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HEATING SYSTEM ANALYSIS IN JOGEVA DISTRICT (ESTONIA)

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Course: Wood Fuel Production and Use

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CONTENTS

1. INTRODUCTION

The history, economy and culture in Estonia have been during 50 years bound with Soviet economy and culture. The Soviet economy was the extensive one and the sources of energy and other row materials were very cheap. It was not used to count, how much does cost heating energy, petrol, oil and etc. That was the reason why the heating energy was mostly produced by oil and the boilers and transmission pipe lines were very unefficient.

Estonia has been intependent over 10 years now and will get the membership of EU in May of 2004. The enviromental problems, the energy policy included, is very important in EU. To belong into EU as equal and responsible state, Estonia has joined to international protocols and agreements, as follows:

1.1.International and national agreements

1.1.1. Rio-de-Janeiro papers:

- Agenda -21, which is the programme for 21th century, to reach sustainable development
- Biodiversity Convention
- Climate Save Convention
- Sustainable management of Forests in World

To make true this agreements, **The Act on Sustainable Development** was passed by the Riigikogu in 1995. For introduction of the principles of sustainable development and creating of possibilities for implementation of sustainable development a joint project of the Ministry of the Environment, Ministry of Economy and UNDP Estonia 21 was initiated in 1997. As part of this project, a collection of articles under the name of *Estonia in the 21st Century. Strategies for Development. Visions. Options,* has been published. The book aims at the opening of public discussion for selecting alternative development routes for Estonia in the 21st century, setting of national development priorities in the light of social consent, and wide introduction of the ideas of sustainable development.

1.1.2. The Act on Emission Taxation

Also the regulations for SO2, CO, CO2, N*x*, solid particles, heavy metals and etc. emission were worked out and the taxes are increasing:

	2003	2004	2005
SO2 EEK/t	95	114	137
CO	14	16	20
Solid particles	95	114	137
NO2	218	262	315
Heavy metals	3476	4171	5005

For instance heating unit of Luua Forestry College pays annualy 3925.- EEK for 2 boilers with capacity of 1 mW together.

For CO2 emission must pay taxes only those producers whose capacity is over 50 mW. The producers who produce heating energy on base of renewable fuels, must not pay CO2 taxes. Each heating energy producer must have emission licence, excepted those, whose capacity is less than 0,3 mW (solid fuels and gas) or 0,5 mW (oil).

1.2. Some figures, characterising Estonian Energy Strategy:

Primary energy (TWh)	**2000**	**2010**	**2020**	**2030**	**2040**	**2050**
Gas	6,8	5,6	4,6	3,9	3,3	2,6
Oils	10,4	7,8	5,9	4,6	3,5	2,7
Biofuels (excepted peat)	5,9	7,2	8,8	10,8	13,2	16,2
Peat	0,4	1,4	2,0	2,0	2,0	2,0
Coal	0,6	0,5	0,4	0,3	0,3	0,2
Lignite (palavakivi)	31,9	24,2	18,5	14,2	11,1	8,5
Others						
Fossil together	**49,4**	**38,1**	**29,4**	**23,0**	**18,1**	**14,0**

Renewable together	**6,3**	**9,5**	**12,7**	**15,5**	**18,7**	**22,5**
Renewable, %	**13**	**20**	**30**	**40**	**51**	**62**
CO2 annual emission tonns/per capita	**11,6**	**9,0**	**6,9**	**5,4**	**4,3**	**3,3**

The figures seems good. But there is no financial support or subsidium from goverment, to improve the competitivenes of renewable fuels, nor for development projects. The only dotations, that the Estonian forest owners could apply for are:

- Dotation for site preparation and assisting the natural regeneration- 1,100 kroons per hectare but not more than 70 per cent of actual expenses
- Dotation for forestry works in a stand younger than 15 years not more than 1,500 kroons per hectare and not more than 70 per cent of actual expenses
- Dotation for buying a service of councelling not more than 1,500 kroons a year.

1.2. **Promotion of renewable fuels**

Estonian Biofuels Association

There is established a Biofuels Association in Estonia (EBA). EBA is non-profit association, which was founded 1998. The EBA is an intependent and voluntary alliance of its members. Fields of activities are by biofuels research, developing and evaluation to engage enviromental, biofuels and energy saving. The members are: energy consultants, scientists, fuel suppliers and technology suppliers. The board of EBA consists of 5 members. The chairman is mrs. Meeli Hyys, meelih@estpak.ee .

1.4. Goals and methods of the project

The goals of the study are:

1) Find out the extent of using of wood-fuels in Jõgeva county
2) Future plans of heat-producing companies of Jõgeva County, among this willingness of the companies to start using wood-fuels
3) Which boilers (models and age of boilers) are used
4) Ownership and entreprineurship
5) Development strategies of heating plants (planned fuels, types of new boilers)

6) Problems.

This way the broader goals of the study consist also the market research of wood-fuels and also the research of possible market for heating equipment. The further goal is, to find out, could there be a training market. Very often the employers in heat-producing companies lack any professional training. Starting using of wood-fuels needs new knowledge as in the field of different wood-fuels, as their source, but also in the field of technology of heat production.

As the goals of the study presume finding out concrete objects- boiler-houses and boilers, their condition and future plans, the only possible way for that was direct contacts with the boilerhouses and with their owners. To make the work more systematic the questionnaires were compiled (appendix 1) for sending to the towns and communes to find out the number of heat producers and their type of ownership in every local municipality. As a big number of boilerhouses are in hands of local municipalities, the workers of these municipalities were aware of the development plans of the heat-producing companies, among them the fuels used at the present time and possible fuels in future.

Separate questionnaires were compiled for the heat-producing companies, which already use wood-fuels (appendix 2).

Quite often the heat producers do not know their plans themselves, as the wishes are often not compatible with possibilities. That is why this study is broader-based than only the question of starting using wood-fuels. Indirect indicators as the age of boilers, fuel used at the present, problems with the heating equipment and distribution piping also make it possible to make conclusions about the possible development tendencies, even if the producers are not aware of these tendencies themselves.

Before starting the practical study the author learned about the properties and the use of wood-fuels in the literature. The study gives an overview of international regulations and the national energy- and environmental policies, as these are the factors that give a basis to the directions of development.

2. LOCAL WOOD FUELS

2.1. Wood resources in Estonia

Forests cover 47.4 % of Estonian territory. The area of forestland in 1999 was 2,143, 100 hectares, 2,059,000 hectares of which were covered by stands. The growing stock of the stands was 352.7 million solid metres. The calculations of scientists show our growing stock between 316 and 443 million solid metres. The increment of the biomass in stands together with not valuable timber biomass in agricultural land is between 12 and 13 million solid metres a year. Particularly rapidly rises the timber biomass with low value (Alnus incana, Populus tremula, Salix spp., Betula pubescens) on private agricultural lands (see the figures 1 and 2). The state owns approximately 50 % and the private sector 50 % of forests.

No each forest site type is suitable for wood fuel procurement. The groups of Estonian forest site types are as follows:

Groups of Estonian forest site types Table 1

Class	Group of types	Site types	Main area of distribution	Occu-rence	Suitabililty for chip procurement
Forests on mineral soil	Alvar forests	• Bearberry alvar • Small reed alvar • Blue moor grass alvar	Western Estonia and islands	• 3 %	• 0
	Heath forests	• Lichen • Heather	Northern Estonia	• 3 %	• 1
	Mesotrop-hic (pine) forests	• Cowberry • Bilberry	Southeastern and norhten, islands	• 7 % • 17 %	• 4 • 3
	Meso-eutrophic (spruce) forests	• Wood sorrel • Hepatica	• Southeastern • Northen and northwestern	• 6 % • 5 %	• 5 • 5
	Nemoral forests	• Goutweed • Fern	Central and eastern	• 8 % • 1 %	• 5 • 4
	Herb-rich mixed forests on wet gley soils	• Meadowsweet • Horsetail • Sedge	• Western, islands	• 15% • 2 % • 5 %	• 1 • 1 • 1
	Dwarf-schrub-sphagnum	• Bog whortleberry • Hair moss	• Northen,south-west	• 3 % • 1 %	• 2 • 2

	plaudified forests				
Peat-land forests	Grass fen forests	• Alder fen • Birch fen		• 1 % • 5 %	• 0 • 0
	Bog moss forests	• Transition bog • Bog		• 7 % • 2 %	• 0 • 0
	Full-drained swamp forests	• Bilberry full-drained swamp • Wood sorrel full-drained swamp		9 %	• 1 • 1

0 – unsuitable
5 – very suitable

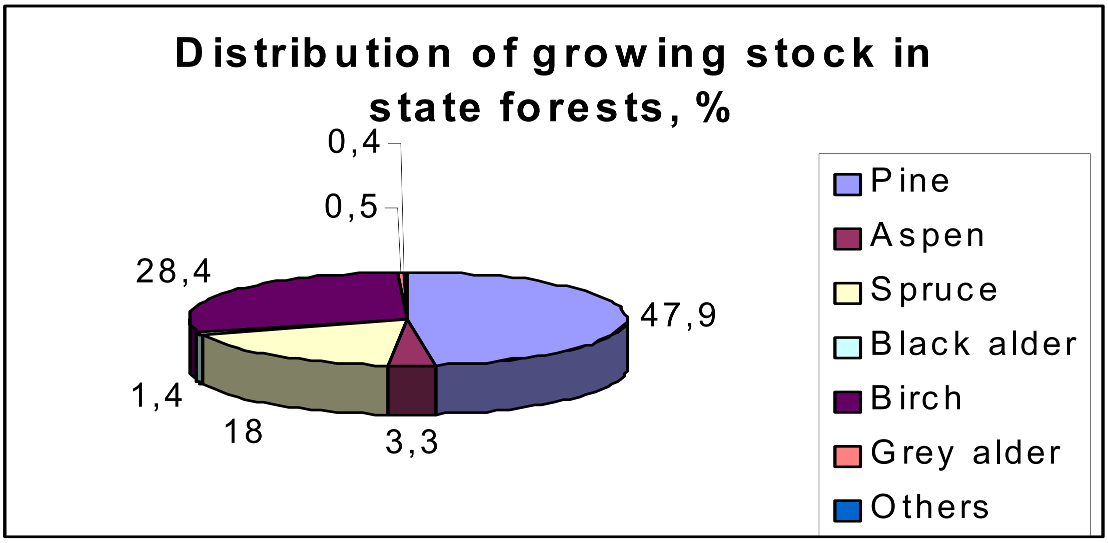

Figure 1. Distribution of growing stock in state forest, %

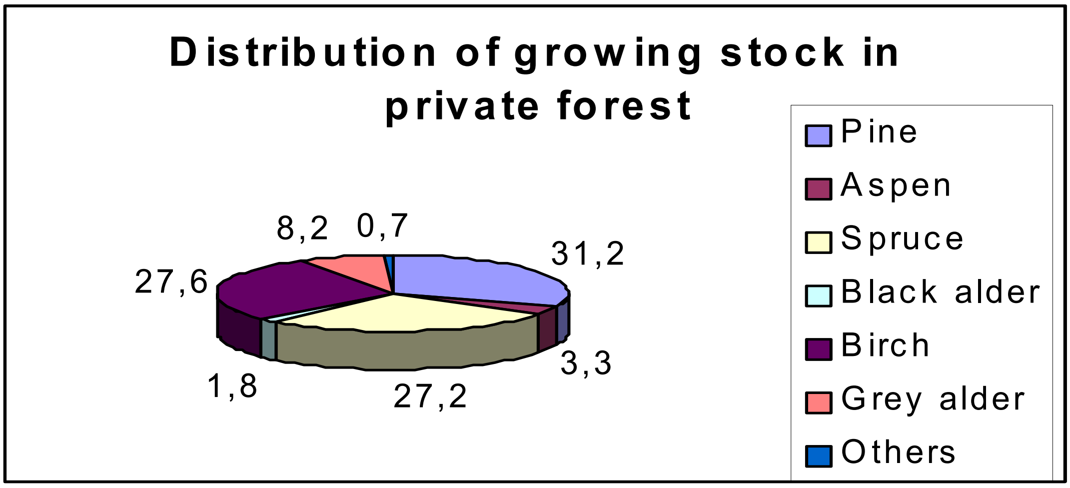

Figure 2. Distribution of growing stock in private forest, %

The figures of annual increment and amounts of real cuttings in Estonia have been the objects for serious discussions lately. Official data shows that there has been a rise of cuttings of 3.2 times between the years 1992 and 1999. Although the increment of forest biomass exceeds the cuttings, there are 2 times higher cuttings in our spruce stands and 1.5 times higher cuttings in our pine stands than the increment there accordingly. At the same time we do not use the production of our grey alder and aspen stands, which would be suitable for using as fuel, as they can not be used for quality timber.

From grey alder stands and ground overgrown with brushwood it could be possible to cut without decreasing the stock almost 500,000 solid metres of grey alder, 130,000 solid metres of brushwood, 50,000 solid metres of bog birch stands and 20,000 solid metres of bog pine stands, altogether 0.7 million solid metres of firewood. The stock of brush biomass in Estonia has not been researched.

Timber, which is cutted, mostly goes to sawmills or will be exported for pulp. The capacity of sawmill industry exceeds the capacity of available saw logs. So approximately 30% of saw logs are nowadays imported from Russia or from Latvia. Small scale disc sawmills are sawing even logs of very low quality and still try make some profit.

2.2. Local wood fuels

The natural distribution of the dominanting tree species has been given in the Appendix 1 – 2 of the report.

2.2.1.Pine - *Pinus sylvestris*

Because there is not enough of logs for Estonian forest industry, sawmills are sawing even very small diametre pine logs. There is no diference betveen pulp wood and saw log diametres. The only one criterium is quality of logs. There must be no decay and not too much branches.

Sawmills which are sawing pine logs, mostly have the hew-saw technology, what means, that logs are debarked and pure chip goes by the shortest way to Finnish or Swedish pulp industy. So only the bark may be used for heating.

The local fuels made from pine are listed below:

1) Chopped fire wood, to be burn in stoves and in small scale boilers. The rowmaterial for this kind of fuel are timber, harvested in improvement cuttings. Because of theyr low quality they can not be sold to wood processing industry, but are very suitable for heating.

2) Bark

3) Chips, made from by-products of sawmilling industry. Slabs come particularly from small scale and from medium scale sawmills, where hew-saws are not used.

4) Stemwood chips, made from small size trees, harvested in pre-commercial thinnings and also in first commercial thinnings.

Because there are no subsidys for harvesting and processing of small size trees, neither stemwood chips nor whole tree chips can be used. From the other hand, there is not very much of jung pine forests in Estonia, which could be suitable for harvesting of small size stems. The reason is, that there was planted during the last decades of last century only very little of pine. The spruce stands were more prefered because the elks didn´t damage them. There was no sens to plant pines. Nowadays the number of elks is going down

The properties of pine, as well of spruce, birch, alder and aspen see tables 1 … 2.

2.2.2. Spruce - *Picea abies*

When we compare pine logs and spruce logs to each other, the quality of spruce logs is better. The reason is, that the soils in Estonia suits mostly for rrowing of spruce stands. Because the capasity of sawmilling industy exceeds supply of saw logs, also the small size spruce logs are used for wood processing as well as small pine logs. There are many sawmills in Estonia, whose busines idea is, to buy for the pulpwood price some cheap rowmaterial and make profit by doing from cheap logs good and expensive sawmaterial. So there is not very much of small size stems for shipping available.

How can spruce still be utilized for heat production?
Because spruce stands are growing on very rich soils, the volume of logging residue is significant. Approximately 250 000 m3 of residue could be harvested annually. It could be enough for 50 1-MW boiler, but there is no users, no harvesters, no chippers yet.

There is a very big problem also with root rot (*Fomes annosus*), which causes decay of stems. This logs can be used only for heating, in form of chopped fire wood.

The local fuels made from spruce are listed below:
1) Chopped firewood, to be burned in stoves and in small scale boilers
2) Logging residue chips (no markets yet)
3) Chips made from low quality logs or from by-products of sawmilling industry (particularly small scale and medium scale sawmills)
4) Whole tree chips (no markets yet)
5) Bark

2.2.3. Birch - *Betula pendula*

Birch is the most popular tree species for burning in stoves and in open fire places, because its heating value is quait high. Birch can be harvested also for producing of stemchips. There have been made very much of cleare cuttings during last 10 years, when one part of Estonian forests has been restituted to the earlier owners. Reforestation of those areas has taken place by natural way, mostly by deciduos trees like birch, alder, aspen. The owners didn´t take care for this areas and very soon there will be unefficient stands which are suitable only for harvesting of fuel wood.

The local fuels made from birch are listed below:

1) Chopped fire wood, harvested in thinning cuttings
2) Logs of low quality
3) Stemwood chips (no markets yet)
4) Chips made from sawmilling by-products
5) Chips made from veneer industry by-products

2.2.4. Alder- *Alnus incana*

Alder, as well as birch is very popular to be burned in stoves and in open fire places. Alder can be used also for smoking of fish and meat and also for barbecues. The gray alder stands make up 11,5% of private forests and 0,4 % of State´s forests. There also is approximately 200 000 ha of fields which are not in use.Those areas very soon will taken by birch and alder.

The local fuels made from alder are listed below:

1) Chopped firewood
2) Chopped firewood for barbecues or for smoking of meat and fish
3) Stemwood chips (no markets yet)

2.2.5. Aspen - *Populus tremula*

As far as good quality aspen timber are available they are used in wood processing industry. There is no sens to pick up the scattered small stands for heating. But the above mentioned field areas are very suitable for growing of hybride-aspen (*Populus tremula x Populus tremuloides*). This plantations will be a very significant resource of stemwood chips in future.

The local fuels made from aspen are listed below:

1) Chopped fire wood, to be burned in stoves and in open fire places

2) Stemwood chips

2.3. Potential of logging residue in Estonia

- Forest resources are 47,4% of total area of Estonia, it means, there are
  >2 mlj. ha of tree stands
  ~350 milj. m3 of wood

- Removal volume:
  -total about 10 milj. m3/a
  -clear cutting ~6 milj.m3/a
  -thinning ~4 milj. m3/a

On base of the figures mentioned above, we can say, that there must be the logging residue resources of 0,5 milj. m3/a. This is only the theoretical value, because not each cubic meter can be picked up. There also are some forest site types which are not so productive and where the haulage of residue is impossible.

It is more easier to pick up logging residues, when forest is cutted by mashines (moto). Nobody knowes exactly, how many harvesters there are working in Estonian forests, but by preliminary calculations about 50 % from total volume of clearcuttings have nowadays been done by harvesters. The manual harvesting still reduces the quantity of avaylable logging residue. It means, approximately 0,25 milj. m3 of logging residue can be used annually. It would be enough for 50 one-megawatt boiler.

Another, quait important row material resource for producing forest scips (stem chip), is gray alder, because of very high productivity of gray alder stands.Also stock of gray alder is significant: approximately 35 milj. m3 (~10 % x 350 milj.m3). There have been estimated, that our gray alder resources make possibly to harvest 0,5 milj. m3/a of gray alder biomass. In future hybrid aspen (Populus tremula x Populus tremuloides) could be grown and used for producing of chips.

2.4. The prices of heat energy, produced by different fuels

The main price components of heat energy are:

1) Equipment costs
2) Salary costs
3) Expluatation costs
4) Technological costs (electricity, water etc.)
5) Fuels

To compare the heat prices, produced by different fuels, we have to take account all the costs, named above.

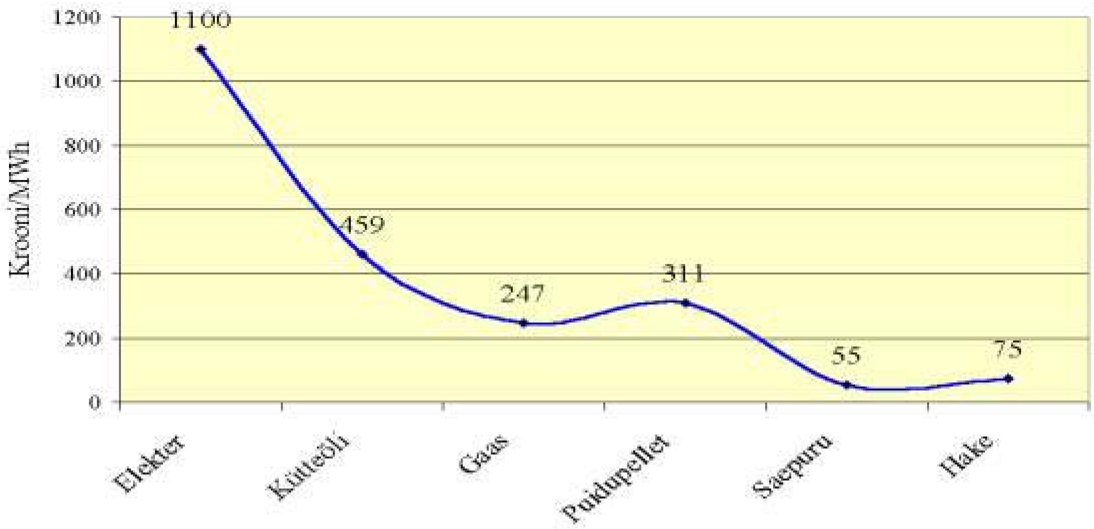

Figure 3. The fuel prices (kroons per MWh): electricity, oil, gas, pellets, saw dust, chips.

3. AN OVERVIEW OF BOILERHOUSES AND THEIR FUTURE PLANS IN JÕGEVA COUNTY

3.1. Administration and population of Jõgeva County

Jõgeva County is located in the central-eastern part of Estonia. It is administratively divided into 10 communes and 3 towns, each from them with its own municipal status. The total territory of Jõgeva County is 2 604,4 sq.km, with a total population of 41 600 people. In towns are living 33 % and in rural areas 67 % of the population. 52 % are working age people.

Average monthly gross wages and salaries in 1st quarter 2003 were in Estonia 6333.00 kroons. Average disposable income per household member in a year was 1612.00 kroons. In Jõgeva County the number was only 754.00 kroons. Because of living of significant part of population in rural areas, the unemployment rate in Jõgeva County is hihger than average, which is 10,6 %. The facts, mentioned above, cause problems and difficulties for heat producers (see p. 3.2.5).

3.2. An overview of boilerhouses

The preferences of settlements of Jõgeva County in choosing the energy carriers are influenced by passing through of gas pipe (Figure 4). As you can see on figure 3, gas is one of the cheapest energy carriers and it is also comfortable to use it, this way the operation costs are also low, in case the pipeline is near. But if there is need for building a long branching pipeline, the investment of course reflects in the price of thermal energy produced.

There are 16 bigger and 44 smaller boilerhouses in Jõgeva County, which all together have 83 boilers in. The smaller boilerhouses (50 kW) are the ones that have been built into the basements of houses. The larger boilerhouses are mostly in the three towns of Jõgeva County and also in bigger communes. The largest one is of 7,5 mW.

The total capacity of boilers, which is in use, is 25 mW, pluss reserv. The oldest boilers are from years1966 and 1968 and the newest from 2003 (7,8 and 5,3 mW, usingsome gas.
As the study shows there are also municipalities, which do not have any boilerhouses. For example Kasepää commune is one of them- in that municipality the houses have got stoves or they are heating by electricity.

The age of boilerhouses depends on municipalities having money for buying new boiler or not. Most of the older boilers belong to communes, because the rest of them, which belong to private owners or co-operative owners, have been replaced in recent years. In many commune centres they want to get rid of central heating, because the very old piping are a big problem for their big losses.

New boilers have been started using wood or because of their location- gas. Old boilers are still heated by black oil, oil or coal. In some bigger boilerhouses boilers using sawdust or wood chips have replaced the black-oil boilers.

The capacity of smaller boilers has been chosen according to the size of houses and they commonly do not have any power resources. Bigger boilerhouses also have bigger boilers, which do not work on their full capacity even during severe cold weather, often the bigger boilerhouses have also one additional boiler in case there are some problems with the main boilers.

3.2.1. Division of boilerhouses according to their capacity

The capacity of smaller boilers has been chosen according to the size of houses and they commonly do not have any power resources. Bigger boilerhouses also have bigger boilers, which do not work on their full capacity even during severe cold weather, often the bigger boilerhouses have also one additional boiler in case there are some problems with the main boilers. The most powerful boilers are in towns of Jõgeva County. The total capacity of the boilers in towns is more than a half of the total capacity of boilers in the whole county. The smallest boilers in Jõgeva county start from 45 kW and the biggest is 7,5 MW. In figure 3 there is the total capacity of boilerhouses used in communes and towns of Jõgeva County, which is a result of summarizing the capacities of all the boilers in the county.

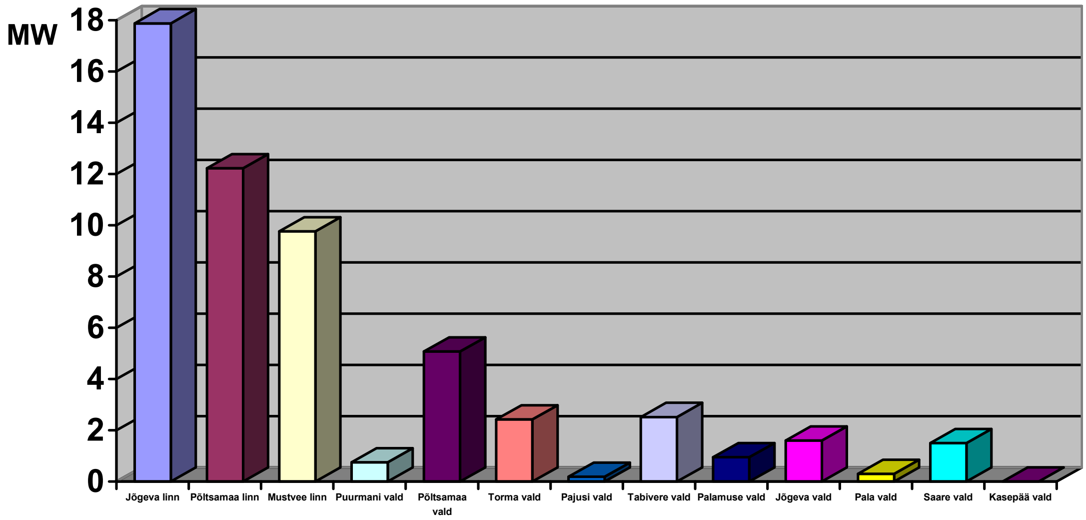

Figure 5. Division of boilers according to their capacity (MWh)

3.2.2.Division of boilers according to their age

The age of boilerhouses depends on municipalities having money for buying new boiler or not. Most of the older boilers belong to communes, because the rest of them which belong to private owners or co-operative owners have been replaced in recent years.In some boilerhouses they keep the old boiler as long as they become unrenewable. It is a case in boilerhouses where there the boiler has been put on place and the building has been built around the boiler. As there is a lack of money in communes they try to keep the boilers in working order as long as possible. But if there is a boiler, which stops working permanently in cold weather, it is late to start replacing it. This is a reason why many houses and companies have replaced the boilers during the last few years, to get rid of that risk.

The average ages of boilers in towns and communes of Jõgeva County are very different in different regions. The age of boilers used in towns comes from the boilers that have been installed a very long time ago, but even then there are some boilers that have been rebuilt or started using some other type of fuel. For example the Jõgeva Soojus (Heat) and Põltsamaa Soojus have rebuilt their old black-oil-based boilers into sawdust-and-wood-chips-based boilers, these boilers have also the biggest working load. This way they have managed to solve the problem of old boilers with relatively low financial resources and started using more nature-friendly fuels.

Table 2

Division of boilers according to their age

Town/commune	Number of boilers	Installed in years	Average age of boilers, years
Pala vald	2	2001.a.	2
Jõgeva vald	11	1998 - 2002.a.	3
Pajusi vald	1	1998 - 2000.a.	4
Tabivere vald	16	1995 - 1997.a.	8
Palamuse vald	8	1982 - 2002.a.	10
Torma vald	7	1985 - 1998.a.	10
Põltsamaa vald	4	1987.a.	16
Mustvee linn	3	1966 - 1997.a.	17
Põltsamaa linn	11	1968 - 2001.a.	17
Puurmani vald	13	1978 - 1988.a.	20
Saare vald	2	1978.a.	25
Jõgeva linn	5	1968 - 1982.a.	30

3.2.3. Division of boilerhouses according to the fuel used

The type of fuel used in boilerhouses depends on type of boilers. Older boilers are heated mainly by black oil, oil or coal, newer ones by gas or wood. The boilerhouses that are using gas have made the decision because there is a gas main passing them close enough. In Jõgeva county the greatest part of them are the gas-based boilerhouses (39 %), because the price of gas is low and it is easy to use automated boilers. Oil, coal and wood are used less (17 % each) than gas- two of them are used as intensively together as gas alone. The other fuels are used less.

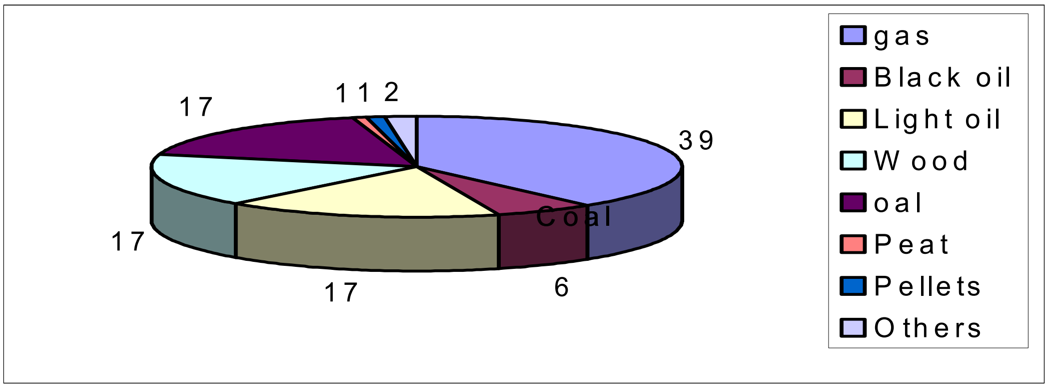

Figure 6. Division of boilerhouses according to the fuel used (% from total capacity of boilers)

3.2.4. Division of boilerhouses according to their ownership

Most of the boilerhouses- 35 belongs to the private owners, 21 of them belong to communes or towns and there are some, which have a greater share belonging to the commune or private owner. Some of the owners of boilerhouses are also foreigners.

Table 3

Division of boilerhouses according to their ownership

Town/commune	Share of municipality	Private share
Pala vald	100%	
Jõgeva vald	40%	60%
Pajusi vald		100%
Tabivere vald	10%	90%
Palamuse vald	100%	
Torma vald	85%	15%
Põltsamaa vald	100%	
Mustvee linn	65%	35%
Põltsamaa linn		100%
Puurmani vald	75%	25%
Saare vald	100%	
Jõgeva linn		100%

3.2.5. Main problems in boilerhouses

The biggest problems for boilerhouses are the heat debtors.
For example, municipal entreprice *Kaarepere Soojus* is operating in 2 heating plants (Palamuse and Kaarepere). The turnover of *Kaarepere Soojus* is 1,6 millions kroons in a year, but the total indebtedness for heat energy is 790 000 kroons. The total number of debtors is 60 and the biggest debt is 23059 kroons. The total number of clients of *Kaarepere Soojus* is 500 and the number of flats is 220.

There are also problems with old distribution systems. For example in Torma commune the distribution losses are even 40 %, it means almost a half of the heat that is produced in boilerhouse, is heated into the air and as there is no dotation from the commune, the customers have to pay for it all.
To lower the heating bills some boilerhouses have started heating periodically, not all the time. Houses are heated before people wake up and stopped about 10.00- 11.00 a.m. In the afternoon they are heated again at 4.00 p.m. until 8.00 or 9.00 p.m. When the heating is stopped the radiators in the flats are still warm for a couple of hours. In this periodical way it is possible to lower the heating expenses.

In case of gas-based boilers there are some problems with the quality of gas and accordingly the problems with the boilers. Possible gas-leakage is a problem, too. But this problem has been solved in some boilerhouses with the help of so-called “sniffers”, which stops the flow of gas automatically if it smells it.

3.2.6. The cubatures heated by the boilerhouses

As not all the questioned towns and communes gave answers about the heated cubature in unified parameters, it had to be calculated according to average sizes of flats and houses. Even when the answers were asked to give in cubic metres, some were still given in square metres, cubic metres or the number of flats. If the answer was given in square metres, it was transferred into cubic metres, taking into account the average height of rooms 2.5 metres and the average size of the flat 45 square metres.

Jõgeva town has the biggest number of area to be heated. When we calculate together all the cubatures of Jõgeva County, we get the area to be heated 1,241,100 cubic metres.

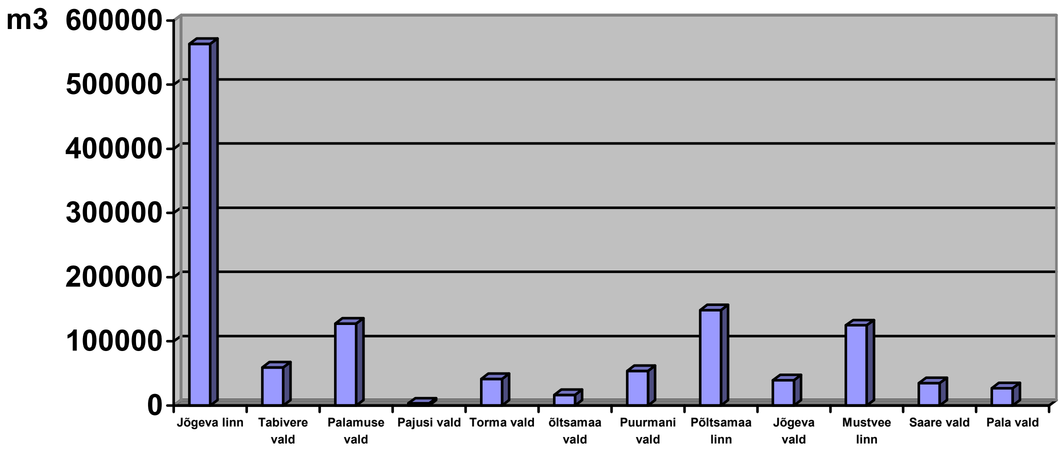

Figure 7. The cubatures heated by the boilerhouses

3.2.7. Age of boilers in use

As it was said before, quite a many boilers have been replaced or re-built for use with some other fuel. Some boilerhouses have been made the same plans for the nearest future, in condition they manage to get financing. The general tendency is getting rid of old central boilerhouses (especially in blocks of flats) and installing new boilers into the basements of houses in order to get rid of losses of piping.

3.2.8. Choice of fuel

The boilerhouses that have replaced their boilers in recent years are not planning to change the fuel used now. If, then only in case the price of fuel used rises dramatically. The boilerhouses that are planning to replace their boilers in the nearest future are going to choose gas or billetwood. In general, if somewhere there is gas that is used for heating, it has spread to a bigger territory than the serving territory of this one particular boilerhouse. The same has happened in case of wood. If in case of gas the constrictions are made or possibilities offered by closeness of gas main, then in case of wood the same seems to be done with a good example of neighbours. If this is the case, it would be quite easy to reach the goals of environmental strategy by establishing the example-boilerhouses.

4. AN OVERVIEW OF BOILERHOUSES BASED ON BIO-FUELS IN JÕGEVA COUNTY

4.1. What kind of bio-fuels are used and how much

Among the boilerhouses in Jõgeva County using bio-fuels the billetwood is most commonly used (if taking account the number of boilerhouses). Billetwood as fuel is used in 13 boilerhouses. Altogether in boilerhouses of Jõgeva county 5,050 solid metres of billetwood is used. In most boilers between 100 and 300 solid metres of billetwood is used annually. But one of the biggest- Luua boilerhouse- consumes 2,700 solid metres of billetwood a year. It makes more than a half of all the wood used in boilerhouses of Jõgevamaa. In some boilerhouses coal is used together with wood that makes the amount of wood used so small. Visiting different boilerhouses it was made clear that billetwood is the fuel most of the boilers are planned to heat that are planned to be installed in blocks of flats.

In Jõgeva county there is also one boilerhouse that uses peat. The annual need for peat in this boilerhouse is 800 tons.

In the list of boilerhouses working in Jõgeva county one can also find a boiler working on wood pellets. Its annual demand is up to 100 tons.

One of the biggest boilerhouses- Põltsamaa Soojus- uses in on of its boilers a mix of sawdust and bark. Sawdust and chips make up 30 % of the total amount of fuel and bark makes up 70 %. Even if they would like to use only chips, it is not possible, because one cannot find as much chips as needed. The annual amount of fuel used in Põltsamaa Soojus is 30,000 cubic metres.

A boilerhouse, which is situated in the centre of the county- Jõgeva Soojus-, uses only wood chips in one of its boilers. Its annual amount used is 46,000 cubic metres.

4.2. Fuel suppliers

Boilerhouses get their fuel from companies from all over Estonia, especially in case of sawdust, wood chips, wood pellets and peat. Billetwood is bought from private forest owners mainly and if some of the owners of boilerhouses have their own forest they get their wood from there, naturally.The most often mentioned wood-fuel suppliers are:

Imavere Sawmill
Ltd Laaneisand
Ltd Känd (peat)
Ltd Valmeka
Ltd Foolia
OÜ Oliver PK

Actually there are more suppliers, but the heat producers did not make them public, being afraid to make public the components of the prime price of the thermal energy and together with it the possible inefficiency.

4.3. Problems in fuel supplying

Most of the boilerhouses (76 %) do not have any problems with the supply of fuel. If there are any, then only that there is not enough of it available. There are also problems with the cars, which would bring the fuel (especially in case of peat), or there are problems with some weather changes, but they are not so common. However, the biggest problem is, that the prices of wood fuels are consistently rising. That fact degrades the competitiveness of energy produced by renewable (wood) fuels.

4.4. Problems with the quality of fuel

There are a lot of problems with the quality of fuel, mostly due to negligence of suppliers and of course there are problems due to lack of financial resources, that is a result of many debtors.

The most common complaint was about the wet fuel. That is mostly common with billetwood and sawdust- chips. There is no place to dry the billetwood and the sawdust- chips are full of snow and their percentage of humidity reaches even 70 %. This kind of humidity more likely puts off the flame, not on. In case of billetwood there are also problems with the different sizes of billets, some of them are not fit for boilers. Most often the wood used for fuel is of low quality, which cannot be used for making something else and which both rot and humidity in it.

There were also problems mentioned which were caused by different size of loads brought and the boilerhouse using wood pellets complained about the big amount of sawdust in wood pellets, also some pieces of metal were found in pellets.

4.5. Average transportation distance

The average distance of transportation mentioned was 20 to 35 kilometres and there are a couple of boiler houses using fuel brought from all over Estonia. The area of Estonia is not so big, but still the great transportation distances raise the prime cost of thermal energy, comparing with the boiler houses that use fuel brought from nearer places.

4.6. Types of fuels planned for future

As wood fuel is an equal selling article among all the other wooden products, the future plans for using it among thermal energy producers were studied. To the question: “Do you intend to start using some other type of wood fuel?” all the producers answered negatively. One of the purposes of this study was to find out how eager are the heat producers starting using the “green” – or forest chips. Although there were no direct answers to that, we can assume that if the feeding systems of Põltsamaa Soojus are fit for bark, they fit for forest chips also. The same technology as in Põltsamaa Soojus is in use in Jõgeva Soojus. So, on the basis of these two boilerhouses and the present production volumes the market for green chips in Jõgeva county might be 76, 000 cubic metres a year.

4.7. Selling price of thermal energy

As they were afraid of making public fuel suppliers, not all of them also made public the price of thermal energy. In the worst case there was not any overview of the components of prime cost of the fuel. Some of the thermal energy producers made public only the price of fuel. They also considered it to be a sufficient basis in calculating the price of thermal energy. But actually the price of thermal energy also contains many other expenses, most of all the permanent expenses (see 2.3.5.)

As some of the producers made public the selling price of thermal energy produced, they are as follows:

- Torma Soojus sells thermal energy for 450 EEK/ MWh
- Jõgeva Soojus sells thermal energy for 425 EEK/MWh
- Põltsamaa Soojus sells thermal energy for 425 EEK/MWh
- Luua boilerhouse sells thermal energy for 383 EEK/MWh

5. WHAT DO TO?

Heating system analysis and the site visits on the contact period-II schow, that in the municipalities owned boilerhouses is the equipment older and not so efficient than in the privat owned boilerhouses, because there is not enough of incomes in the communes, to make investments. In privat companies, there very often are shareholders from abroad and they bring money, but also experience. What to do in the other places?

- To develop heating entrepreneurship. The same entrepreneur must manage the whole chain, from fuel production to selling of heat. It is possible on the basis of the municipality owned heat plants.

- To arrange training for municipality officers, who are responsible for the heat supply to people; to educate also the heating plant operators. A very relevant part of the training are the study trips to Finnland (site visits to Thermia and to heating plants).

- Luua Forestry College has to design the training program and implement the courses.

- To try to avoid disengagement of big flathouses from heating networks and the installation of very small boilers (10…50 kw), because there exist quite good network pipelines in the villages.

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