regarding protection of environment.

The next (orange) group of breaking factors is directly connected with the consequences of wood production for the forest which was reflected also in the above mentioned influential factor of strained conditions and restrictions.

The next braking factors are qualification of people for works in the forest, especially private forest owners, and deficient openness with forest roads. The last breaking factor which still has a negative stock of value, is deficient apprising of owners, however three out of eight thought that apprising is already such that stimulates the development of this area. In case of lack of raw material on the market, the structure of answers gave a »draw« position. Most of them (four) think that market has no impact on the development of this area. The price of wood biomass as a developmental factor is, in their opinions, a stimulating rather than braking factor and nobody answered that price had no impact.

Apprising of people about environmental impacts and introduction of contemporary technologies of production of wood biomass have turned out to be the most important stimulating factors for further development of production, utilization and marketing of wood biomass. Opinions regarding the latter were unified.

5.5. STATEMENTS AND CONCLUSIONS

Considering that Slovenia is planning a greater consumption of wood for energy purposes from domestic sources (from forests), inputs into forestray will have to undergo substantial changes, especially with respect to people, equipment and infrastructure. The unified programme document is setting forestry on the priority list of investmnets and resolving, but above all into reinforcement of the environmental role and reinforcemnet of forests.

Promotion of contemporary ways of utilization of wood for energy purposes is important for forestry as an economic activity, which fulfills its environmental mission as a buffer of impacts of greenhouse gasses and gives the opportunity to buffer quick changes in social-economic aggravation of the situation of countryside population and to strongly influence the regional development and image of Slovenia.

Forestry is not sufficiently aware of this exceptionally important role, professionals above all, do not do enough to help fulfill this mission of the forest through economic pointers of management at forest owners.

Quick economic development and rising GDP additionally reduce relative meaning of forestry as an economic branch, because together with farming it represents only still trends ot the permanently falling share of the GDP.

With the role of forest as a storage of carbon and the meaning of wood as a CO2 neutral raw material, the growing problems of pollution with greenhouse gases, which is known to a wide population and with this socially favourable climate, forestry has an opportunity to take the advantage of both for further professional work.

In this, it must know how to stimulate owners to use all available potentials of the forest to ensure their own energy and raw material independence. Provided there's good professional work environmental and social roles will not be impeded. However, the profession will justify its existence because of its efforts to ensure economic development and to fulfil the demands of the Kyoto protocol.

The rise of real cut in Slovenian forests for every 100.000 m3, supposing the price of a m3 of wood is 50 EUR, contributes 5 mio Euros of domestic capital to society. At the productivity of 2,3 - 3,3 m3/day and the utilization rate of 190 weekdays annually as well as 151-217 direct workplaces in forestry, it means, that one workplace is worth 50.000 EUROs. The energy value of 10 MJ/m3 means also additional 1 PJ of own energy from OVE. With regard to a multiplication effect of a bigger domestic production the number of workplaces grows for additional indirect and induced workplaces.

One PJ of domestic energy from 100.000 m3 of wood (density 0,75 t/m3 and factor 2,5 t/TOE) replaces an import of 30.000 t of fuel oil. If the purchase value is 500 $/t, it also

represents the reduction of import expenditures of the state in the amount of 15.000.000 $ or almost 12.000.000 EUROS or almost 3 billion TOLARS.

1 mio m3 of additional domestic wood thus represents almost 30 billion Tolars of state savings. It means that forestry which through the fulfilment of the economic role of the forest, wit a realistically possible annual cut of 4.000.000 m3 wood, where the intensity of cutting is still only 61% of the increment, can »grow« 100 billion of state saving, if the total energy value is expressed in TOE.

The question which causes constant dilemmas of sustainable development of the society and research challenges to natural and economic sciences is how to reach the goals of close-to-nature forest management and at the same time ensure a stable economic growth.

6. LITERATURE

Dolenšek, M., 2002. Katalog stroškov kmetijske mehanizacije.- Ministrstvo za kmetijstvo, gozdarstvo in prehrano, Ljubljana, 8 s.

Energetska bilanca republike Slovenije 2003, Ministrstvo za okolje proctor in energijo, 25 str.

http://www.aure.si/

http://www.ius-software.si/

http://www.stat.si/doc/stat_urad/nk/ekon-kmet_310304.doc, (31. marec 2004)

http://www.uradni-list.si/index.jsp

Jonas, A., Haneder, H. 2001. Energie aus Holz, Landes-Landwirtschaftskammer, St. Polten, (8 dopolnjena izdaja), 76 s.

Kovač, M. 2004. Gozdarstvo. Ekonomsko ogledalo, UMAR, 5, str. 8

Krajnc N. 2002. Biomass developments and research in Slovenia. V: SAYIGH, A. A. M. (ur.). Renewable energy : renewables: World's best energy option : World Renewable Energy Congress VII : 29 June - 5 July 2002 : Cologne, Germany. Oxford: Pergamon,

Krajnc N. 2002. Review of national activities Slovenia. V: Biomass Cogeneration Network: BIOCOGEN (ENK5-2001-80525) : Kick-off meeting : Brussels 31-1-2001. Pikermi: Centre for renewable energy sources, 3 str.

Krajnc N., Domac J. 2000. South-Eastern European Biomass Action - A new international research cooperation between Slovenia and Croatia. V: PELKONEN, Paavo (ur.). Woody Biomass as an energy source - challenges in Europe : Joensuu, Finland, 25-28 September 2000, (EFI proceedings, No. 39, 2001). Joensuu: European Forest Institute, str. 131-138.

Krajnc N., Simončič P., Robek R. 2002. Vloga gozdov pri izpolnjevanju Kyotskih zahtev v Sloveniji. V: VORŠIČ, Jože (ur.). 11. mednarodno posvetovanje Komunalna energetika, Maribor, Slovenija, 14.-16. maj 2002. Komunalna energetika. V Mariboru: Univerza.

Krajnc N., Winkler I. 2000. Metode svetovanja lastnikom gozdov za učinkovito rabo lesne biomase v energetske namene = Counselling methods for forest owners in the field of effective use of wood as energy-producing raw material. *Gozd. vestn*, letn. 58, št. 10, str. 419-431.

Krajncevic, E. 2003. Evaluation of the policy, legal frameworks and bariers of biomass CHP/DHC in Slovenia. Opet Slovenija, Jožef Stefan Institute, 29 p. http://www.rcp.ijs.si/-eec/

Načrti za vsa GGO 2001-2100

Pogačnik N. 1999. Strategija in akcijski program Evropske unije na področju izrabe obnovljivih virov energije. Gozd. vestn., 1999, let. 57, št. 7-8: 322-330.

Pogačnik N. 2000. Metode svetovanja lastnikom gozdov za učinkovito rabo lesa v energetske namene : magistrsko delo = Extension for forest owners in the field of effective use of wood as energy-producing raw material : master of science thesis. Ljubljana: [N. Pogačnik], 2000. 199 str.

Poročila Zavoda za gozdove Slovenije 1994 -2003 in Poročila o gozdovih 1997-2003.

Program energetske izrabe lesne biomase v Sloveniji. Februar 2001. URL: http://www.sigov.si/mop/vsebina/oglasna.html. (7.3.2003)

Resman, S. 2004. Statistično spremljanje mehaniziranosti gospodarskih družb. Diplomsko delo, UL BF Ljubljana, 76 str.

Robek R., Medved M., Žgajnar L., Pogačnik N., Bitenc B. 1998. Analysis of wood biomass potential in Slovenia : final report. Ljubljana, Gozdarski inštitut Slovenije, Ljubljana: 40 str.

Samuelson P. A., Nordhaus D. W. 2002. Ekonomija. (Economics, 16th Edition 1998) Ljubljana, Naklada MATE in GV Založba: 690 str.

Simončič P., Kobler A., Krajnc N., Medved M., Torelli N., Robek R. 2001. Podnebne spremembe in slovenski gozdovi : Climate change and Slovene forests. Gozd. vestn., letn. 59, št. 4: 184-202.

Simončič P., Krajnc N., 2003. Bilančno emisijski model (REES) za gozdarstvo. Gozdarski inštitut Slovenije, fazno poročilo projekta: Raziskava v podporo uresničitvi kjotskega protokola: strokovna podpora operativnemu programu RS, Ljubljana: 21 str.

Unified wood energy terminology. 2001. FAO - Forestry energy forum. http://www.fao.org/forestry/FOP/FORW/EENERGY/ (2.3.2004)

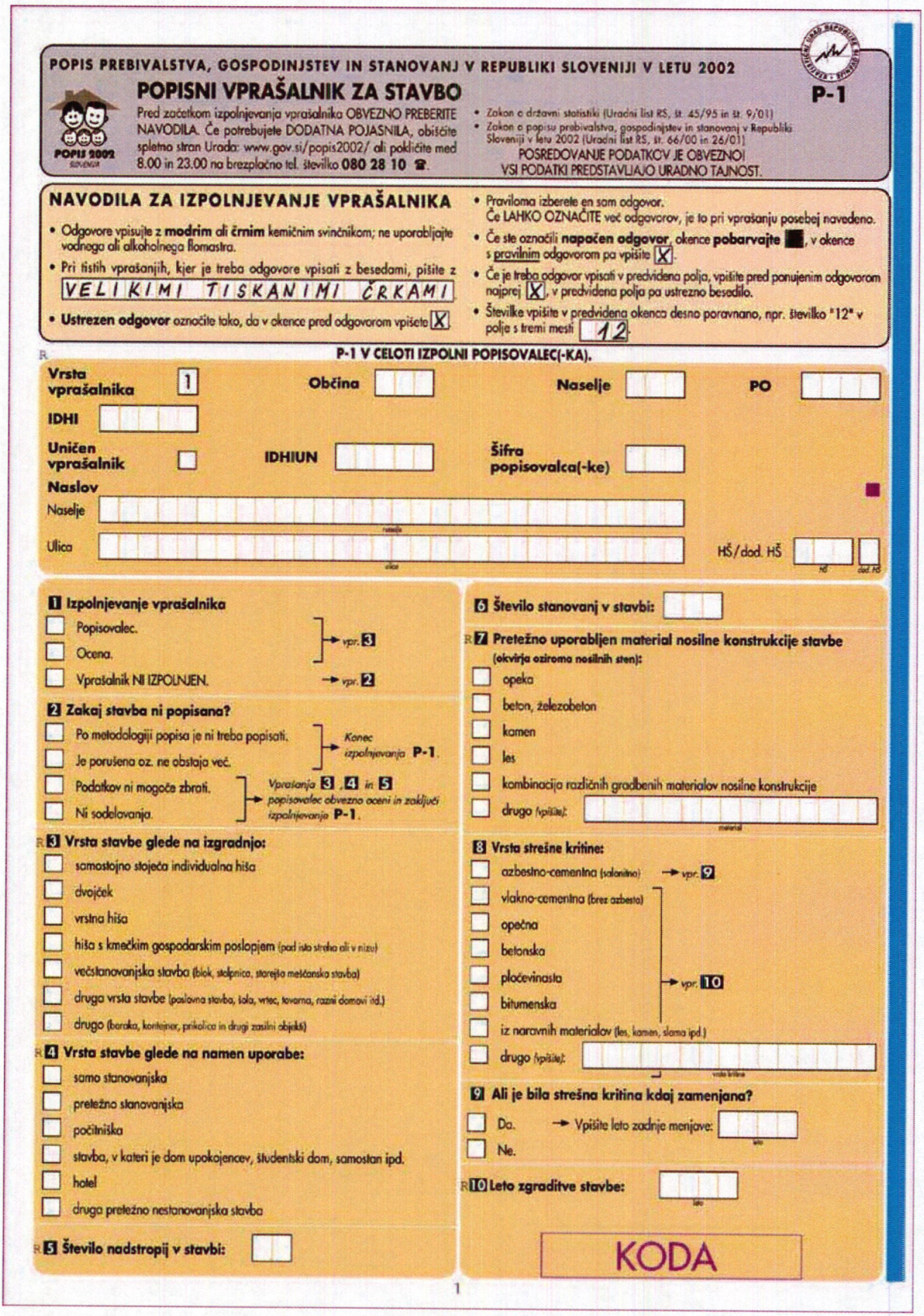
Winkler, I., Košir, B., Krč, J., Medved, M., 1994. Kalkulacije stroškov gozdarskih del.- Strokovna in znanstvena dela, 116, 69 s.

Žaucer, I. 2004. Ekonomski računi za kmetijstvo 1995 – 2003, Statistični urad Republike Slovenije,

-. 2004. Uporaba sistema IUS-INFO / EURO IUS-INFO. Gradivo seminarja, IUS SOFTWARE, Ljubljana, 22 s.

Annexes

Annex 1. Census questionnaire for the building P-1 (SURS, CENSUS 2002)



POPIS PREBIVALSTVA, GOSPODINJSTEV IN STANOVANJ V REPUBLIKI SLOVENIJI V LETU 2002

POPISNI VPRAŠALNIK ZA STAVBO **P-1**

Pred začetkom izpolnjevanja vprašalnika OBVEZNO PREBERITE NAVODILA. Če potrebujete DODATNA POJASNILA, obiščite spletno stran Urada: www.gov.si/popis2002/ ali pokličite med 8.00 in 23.00 na brezplačno tel. številko **080 28 10** ☎.

- Zakon o državni statistiki (Uradni list RS, št. 45/95 in št. 9/01)
- Zakon o popisu prebivalstva, gospodinjstev in stanovanj v Republiki Sloveniji v letu 2002 (Uradni list RS, št. 66/00 in 26/01)

POSREDOVANJE PODATKOV JE OBVEZNO!
VSI PODATKI PREDSTAVLJAJO URADNO TAJNOST.

NAVODILA ZA IZPOLNJEVANJE VPRAŠALNIKA

- Odgovore vpisujte z **modrim** ali **črnim** kemičnim svinčnikom; ne uporabljajte vodnega ali alkoholnega flomastra.
- Pri tistih vprašanjih, kjer je treba odgovore vpisati z besedami, pišite z VELIKIMI TISKANIMI ČRKAMI.
- **Ustrezen odgovor** označite tako, da v okence pred odgovorom vpišete [X].
- Praviloma izberete en sam odgovor. Če LAHKO OZNAČITE več odgovorov, je to pri vprašanju posebej navedeno.
- Če ste označili **napačen odgovor**, okence **pobarvajte** ■, v okence s pravilnim odgovorom pa vpišite [X].
- Če je treba odgovor vpisati v predvidena polja, vpišite pred ponujenim odgovorom najprej [X], v predvidena polja pa ustrezno besedilo.
- Številke vpišite v predvidena okenca desno poravnano, npr. številko "12" v polje s tremi mesti 12.

R **P-1 V CELOTI IZPOLNI POPISOVALEC(-KA).**

Vrsta vprašalnika 1 **Občina** **Naselje** **PO**

IDHI

Uničen vprašalnik ☐ **IDHIUN** **Šifra popisovalca(-ke)**

Naslov

Naselje

Ulica HŠ/dod. HŠ

1 Izpolnjevanje vprašalnika
- ☐ Popisovalec. → vpr. 3
- ☐ Ocena. → vpr. 3
- ☐ Vprašalnik NI IZPOLNJEN. → vpr. 2

2 Zakaj stavba ni popisana?
- ☐ Po metodologiji popisa je ni treba popisati. → Konec izpolnjevanja P-1.
- ☐ Je porušena oz. ne obstaja več. → Konec izpolnjevanja P-1.
- ☐ Podatkov ni mogoče zbrati. → Vprašanja 3, 4 in 5 popisovalec obvezno oceni in zaključi izpolnjevanje P-1.
- ☐ Ni sodelovanja. → Vprašanja 3, 4 in 5 popisovalec obvezno oceni in zaključi izpolnjevanje P-1.

R **3 Vrsta stavbe glede na izgradnjo:**
- ☐ samostojno stoječa individualna hiša
- ☐ dvojček
- ☐ vrstna hiša
- ☐ hiša s kmečkim gospodarskim poslopjem (pod isto streho ali v nizu)
- ☐ večstanovanjska stavba (blok, stolpnica, starejša meščanska stavba)
- ☐ druga vrsta stavbe (poslovna stavba, šola, vrtec, taverna, razni domovi itd.)
- ☐ drugo (baraka, kontejner, prikolica in drugi zasilni objekti)

R **4 Vrsta stavbe glede na namen uporabe:**
- ☐ samo stanovanjska
- ☐ pretežno stanovanjska
- ☐ počitniška
- ☐ stavba, v kateri je dom upokojencev, študentski dom, samostan ipd.
- ☐ hotel
- ☐ druga pretežno nestanovanjska stavba

R **5 Število nadstropij v stavbi:**

6 Število stanovanj v stavbi:

R **7 Pretežno uporabljen material nosilne konstrukcije stavbe (okvirja oziroma nosilnih sten):**
- ☐ opeka
- ☐ beton, železobeton
- ☐ kamen
- ☐ les
- ☐ kombinacija različnih gradbenih materialov nosilne konstrukcije
- ☐ drugo (vpišite):

8 Vrsta strešne kritine:
- ☐ azbestno-cementna (salonitna) → vpr. 9
- ☐ vlakno-cementna (brez azbesta) → vpr. 10
- ☐ opečna → vpr. 10
- ☐ betonska → vpr. 10
- ☐ pločevinasta → vpr. 10
- ☐ bitumenska → vpr. 10
- ☐ iz naravnih materialov (les, kamen, slama ipd.) → vpr. 10
- ☐ drugo (vpišite): → vpr. 10

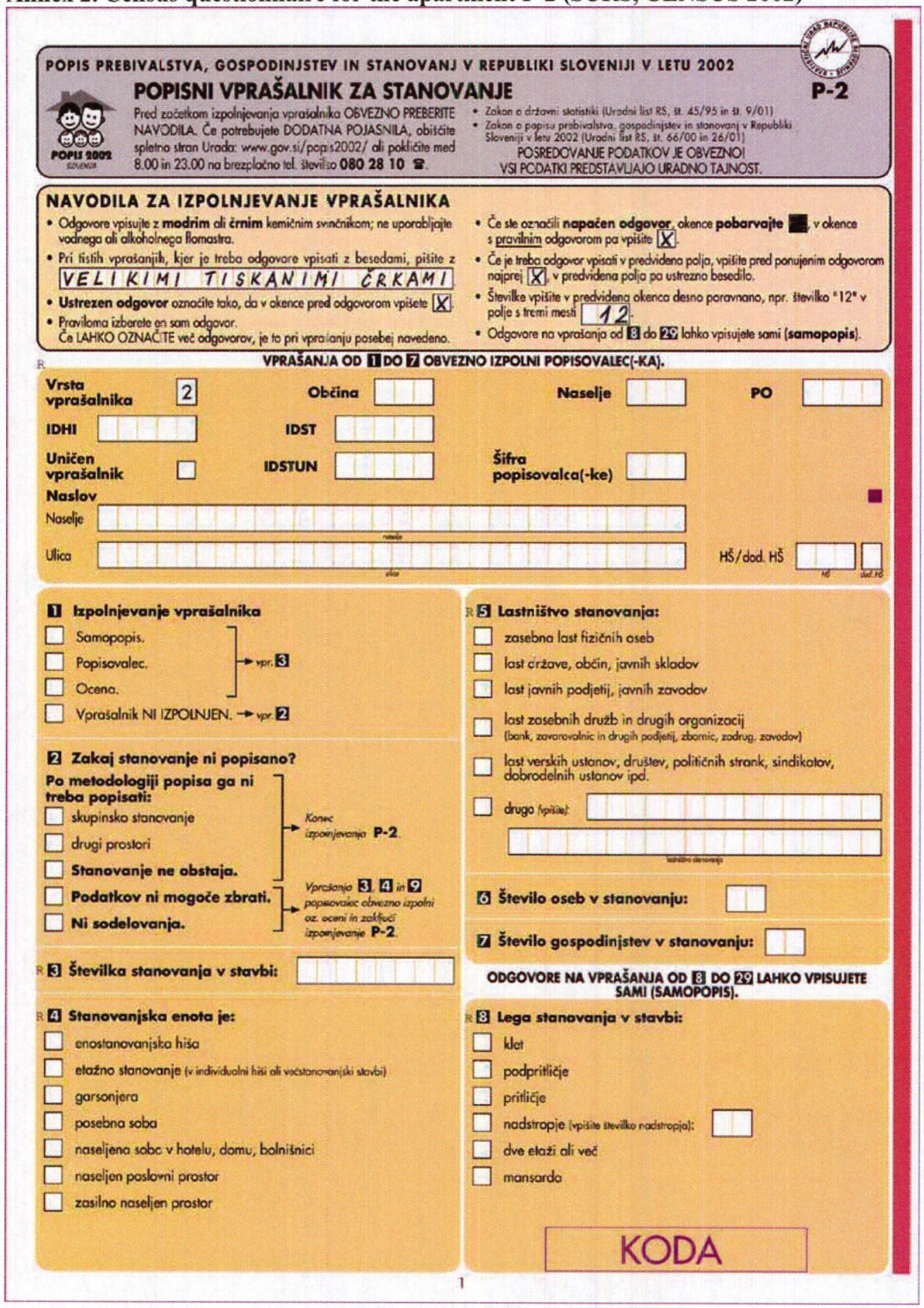
9 Ali je bila strešna kritina kdaj zamenjana?
- ☐ Da. → Vpišite leto zadnje menjave:
- ☐ Ne.

R **10 Leto zgraditve stavbe:**

KODA

1

Annex 2. Census questionnaire for the apartment P-2 (SURS, CENSUS 2002)



POPIS PREBIVALSTVA, GOSPODINJSTEV IN STANOVANJ V REPUBLIKI SLOVENIJI V LETU 2002

POPISNI VPRAŠALNIK ZA STANOVANJE **P-2**

Pred začetkom izpolnjevanja vprašalnika OBVEZNO PREBERITE NAVODILA. Če potrebujete DODATNA POJASNILA, obiščite spletno stran Urada: www.gov.si/popis2002/ ali pokličite med 8.00 in 23.00 na brezplačno tel. številko **080 28 10** ☎.

- Zakon o državni statistiki (Uradni list RS, št. 45/95 in št. 9/01)
- Zakon o popisu prebivalstva, gospodinjstev in stanovanj v Republiki Sloveniji v letu 2002 (Uradni list RS, št. 66/00 in 26/01)

POSREDOVANJE PODATKOV JE OBVEZNO! VSI PODATKI PREDSTAVLJAJO URADNO TAJNOST.

NAVODILA ZA IZPOLNJEVANJE VPRAŠALNIKA

- Odgovore vpisujte z **modrim** ali **črnim** kemičnim svinčnikom; ne uporabljajte vodnega ali alkoholnega flomastra.
- Pri tistih vprašanjih, kjer je treba odgovore vpisati z besedami, pišite z VELIKIMI TISKANIMI ČRKAMI
- **Ustrezen odgovor** označite tako, da v okence pred odgovorom vpišete X.
- Praviloma izberete en sam odgovor. Če LAHKO OZNAČITE več odgovorov, je to pri vprašanju posebej navedeno.
- Če ste označili **napačen odgovor**, okence **pobarvajte** ■, v okence s pravilnim odgovorom pa vpišite X.
- Če je treba odgovor vpisati v predvidena polja, vpišite pred ponujenim odgovorom najprej X, v predvidena polja pa ustrezno besedilo.
- Številke vpišite v predvidena okenca desno poravnano, npr. številko "12" v polje s tremi mesti 12.
- Odgovore na vprašanja od 8 do 29 lahko vpisujete sami (**samopopis**).

R **VPRAŠANJA OD 1 DO 7 OBVEZNO IZPOLNI POPISOVALEC(-KA).**

Vrsta vprašalnika 2 **Občina** **Naselje** **PO**

IDHI **IDST**

Uničen vprašalnik **IDSTUN** **Šifra popisovalca(-ke)**

Naslov

Naselje

Ulica HŠ/dod. HŠ

1 Izpolnjevanje vprašalnika

- Samopopis.
- Popisovalec.
- Ocena.

→ vpr. 3

- Vprašalnik NI IZPOLNJEN. → vpr. 2

2 Zakaj stanovanje ni popisano?

Po metodologiji popisa ga ni treba popisati:

- skupinsko stanovanje
- drugi prostori
- **Stanovanje ne obstaja.**

→ *Konec izpolnjevanja* **P-2**.

- **Podatkov ni mogoče zbrati.**
- **Ni sodelovanja.**

→ *Vprašanja* 3, 4 *in* 9 *popisovalec obvezno izpolni oz. oceni in zaključi izpolnjevanje* **P-2**.

R **3 Številka stanovanja v stavbi:**

R **4 Stanovanjska enota je:**

- enostanovanjska hiša
- etažno stanovanje (v individualni hiši ali večstanovanjski stavbi)
- garsonjera
- posebna soba
- naseljena soba v hotelu, domu, bolnišnici
- naseljen poslovni prostor
- zasilno naseljen prostor

R **5 Lastništvo stanovanja:**

- zasebna last fizičnih oseb
- last države, občin, javnih skladov
- last javnih podjetij, javnih zavodov
- last zasebnih družb in drugih organizacij (bank, zavarovalnic in drugih podjetij, zbornic, zadrug, zavodov)
- last verskih ustanov, društev, političnih strank, sindikatov, dobrodelnih ustanov ipd.
- druga (vpišite):

6 Število oseb v stanovanju:

7 Število gospodinjstev v stanovanju:

ODGOVORE NA VPRAŠANJA OD 8 DO 29 LAHKO VPISUJETE SAMI (SAMOPOPIS).

R **8 Lega stanovanja v stavbi:**

- klet
- podpritličje
- pritličje
- nadstropje (vpišite številko nadstropja):
- dve etaži ali več
- mansarda

KODA

1

R 9 **Uporaba stanovanja:**
Šesti (6) odgovor označite samo, če izpolnjujete vprašalnik še za drugo stanovanje, ki ga gospodinjstvo uporablja na istem naslovu. V tem primeru vpišite tudi IDGO.

- ☐ samo za bivanje
- ☐ za bivanje in opravljanje dejavnosti
- ☐ samo za opravljanje dejavnosti
- ☐ začasno nenaseljeno stanovanje
- ☐ nenaseljeno (zapuščeno) stanovanje
- ☐ drugo stanovanje, ki ga gospodinjstvo uporablja na istem naslovu (6) **IDGO** ____ (IDGO)
- ☐ za čas sezonskih del v kmetijstvu

→ vpr. 11

- ☐ za počitek in rekreacijo → vpr. 10

10 Stanovanje za počitek in rekreacijo je v
- ☐ počitniški hiši.
- ☐ družinski hiši.
- ☐ večstanovanjski stavbi.

R 11 **Skupna površina stanovanja v m²:** ____

R 12 **Število sob v stanovanju:** ____

13 Če se stanovanje uporablja za opravljanje dejavnosti, vpišite število sob, ki se uporabljajo samo za opravljanje dejavnosti: ____

R 14 **Kuhinja v stanovanju:**
- ☐ da → vpr. 15
- ☐ ne → vpr. 16

R 15 **Površina kuhinje v m²:** ____

R 16 **Kopalnica v stanovanju:**
- ☐ da
- ☐ ne

R 17 **Stranišče v stanovanju:**
- ☐ na izpiranje
- ☐ brez izpiranja
- ☐ v stanovanju ni stranišča

R 18 **Drugi prostori v sklopu stanovanja:**
*Označite lahko **več** odgovorov.*
- ☐ balkon
- ☐ terasa
- ☐ atrij
- ☐ zimski vrt
- ☐ shramba
- ☐ klet
- ☐ nobenega od naštetih prostorov ni v sklopu stanovanja

R 19 **Napeljava vodovoda:**
- ☐ iz vodovodnega omrežja
- ☐ iz lastne kapnice
- ☐ iz lastnega zajetja
- ☐ ni napeljave

R 20 **Napeljava kanalizacije**
- ☐ kanalizacijsko omrežje
- ☐ nepretočna greznica
- ☐ pretočna greznica
- ☐ prosti izpust v okolje
- ☐ ni napeljave

R 21 **Napeljava elektrike:**
- ☐ da
- ☐ ne

R 22 **Napeljava plina:**
- ☐ plinovodno omrežje zemeljskega plina
- ☐ plinovodno omrežje utekočinjenega naftnega plina
- ☐ lastna cisterna ali cisterna za nekaj sosednjih stavb
- ☐ ni napeljave

R 23 **Priključek na telefonsko omrežje:** ☐ da ☐ ne

R 24 **Priključek na omrežje za kabelsko TV:** ☐ da ☐ ne

R 25 **Napeljava centralnega ogrevanja:** ☐ da ☐ ne

R 26 **Način ogrevanja v zadnji kurilni sezoni:**
- ☐ daljinsko (toplarna ali večja območna kotlarna)
- ☐ kotlarna, ki oskrbuje nekaj sosednjih stavb

→ vpr. 29

- ☐ centralna kurilna naprava samo za vašo stavbo (v hiši, bloku)
- ☐ etažno centralno ogrevanje (samo za stanovanje)
- ☐ stanovanje ni centralno ogrevano (ogreva se z raznimi pečmi, kamini)

→ vpr. 27

- ☐ stanovanje ni ogrevano → vpr. 29

27 Vir ogrevanja v zadnji kurilni sezoni:
*Označite lahko **več** odgovorov.*
- ☐ premog, premogovi briketi (1)
- ☐ les in lesni odpadki (2)
- ☐ kurilno olje (3)
- ☐ elektrika (4)
- ☐ zemeljski plin (5)
- ☐ utekočinjeni naftni plin (propan - butan) (6)
- ☐ sončna energija (7)
- ☐ drugo (8) *(vpišite)*: ____ (drugi vir ogrevanja)

28 Če ste pri vprašanju 27 označili več kot en vir, vpišite številčno oznako glavnega vira ogrevanja: ____

R 29 **Ali je bilo stanovanje kdaj prenovljeno?**
- ☐ Da. → Vpišite letc zadnje prenove: ____ (leto)
- ☐ Ne.

2

Annex 3. Inquiry questionnaire for producers of wood biomass in Slovenia

INQUIRY QUESTIONNAIRE FOR PRODUCERS OF WOOD BIOMASS IN SLOVENIA

A. Type and quantity of input raw materials

1. **Evaluate annual quantities of input raw material (only wood): _____ r or m^3** (encircle unit)

Evaluate shares of individual types of input raw materials (total sum is 100%)

round wood _____ %
piece wood residues _____ %
saw dust, wood dust _____ %
wood residues _____ %

B. Type and quantity of annual production

1. **Evaluate annual production: _____ r or m^3** (encircle unit)

If you produce different types of wood biomass, evaluates their shares (total sum is 100 %):

Logs _____ %
Wood chips _____ %
Pellets _____ %
Other_____: _____ %

2. **Selling price of wood biomass:** (enter units)

Logs: _____ SIT / _____
Wood chips: _____ SIT / _____
Pellets: _____ SIT / _____
Briquettes _____ SIT/_____
Other _____: _____ SIT / _____

3. **End users (customers):** (total sum is 100%)

Households (for heating): _____ %
Biomass systems (DSO, CHP,…): _____ %
Retail companies (commercial enterprises) : _____ %
Companies for own use (production of pellets, processing heat or electricity…): _____ %
Own use: _____ %

4. **Share of export:_____ % of annual production**

5. **Do you think your annual production in the next 10 years will *(encircle):***

Increase a lot (by more than 50 %)
Increase (by up to 50 %)
Remain equal
Decrease (down to 50 %)
Decrease a lot (by more than 50 %)

6. **Name of the company:**_____
Interviewee's name: _____
Interview:

Date:_____, Time: _____
Interviewer: _____, Method of interview: _____

Annex 4. LIST OF SLOVENIAN WOOD BIOMASS PRODUCERS

WOOD CHIPS

Biomasa d.o.o.
Rok Suhodolnik s.p.,
Logarska dolina 25,
3335 Solčava
phone: 070 383 383

TISA d.o.o
Marko Šercer
Ižanska 213
1000 Ljubljana
Mobi: 041 895 774
Phone: 01 428 72 60

GG Postojna
Frenk Kovač
Vojkova ul. 9
6230 Postojna
Phone: 05/721 11 02
GSM: 041/648-879

Zalokar Franc
Vinica pri Šmarjeti 3
8220 Šmarješke toplice
phone: (07) 3073286

EKO S
Peter Muri s.p.
Zgornje Jezersko 72
4206 Zgornje Jezersko
phone: (04) 2541044
mobi: (031) 542293

· **Biopel d.o.o.**
wood **chips, pellets***
Skakovci 21
9261 Cankova
phone: 02 540 90 50
Fax: 02 540 90 51
GSM: 041/ 070/ 673 555
e-mail: fras.janez@siol.net
contact: Milan Fras

· **Snežnik SINPO d.o.o.**
Wood residues, **wood chips**
Kočevska reka 1a
1383 Kočevska reka
phone: 01 894 90 56
Fax: 01 894 05 03
e-mail: sinpo@sneznik.si
URL: www.sneznik.si
contact: Anton Križ, dir

· **Snežnik PE lesna predelava**
wood residues, wood chips
Kočevska reka 40
1383 Kočevska reka
phone: 01 894 05 22
Fax: 01 894 00 36
e-mail: lp@sneznik.si
URL: www.sneznik.si
contact: Andrej Puš

· **Letnik Saubermacher d.o.o.**
Removal of waste; wood **chips**
Spodnji Porčič 4a
2230 Lenart v Slov. goricah
phone: 02 720 66 71
Fax: 02 760 66 74
e-mail: info@letnik-saubermacher.si
URL: www.letnik-saubermacher.si
contact: Janez Letnik, dir

· **Ivan Ornik**
wood **chips**, chipper
Ledinek 47
2233 Sv. Ana v Slov. goricah
phone: 02 703 24 47
GSM: 031 460 092

· **Čisto mesto Ptuj d.o.o.**

Waste processing company, wooć **chips**
Dornavska c. 26
2250 Ptuj;
phone: 02 780 90 20
Fax: 02 780 90 30
e-mail: franc.cisto@siol.net
contact: Franc Merc

· **EKO LES d.o.o. Ptuj – Luka Koper**

wood **chips**
Rogozniška ul. 14
2250 Ptuj
phone: 05 665 64 86
GSM: 041 612 233
contact: Jordan Štokelj

GAŠPER TRŽENJE d.o.o.
Stegne 21
1000 Ljubljana
(01) 511 34 20
(01) 511 34 21
E-mail:
Web site: http://www.gasper.si
manager: Gašper Jurij

RAZREZ HLODOVINE IN IZDELAVA PREDMETOV IZ LESA Cugmajster Alojz s.p.
Cesta v Železnik 7
3215 Loče
(03) 759 21 70
(03) 759 21 71
(041) 665 373
manager: Cugmajster Alojz

ŽAGA GODOVIČ d.o.o. PREDELAVA LESA
Godovič 153
5275 Godovič
(05) 374 71 60
(05) 374 70 56
(05) 374 70 56
E-mail:
manager: Bizjak Bruno

JERINA TOMAŽ s.p. ŽAGANJE LESA
Blekova vas 28
1370 Logatec
(01) 754 22 28
(01) 754 22 28
director (070) 758 055
E-mail:
director Jerina Tomaž

LOGS

GG Postojna
Frenk Kovač
Vojkova ul. 9
6230 Postojna
Phone: 05/721 11 02
GSM: 041/648-879

Metra Cont d.o.o.,
Mednarodni prehod 2 Vrtojba,
5290 Šempeter pri Gorici,
Phone: +386 (0)5 393 7220,
+386 (0)5 303 5372,
e-mail: info@metracont.com

Branko Resnik
Rebr d.o.o.
Lokve 6
8280 Brestanica
phone: (07) 4979712
mobi: 041 621 684

· **Komunala Nova Gorica, d.d.**

agency and transport
Cesta 25. junija 1
5000 Nova Gorica
phone: 05 33 55 300
Fax: 05 33 55 311
GSM: 041 333 523
e-mail: damjan.kravos@komunala-ng.si
URL: www.komunala-ng.si
contact: Damjan Kravos

DECIMIRJENJE LESA Lamovšek Jože s.p.
Podboršt 26
8297 Šentjanž
(07) 818 47 95
(031) 212 036
manager: Lamovšek Jože

ŽAGANJE IN SKOBLJANJE LESA Krajnik Ciril s.p.
Breznica pod Lubnikom 5
4220 Škofja Loka
(04) 512 81 60
(04) 512 81 61
E-mail:
contact: Krajnik Ciril

ŽAGARSTVO Pogačnik Mirko s.p.
Pozirno 5
4227 Selca
(04) 514 12 71
(041) 730 978
manager: Pogačnik Kazimir

BOR ŽAGANJE DRV ZA KURJAVO PRI NAROČNIKIH Štampfler Jakob s.p.
Gradiška 251
2211 Pesnica pri Mariboru
(02) 655 31 61
manager: Štampfler Jakob

FOREST PROIZVODNJA, TRGOVINA, STORITVE d.o.o.
Ulica 9. maja 25
5000 Nova Gorica
(05) 302 85 41
(05) 302 85 41
manager: Kolavčič Damjan

BRIQUETTES

· **Kia d.o.o.**

Transport and briquette production; **logs, wood residues, briquettes**
Šmihel 12
6257 Pivka
phone: 05 753 20 44
Fax: 05 753 20 44
contact: Anton Kaluža

· **Marija Škerget**
Zvezna ulica 8,
phone: 02 647 00 81, 041 34 01 39

· **Robert Bečaj**
Blekova vas 20
phone: 01 754 18 12

HORIZONT d.o.o.
Vodovodna ulica 30c,
2000 Maribor
(02) 320 71 50
info@horizont.si

Les trgovina in storitve d.d.
Rogozniška cesta 4,
250 Ptuj
(02) 748 27 86
info@les-ptuj.si

LIP Bled d.d. Trgovina
Ljubljanska cesta 27,
4260 Bled
(04) 579 50 00
lipbl@lip-bled.si

MIZARSTVO KOREN,
Korer Peter s.p.
Milanova ulica 3,
5222 Kobarid
(05) 388 50 75

TOPDOM d.d.
Letališka cesta 1,
1000 Ljubljana
(01) 586 65 43
info@topdom.si

MIZARSTVO,
Babič Janez s.p.
Bistrica 7,
4202 Bistrica
(04) 533 10 07
SMART INDUSTRIES, d.o.o.
Mednarodni prehod 1f,
5290 Šempeter pri Gorici
(05) 330 42 80
info@smart-industries.si

STROJNA OBDELAVA IN PRODAJA LESA, s.p.

Turjak 27,
1311 Turjak
(01) 788 12 44
Košnjek Anica
Češnjica pri Kropi 15a,
4244 Češnjica pri Kropi
(04) 533 16 48

LIPA Kostanjevica d.o.o.
Krška cesta 7,
Kostanjevica na Krki,
8311 Kostanjevica na Krki
(07) 498 72 38

LIK-VIO d.o.o.
Novomeška cesta 5
1330 Kočevje
(01) 895 92 80
g. Bojan Pakiž

ESOL LESNA PREDELAVA d.o.o.
Belokranjska cesta 40
8340 ČRNOMELJ
(07) 306 13 30, 306 13 34, 031/648-859,
041/648-859, 031/688-275
g. Ivan Lakner

ROYAL PARKETI MARIBOR d.o.o.
Limbuška cesta 2
2000 Maribor
(02) 421 20 10, 041/672-522
g. Darko Petrovič

WOOD PELLETS

Istrabenz energetski sistemi
Jure Špacal
Delpinova ul.18
5000 Nova Gorica
Phone: 05 331 19 71

- **Feroterm Lenterm d.o.o.**

Production of boilers, Purchasing of wood biomass - pellets
Mariborska c. 12
2352 Selnica ob Dravi
phone: 02 673 00 10
Fax: 02 673 00 11
e-mail: udov.feroterm@siol.net
contact: Danijel Mandl, dir.

WOOD RESIDUES

Eko d.o.o.
Prežigal 9 S
lovenske Konjice 3210
Phone: 03 759 00 50
Fax: 03 759 34 07

CHARCOAL PRODUCTION

ŽAGARSTVO Pogačnik Mirko s.p.
Pozirno 5
4227 Selca
(04) 514 12 71
(041) 730 978
manager: Pogačnik Kazimir

CEFIM d.o.o.
Kajuhova ulica 19
1000 Ljubljana
(01) 540 40 19
(01) 540 40 19
manager: Celestina Igor

GRILL PROIZVODNJA OGLJA IN REZANEGA LESA Medved Vlado s.p.
Dobrina 63
2287 Žetale
(02) 769 15 91
(02) 769 15 91
manager: Medved Vlado

IZDELOVANJE OGLJA Rihtaršič Jože s.p.
Bukovščica 22
4227 Selca
(04) 514 12 77
Contact: Rihtaršič Jože

OGLARSTVO Čadež Franc s.p.
Delnice 7
4223 Poljane nad Škofjo Loko
(04) 518 81 34
(04) 518 81 34
contact:
Čadež Franc

PROIZVODNJA LESNEGA OGLA, PREVOZI Jelenc Pavel s.p.
Javornik 33
3220 Štore
(03) 577 41 38
manager:
Jelenc Pavel

Annex 5. INQUIRY QUESTIONNAIRE FOR PRODUCERS AND DISTRIBUTORS OF MACHINES AND BOILERS (technologies for production and utilization of wood biomass)

A. Type of machine/equipment *(encircle):*

a) chippers
b) cleaving machines
c) cleaving-cutting machines (processors)
d) fireplaces
f) central heating boilers: logs, wood chips, pellets (encircle)
g) other_____

- **Machines/eyuipment** (*encircle*): a) produces
  - b) distributes

B. Type and quantity of annual production or sale

1. Year of the beginning of production or distributorship:_____

2. Evaluate annual production or sale in number of units, produced of sold:

	Before 99	1999	2000	2001	2002	2003	2004
Chippers							
Cleaving machines							
Cleaving-cutting machines							
Fireplaces							
Central heating boilers							

3. Best sold product: _____

4. End users (buyers): *(total sum is100%)*

- Households (farmers, private users): _____ %
- Biomass systems (DSO, CHP,...): _____ %
- Retail companies (commercial enterprises) : _____ %
- Companies for own use (production of pellets, processing heat or electricity...): _____ %
- Others: _____ %

5. Share of export:_____ **% of annual production**

6. Do you think your annual production/sale in the next 10 years will ***(encircle)***

- Increase a lot (by more than 50 %)
- Increase (by up to 50 %)
- Remain equal
- Decrease (down to 50 %)
- Decrease a lot (by more than 50 %)

7. Name of the company:_____

Interviewee's name: _____

Interview:

Date:_____, **Time:** _____
Interviewer: _____, **Method of interview:** _____

Annex 6. List of tenderers of wood biomass utilization technologies

1 Etiks d.o.o. (distributor of Czech furnaces ATMOS, producer of boilers ETIKS BIOMATIK for wood chips and pellets)
Prožinska vas 15, 3220 Štore
PHONE: (03) 4282880, (03) 4282882, (031) 643137, (041) 759857, (041) 346234, (050) 643137,
FAX: (03) 4282890

2. Biomasa (distributor for boilers FROLING)
Rok Suhodolnik s.p., Logarska dolina 25, 3335 Solčava

3. Feroterm Lenterm d.o.o. (producer of furnaces BIOLES)
Mariborska cesta 12, 2352 Selnica ob Dravi
HEATING TECHNIQUE
PHONE: N.C. (02) 6730010
FAX: (02) 6730011
MANAGER PHONE: (02) 6730012
COMMERCIAL DEP PHONE: (02) 6730015
PHONE: (02) 6730016
PHONE: (02) 6730017
FINANCIAL DEP. PHONE: (02) 6730018

4. KWB (distributor for boilers KWB)
Tomaž Rifelj s.p., Attemsov trg 9, 3342 Gornji Grad

5. PESED heating technique (producer of boilers and chippers PESED)
Justin Sedeljšak s.p., Prapreče 25, 3305 Vransko
PHONE: (03) 7038490
FAX: (03) 7038495
E-MAIL: PESED@AMIS.NET

5. TAJFUN PLANINA d.o.o. (producer od cleaving-cutting machine - processor)
Planina 41a, 3225 Planina pri Sevnici
PHONE.: 03 5791 011, faks: 03 5791 241
E-MAIL: prodaja@tajfun.si
www.tajfun.si

7. Vitli KRPAN Franc Pišek s.p. (producer od cleaving-cutting machine - processor)
Jazbina 9a, 3240 Šmarje pri Jelšah
PHONE.: 03 819 00 90 FAX: 03 819 00 92
E-MAIL: info@vitli-krpan.com
www.vitli-krpan.com

8. MEHANIZACIJA MILER d.o.o. (distributor for stamping machines BIBER, ESCHELBOCK)
Šentanel 20a, 2391 Prevalje
PHONE: 02 82 31 959, FAX: 02 82 32 959
Gsm: 041 747 181

9. UNIFOREST d.o.o. (distributor for cleaving machines BERNARDI)
Dobriša vas 14, 3301 Petrovče
PHONE.: 03 713 14 10
Mr Kolarek Darko
E-MAIL: info@uniforest.si
www.uniforest.si

10. BIDER Bojan s.p. (producer of stamping machines BIDER, fireplace)
Dol-suha 3, 3332 Rečica ob Savinji
PHONE. 03 839 18 00

11. Ulysess d.o.o. (distributor of cleaving machines POSCH)
Rošpoh 74, 2351 Kamnica
PHONE.: 031/365-153, 041/611-298

12. KIV d.d. Vransko (producers of boilers and stamping machines)
Vransko 66,
n.c.: 03 703 41 00
03 703 41 02
FAX: 03 703 41 50

KIV TRADE d.o.o.
Vransko 66, PHONE.: 03 703 41 20

KIV INGINEERING d.o.o.
Vransko 66, PHONE.: 03 703 41 18, FAX: 03 703 41 60

13. GIPO d.o.o. Koper (distributors of Italian boilers KONDOR)
Pristaniška ulica 45, 6000 Koper
PHONE.: 05/664 55 10, 664 55 09, FAX:

14. Tilia Novo Mesto (distributor of Swedish furnaces CTC)
Ljubljanska cesta 89, Novo mesto
PHONE.: 07 332 44 42, 041 238 835

15. KOVINTRADE Štore (distributor of boilers for logs BUDERUS)
Železarska cesta 3
PHONE.: 03 780 58 50

17. Andrej Mušič s.p. (producer of cleaving machines)
Mengeš

18. GOMARK d.o.o. (distributors for cleaving machines WOODLINE)
Prekopa 10/b
SI – 3305 VRANSKO, p.p.1
PHONE.: 03/700 15 03
FAX: 03/700 15 04

19. VIESSMAN d.o.o. (distributor for furnaces VIESSMAN)
C. XIV. Divizije 116a
2000 Maribor
Mr.. Marjan Pelc

20. AMV d.o.o. (distributors for Czech furnaces for logs, wood chips and pellets DAKON)
Kočevska cesta 119
1330 Kočevje
PHONE. 01/893-14-46,
Mr. Dušan Žagar

Annex 7. Inquiry for experts

1. LEGAL ORDER OF PRODUCTION, MARKETING AND UTILIZATION OF WOOD BIOMASS (PMUWB)

1.1. Evaluate general level of legal order of PMUWB in the RS:
a) I don't know/I'm not acquainted with
b) Not regulated
c) Regulated on a programme level
d) Regulated on a programme and system (legal) leve
e) Regulated on an programme, system and executive level

1.2. Evaluate (mark with X) the following programme documents for development of PMUWB until. 2012:

Resolution / strategy / programme	stimulating ☺	no impact 😐	breaking ☹	I don't know ?
National programme for the protection of environment				
Forest development programme				
Programme of energy utilization of wood biomass in the RS for 2001-2010				
National energy programme resolution				
Unified programme document of the RS for the period 2004-2006				
Strategy and short term action plan of reduction of emissions TGP				
Strategy for spatial development of Slovenia				

1.3. Evaluate (encircle) coordination of programme documents from the previous questio:
a) I don't know/I'm not acquainted with
b) Not coordinated
c) Mostly not coordinated
d) Mostly coordinated
e) Coordinated

1.4. Evaluate (mark with X) importance of the valid regulations for PMUWB ir. Slovenia:

Act and its executive regulations	stimulating ☺	no impact 😐	breaking ☹	I don't know ?
Spatial Planning Act				
Environment Protection Act				
Nature Conservation Act				
Construction Act				
Act on Forests				
Wild game and Hunting Act				
Agriculture Act (regulation about supplementary activities)				
Agricultural Land Act				
Companies Act				
Personal Income Tax Act				
Value Added Tax Act				
Energy Act				
Housing Act				
Local Government Act				
Republic of Slovenia Budget Implementation Act				
Organization and Competence of Ministries Act				
Promotion of Balanced Regional Development Act				
Chamber of Agriculture and Forestry Act				
Occupational Health and Safety Act				
Add:				

5. Do you think we need additional regulations to promote PMUWB:

   a) I don't know
   b) no
   c) yes, which:_____

6. Your suggestion of changes of legal order of PMUWB:
   a) immediately:_____
   _____
   _____
   b) after 2006: _____
   _____
   _____

2. INSTITUTIONS RELATED TO UTILIZATION OF WOOD BIOMASS

2.1 Do you think that the following institutions play the roles which in your opinion they should play?

Institutions	The current role of the individual institution is:	Notes
Ministry of the Environment, Spatial Planning and Energy– Directorate for Energy.	☺ completely adequate 😐 adequate ☹ not adequate	
Ministry of the Environment, Spatial Planning and Energy– – Directorate for Environment	☺ completely adequate 😐 adequate ☹ not adequate	
Ministry for Agriculture, Forestry and Food – Direct. for Forestry	☺ completely adequate 😐 adequate ☹ not adequate	
Ministry for Agriculture, Forestry and Food - Direct. for Agriculture	☺ completely adequate 😐 adequate ☹ not adequate	
Ministry of the Economy	☺ completely adequate 😐 adequate ☹ not adequate	
AURE	☺ completely adequate 😐 adequate ☹ not adequate	
Eco-fund	☺ completely adequate 😐 adequate ☹ not adequate	
Agency for Agricultural Markets and Rural Development	☺ completely adequate 😐 adequate ☹ not adequate	
Slovenia Forest Service	☺ completely adequate 😐 adequate ☹ not adequate	
Chamber of Agriculture and Forestry	☺ completely adequate 😐 adequate ☹ not adequate	
National Farm Land and Forest Fund	☺ completely adequate 😐 adequate ☹ not adequate	
Research institutes	☺ completely adequate 😐 adequate ☹ not adequate	
Not vladne organizacije	☺ completely adequate 😐 adequate ☹ not adequate	
Chamber of Commerce and Industry	☺ completely adequate 😐 adequate ☹ not adequate	
Development centres (Associations)	☺ completely adequate 😐 adequate ☹ not adequate	
Counselling companies (planning, studies performance….)	☺ completely adequate 😐 adequate ☹ not adequate	
Local communities (municipalities)	☺ completely adequate 😐 adequate ☹ not adequate	

2.2 What changes, in your opinion,would be necessary on the institutional leve for more efficient acting in the area of wood biomass?

1. _____
2. _____
3. _____

3. FUTURE UTILIZATION OF WOOD BIOMASS IN SLOVENIA

3.1. What will, in your opinion, be the future use of wood biomass like(according to number of users or number of systems)?

	Use until 2006 will:	In the period from 2006 to 20012, use will:	Until 2020 use will:
Households	• increase a lot (more than 50 %) • increase (up to 50 %) • remain the same • decrease (do 50 %) • decrease a lot (more than 50 %)	• increase a lot (more than 50 %) • increase (up to 50 %) • remain the same • decrease (do 50 %) • decrease a lot (more than 50 %)	• increase a lot (more than 50 %) • increase (up to 50 %) • remain the same • decrease (do 50 %) • decrease a lot (more than 50 %)
Micro systems	• increase a lot (more than 50 %) • increase (up to 50 %) • remain the same • decrease (do 50 %) • decrease a lot (more than 50 %)	• increase a lot (more than 50 %) • increase (up to 50 %) • remain the same • decrease (do 50 %) • decrease a lot (more than 50 %)	• increase a lot (more than 50 %) • increase (up to 50 %) • remain the same • decrease (do 50 %) • decrease a lot (more than 50 %)
District heating systems	• increase a lot (more than 50 %) • increase (up to 50 %) • remain the same • decrease (do 50 %) • decrease a lot (more than 50 %)	• increase a lot (more than 50 %) • increase (up to 50 %) • remain the same • decrease (do 50 %) • decrease a lot (more than 50 %)	• increase a lot (more than 50 %) • increase (up to 50 %) • remain the same • decrease (do 50 %) • decrease a lot (more than 50 %)
CHP	• increase a lot (more than 50 %) • increase (up to 50 %) • remain the same • decrease (do 50 %) • decrease a lot (more than 50 %)	• increase a lot (more than 50 %) • increase (up to 50 %) • remain the same • decrease (do 50 %) • decrease a lot (more than 50 %)	• increase a lot (more than 50 %) • increase (up to 50 %) • remain the same • decrease (do 50 %) • decrease a lot (more than 50 %)
Industry	• increase a lot (more than 50 %) • increase (up to 50 %) • remain the same • decrease (do 50 %) • decrease a lot (more than 50 %)	• increase a lot (more than 50 %) • increase (up to 50 %) • remain the same • decrease (do 50 %) • decrease a lot (more than 50 %)	• increase a lot (more than 50 %) • increase (up to 50 %) • remain the same • decrease (do 50 %) • decrease a lot (more than 50 %)

3.2. Do you think that export of wood biomass into neighbor countries until 2012 will:

- increase a lot (more than 50 %)
- increase (up to 50 %)
- remain the same
- decrease (do 50 %)
- decrease a lot (more than 50 %)

3.3. Classify individual types of fuel wood according to importance which it has, in your opinion, for households (1: the most important, ... , 7: least important)

	Today	Until 2012
Briquettes		
Piece wood residues		
Charcoal		
Pellets		
Logs		
Wood chips		
Saw dust or wood dust		

3.4. Evaluate influence of the following factors for the development (until 2012) of production, marketing and utilization of wood biomass:

	Your estimation of factors for development			
Factors according to groups	Breaks	No impact	Stimulates	I don't know
	☹	😐	☺	
FOREST / FORESTRY	**Production of WB**			
Costs of production of WB from forests				
Introduction of modern production technologies				
Property structure of private forests				
Opennes of forests with forest roads				
Restrictions for exploitations of economy forests (natura 2000, protection of water springs, urban forests, ...)				
Qualification (people who work in private forests)				
Negative impacts of production for forests				
MARKET	**Marketing of WB**			
Non organized market (unclear market of producers and tenderers of WB)				
Information				
Lack of raw material on the market				
Price of WB				
High costs of initial investments				
Knowledge of people about ecologic impacts				

Annex 8 CALCULATION OF MATERIAL COSTS FOR A CHAIN SAW

Price of fuel (95 octane gas): 200,30 SIT/l (source: Petrol 28.6.2004)
Price of lubricant:

- Petror mix: 1.100,00 SIT/l (source : Petrol 28.6.2004)
- Verigol: 657,5 SIT/l (source : Petrol 28.6.2004)

Considered price of fuel + 2% added oil (1:50).

Depreciation period: 8 years (source : Dolenšek, 2002)
Life span: 1.500 h (source : Dolenšek, 2002)

Use of fuel: (source : Winkler et al., 1994)

- Medium size chain saw (power up to 3 kW): 0.75 l/obr. uro)
- Heavy chain saw (power over 3 kW): 1.00 l/obr. uro)

Consumption of fuel: (source : Winkler et al., 1994)

- Medium size chain saw (power up to 3 kW): 0.40 l/obr. uro)
- Heavy chain saw (power over 3 kW): 0.50 l/obr. uro)

Consumption of consumables: (source : Winkler et al., 1994)

- Duration of blade: 900 h
- Duration of the chain: 300 h
- Duration of the driving wheel: 900 h

Prices of chain saw and spare parts:

- Intergozd d.o.o., Cesta Staneta Žagarja, Kranj (state 28.6.2004)
- Agromarket, Kočevje (state 28.6.2004)

Characteristics of the selected chain saws:

Type	Sort	Power (kW)	Weight (kg)	Price (SIT)
Husquarna 340	Semi-professional	2,0	4,7	99.000,00
Husquarna 350	Semi-professional	2,3	4,8	113.000,00
Husquarna 365	Professional	3,4	6,0	179.900,00
Stihl 290	Semi-professional	3,0	5,9	127.000,00
Stihl 390	Semi-professional	3,4	5,9	157.000,00

Annex 9 Basic data for the calculation of material costs of tractors

	Brand -Type	Purchase price	Fuel consumption	Tyres value
Adjusted agricultural tractor	TORPEDO TD 75A	8.800.000	2,0	250.000
Protection of cabin and underbody 650.000 SIT	Lamborghini 684-85 SPRINT	10.340.000	2,0	250.000
winch LIV GV2-h50 and h boards 3 mio SIT	ZETOR 6340	9.500.000	2,2	240.000
IGLAND 5002 tl and h boards 4 mio SIT	IMT 577 4WD	9.750.000	2,2	240.000
	NH TN75D Rival	10.521.000	2,0	240.000
	NH TN75D	10.990.000	2,0	250.000
4*2 drive	IMT 539	1.970.000	1,8	110.000
	IMT 577	3.741.360	2,1	160.000
(data March-April 2004)	ZETOR 4320	3.612.269	1,9	160.000
	ZETOR 6320	4.074.274	2,1	160.000
	NH TN75D	6.050.000	1,9	210.000
4*4 drive	SAME DORADO 75 DT	6.500.000	2,0	250.000
	Lamborghini 684-85 SPRINT	6.690.000	2,0	250.000
(data March-April 2004)	ZETOR 6340	4.807.274	2,2	240.000
	IMT 577 4WD	5.100.000	2,2	240.000
	NH TN75D Rival	6.871.000	2,0	240.000
	NH TN75D	7.540.000	2,0	250.000

Sample calculation for one of the tractor types

Agricultural tractor 2WD – up to 55 kW **IMT 577**

			Units	Consumption	SIT/du
Fuel	SIT/l	170,8	l/du	2,1	358,68
Lubricant	SIT/l	1000	l/du	0,15	150,00
				duration	
Tyres - garnitura	SIT/set	160000	du	2000	63,33
Chains	SIT/set	260000	du	2000	102,92
Total variable costs					674,93
Purchase price	SIT	3741360			
Depreciation period	let	12			
Annual use	dni	100			
Depreciation					389,73
Service and maintenance	% depreciation	7			350,75
Interests	%	7			177,32
Insurance	%	3			140,30
Total direct material costs					1733,03
Efficiency	m3/du	1,7			1019,43

Annex 10. Calculation of direct costs for a cleaving – cutting processor

Log making processor - tractor driven

				Units	Consumption	SIT/du
Fuel	SIT/l			l/du		0,00
Lubricant	SIT/l	700		l/du	0	0,00
			number		duration	
Knives	SIT	47000	1	du	1500	27,4
Chain	SIT	2500		work h	600	4,0
Board	SIT	4300		work h	1500	2,8
Driving wheel	SIT	3300		work h	1500	1,9
Total variable costs						36,1
Purchase price	SIT	1520000				
Depreciation period	years	15				
Annual use	days	100				
Depreciation						126,7
Service and maintenance	% depreciation	15				88,7
Interests	%	7				70,9
Insurance	%	3				57,0
Total direct material costs of the chipper						379,4
Total direct material costs of the tractor						1371,7
Together - direct material costs	SIT/du					**1751,1**
Efficiency of the chipper	stacked m3/h	5				
Cost per unit	SIT/stacked m3					**350,2**

Annex 11. Calculation of direct costs for a middle power tractor driven chipper

Chipper-middle-tractor driven

				Units	Consumption	SIT/du
Fuel	SIT/l			l/du		0,00
Lubricant	SIT/l			l/du	0,01	0,00
			number		duration	
Knives	SIT/set	18000	3	du	1500	31,50
	SIT/set			du	2000	0,00
				quantity	duration	
Total variable costs						31,50
Purchase price	SIT	2800000				
Depreciation period	years	15				
Annual use	days	100				
Depreciation						233,33
						0,00
Service and maintenance	% depreciation	15				163,33
Interests	%	7				130,67
Insurance	%	3				105,00
Total direct material costs of the chipper						663,83
Total direct material costs of the tractor						1371,70
Together - direct material costs	SIT/du					**2035,53**
Efficiency of the chipper	stacked m3/h	12				
Cost per unit	SIT/stacked m3					**169,63**