Trends in wood biofuel production, marketing and utilization in Latvia

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Abstract

Wood biofuel production and use of wood biofuel is an important part of the Latvian economy because it is an alternative to fossil energy sources. That encourage to the preservation of the environment and offers an opportunity to achieve the objectives set by the EU and Latvia in relation to the use of renewable energy production. The aim of thesis is to examine the literature on wood bioenergy production, marketing in Latvia. Wood biofuel producers and experts are questioned within their challenges and prospects in wood biofuel production and marketing in Latvia. Data were collected from 107 wood biofuel companies using interviews and were analyzed using SWOT and simple percentages. The results showed that almost 100% of the wood biofuel in Latvia are produced from local wood raw materials. Wood is the most important domestic household fuel in Latvia, and opportunities in biofuel domestic and export markets exist in the country. Latvia has great potential to increase its energy supply system using biofuel products and become less dependent on fossil fuel. Biofuel producers in Latvia face challenges such as shortage of raw materials, unstable market prices, and difficulties in accessing funds for investment as well as institutional rules and regulations. In order to achieve Latvian renewable energy policy goals an effective national policy is required to promote the use of renewable energy.

Keywords: Biofuel production, Latvia renewable energy sector, wood biofuel producers, energy policy goals

Kopsavilkums

Koksnes biokurinamā ražošana un izmantošana ir svarīga Latvijas ekonomikas daļa, jo tā ir alternatīva fosilajiem enerģijas resursiem. Tas veicina vides saglabāšanu un sniedz iespēju sasniegt ES un Latvijas izvirzītos mērķus attiecībā uz atjaunojamās enerģijas izmantošanu. Šī diplomdarba mērķi ir pārskatīt pieejamo literatūru par koksnes biokurinamā ražošanu, realizāciju un izmantošanu Latvijā. Tāpat jāizskata arī koksnes biokurinamā ražotāju un ekspertu viedokļi par problēmām, kas saistītas ar koksnes biodegvielas ražošanu un tirdzniecību Latvijā. Dati tika apkopoti no 107 koksnes biokurinamā ražošanas uzņēmumiem, izmantojot intervijas, un analīzē izmantojot SWOT analīzi. Rezultāti parādīja, ka gandrīz 100% Latvijas koksnes biodegvielas tiek ražoti no vietējām koksnes izejvielām. Koksne ir vissvarīgākais vietējais mājsaimniecības kurināmais Latvijā, un valstī pastāv iespējas izmantot biokurinamo vietējā un eksporta tirgos. Latvijai ir liels potenciāls palielināt enerģijas apgādes sistēmu, izmantojot biokurinamā produktus, un kļūt mazāk atkarīgai no fosilā kurināmā. Biokurinamā ražotāji Latvijā sastopas ar tādiem izaicinājumiem kā izejvielu trūkums, nestabilas tirgus cenas un grūtības piekļūt investīcijām, kā arī institucionāliem noteikumiem un likumiem. Lai sasniegtu Latvijas atjaunojamās enerģijas politikas mērķus, ir nepieciešama efektīva valsts politika atjaunojamo energoresursu izmantošanas veicināšanai.

Atslēgvārdi: biokurināmā ražošana, Atjaunojamā enerģija Latviā, koksnes biokurināmā ražotāji, enerģētikas politikas mērķi.

Contents

1. Introduction

The production of biofuel is an important segment of the Latvian economy. Due to that bio-fuel is an alternative to fossil fuel it contributes to Latvian and EU objectives concerning the use of renewable energy resource. In Latvia, almost 100% of wood bio-fuel is produced from local raw materials (Renewable energy in Latvia, 2008). This provides jobs for many people and at the same time contributes to revenue for the state through taxes. The use of wood bio-fuel for the production of energy in Latvia contributes to making the country less dependent on fossil fuels. Furthermore, the vast bio-fuel product export opportunities in Latvia make investment in the bio-energy sector very lucrative.

The main types of renewable resources (RR) in Latvia are fuel wood and hydro-resources, which account for about one third of total energy consumption in 2013. Wind power, biogas, bio-fuel and biomass have been used to lesser extent in Latvia. The proportion of fuel wood in Latvian energy consumption traditionally has been quite large due to its availability. From energy resources produced in Latvia, fuel wood takes up 75% - 80% (Renewable energy in Latvia, 2008). The fire wood market is superseded by companies, which use wood in electricity and heat production, as well as export produced bio fuel.

Latvia has great opportunities to improve its energy supply system by use of bio-fuel products and learning from the experience of Sweden and Finland, thus increasing its energy independence from gas and fossil fuel import. Latvian economy would benefit from utilization of wood products in energy production. Wood as a fuel product has successfully entered Latvian energy market and has been exported for this purpose also to European markets in form of woodchips, briquettes, pellets or simple firewood. There have been production facilities developed for such products and their capacity keeps growing. (Renewable energy in Latvia, 2008) Due to its availability, the proportion of wood in Latvian energy resource consumption traditionally has been large. For several years now wood fuel takes stable quarter (25.6% in 010, 25.4% in 2011 and 2012) of the total energy resource consumption in Latvia (Einiks, 2013).

In accordance with the European Parliament and Council directive 2009/28/EK on renewable energy resources, Latvia has resolved that the proportion of the produced renewable energy of the gross final energy consumption should be 40% by year 2020 (in 2010 32.6% were reached, while in 2011 – 33.6%)(European Parliament and Council directive, 2009). Likewise, each member state by 2020 must ensure that the proportion of the energy (bio fuel, bio gas, electricity produced and transported by use of RR) produced from RR used in the final energy consumption transport is at least 10% (in Latvia in 2009 it was 1.2%, in 2010 and 2011 – 3.3%). This resolve is an important argument for the development of wood biofuel production and utilization in Latvia and allows for even more support for RR manufacturers in the future (Einiks, 2013).

Due to the extensive support from the state by guaranteeing high and stable purchase prices for electricity produced in cogeneration plants by using RR, including wood biofuel, the demand for woodchips has grown considerably in 2012-2013. For this reason, it is important to survey the situation in the area of wood biofuel manufacturing and learn about the opportunities to provide the local market with this important local renewable resource.

The main aim of this thesis is to evaluate the development tendencies of bio-fuel production and consumption in Latvia.

The specific aims are:

1. To review theoretical literature and other information sources on wood bio-fuel production, trade and utilization in Latvia.
2. To examine wood bio-fuel manufacturers' opinion about topical issues and future perspectives in wood biofuel production and utilization.
3. To perform strength weaknesses opportunities and threats (SWOT) analysis of Latvian wood bio-fuel production and market.

2. Wood bio-fuel resources in Latvia

The concept of wood bio-fuel includes several types of wood raw materials that can be used for production of heat or electricity:

- firewood assortment: round timber assortment prepared from the parts of trunks that do not correspond to the quality requirements of other assortments
- logging residue: wood biomass that remains in the forest after logging e.g. branches, tops, rejected parts of trunks, cut offs, small round wood, needles, and leaves
- small round wood obtained in forest stand during thinning, roadside, agricultural ditch, trench and overgrowth thinning;
- timber grown in fuel wood plantations such as (osier, asp, poplar and other quick-growing tree plantations
- byproducts from wood processing e.g. bark, chips, cut offs, discarded wood, pulp and paper production waste.
- recyclable (reusable) timber (Lazdiņš, 2009).

Generally, the most popular wood bio-fuel used in Latvia and exported are firewood, woodchips, briquettes, pellets and wood shavings.

The most widespread are pellets and briquettes, which are manufactured from woodchips, as they are easier to transport and technologically suited for heat production (Lazdiņš, 2009). Different kind of wood fuel is usable but there is a need for Significant incentives to develop and to encourage more efficient wood-burning stoves and boilers. (Commission Report, 2004) Heating is the largest single user of final energy, accounting for about one third of total consumption. The market ranges from household heating (including hot water) to steam production for industrial uses. (Towards a European, 2000)

Wood is also used for the production of charcoal and biogas – these types of bio-fuel are products of thermal treatment of wood and therefore are considerably more expensive and are used for electricity production only in specific situations. Charcoal is a micro-porous product with a high level of carbon obtained in the process of pyrolysis when the wood burns with no oxygen supply.

Heating or fuel pellets are pressed cylinders with the diameter of 4-10mm and length of 2-5cm that are manufactured from dried wood processing waste products and cutoffs: sawdust, shavings, bark, branches, sprigs etc. One kilogram of wood pellets contains the same amount of energy as 0,5l of liquid fuel. Another benefit of fuel pellets is the considerably reduced amount of harmful emissions.

Wood pellets is an environmentally friendly bio-fuel due it low levels of sulfur and nitrogen. These levels are so low that at correct combustion the amounts of nitric oxide and sulfur dioxide are practically untraceable. However, fossil fuels such as oil products and gas release considerable amounts of these byproducts upon combustion. Table 1 shows the calorific values of wood products in Latvia.

Table 1. Mean net calorific values for various wood products

Product	Unit	GJ	MWh	Toe
Wood pellets	T	17.3	4.8	0.472
Shavings (50%)	m^3	2.16	0.6	0.053
Chips (50%)	m^3	2.88	0.8	0.071
Freshly cut timber (50%)	T	8.5	2.36	0.203
Dry timber	T	19-20,5	5,3-5,7	0,45-0,49
Sawdust	T	9.0-11.0	2.5-3.0	-
Pellets/briquettes	T	16.0-18.0	4.5-5.0	-

(Monitoring of the use of wood for biomass, 2012)

The mean net calorific values for various wood products shown in Table 1. are used to compare the price of different wood products per one energy intensity unit and it would be possible to compare the energy price of various products and chose the most optimal variant that is suited to the combustion technology and is the cheapest of the available bio-fuel. The heat capacity of various tree species is presented in Table 2.

Table 2. Heat capacity of various types of wood

Type of wood	Heat capacity / 1kg		
	Kcal	kJ	kw/h
Spruce	3900	16250	4,5
Pine	3800	15800	4,4
Birch	3750	15500	4,3
Oak	3600	15100	4,2
Beech	3450	14400	4,0

(Monitoring of the use of wood for biomass use, 2012)

As shown in the Table 2, the highest heat capacity is associated with coniferous trees (e.g. Norway spruce and Scots pine) due to the presence of resinous substances in their woods. However, due to the same reason such woods cause more smoke and soot upon combustion.

Briquettes are modern, economic and ecologically friendly type of fuel. Fuel briquettes are easy to use both for household and boiler plant applications. (Monitoring of the use of wood for biomass, 2012) They are used for heating furnaces and boilers intended for solid fuel combustion. Woodchip briquettes are high quality fuel material with a very high heat capacity, much higher than firewood. The energy efficiency of fire wood in regular furnaces is about 70% and about 85% in modern boiler furnaces, while the energy efficiency of woodchip briquettes is above 90% in all types of furnaces. The higher energy efficiency is obtained due to higher density and lower moisture content, i.e. 12% ±2%.

Woodchips are superior wood processing byproduct. It is produced by crushing sawn timber residue. Woodchips have many applications; they can be used for:

- high quality fuel in special boiler furnaces;
- production of chipboards;
- production of woodchip briquettes;
- in biomass energy plants;
- in agriculture, gardening etc.

The bio-fuel includes several types of wood raw materials that can be used for production of heat or electricity:

- firewood assortment (round timber assortment prepared from the parts of trunks that do not correspond to the quality requirements of other assortments);
- logging residue (wood biomass that remains in the forest after logging: branches, tops, rejected parts of trunks, cut offs, small round wood, needles, leaves etc.)
- small round wood obtained in forest stand thinning, roadside, agricultural ditch, trench and overgrowth thinning;
- timber grown in fuel wood plantations (osier, asp, poplar and other quick-growing tree plantations);
- woodworking and wood processing byproducts (bark, chips, cut offs, discarded wood, pulp and paper production waste); recyclable (reusable) timber.

Stumps as a source of bio fuel

The largest forest bio -fuel resource with comparatively low production costs, suitable for large centralized heating systems (fluidized bed boilers). It is not currently used in Latvia.

Industrial production of bio-fuel from tree stumps has been initiated in the last 2-3 years by JSC 'Latvijas valsts meži" (Latvian state forests) in the forest road construction sites. In clear felling sites the preparation of stump bio-fuel has only been carried out in experimental level.

There is only little information on stump bio-fuel production amounts in Latvia is not available.

Stump wood harvesting technology

Stumps are uprooted by excavators fitted with a special stump extraction head, stumps are then transported to an access road by forwarder tractor with a branch bucket, chipping is done in larger terminals with powerful wood chippers.

One of the most expensive stages in the preparation of stump biofuel is road transportation, as the bulk density of stumps is three times lower as that of chips.

Preparation of bio-fuel in saplings

One of the most common types of bio-fuel resources the production of which is not affected by changes in logging volumes; the produced bio-fuel is of high quality and suitable for smaller boiler houses; nevertheless, the production costs are high, therefore in Scandinavia the supply of this type of bio-fuel is mostly based on state subsidies for the increasing of the forest economic value (sapling tending), for example, Kemira program in Finland.

Industrial production of bio-fuel from small round wood in saplings is carried out only in experimental level.

Technology:

In Scandinavia, small round wood saplings are prepared mechanically by the use of various harvesters (usually older harvesters are used, that are no longer suitable for clear felling) equipped with accumulating cutting and felling heads and using packers, that allow decreasing the proportion of damage to the remaining trees.

One of the main challenges for introduction of this technology in Latvia is the insufficient level of education of logging machinery operators.

Small round wood in undergrowth

The most expensive type of forest bio-fuel, the preparation of which is by using the currently practiced methods will not pay off for an extended period of time; however, the fuel quality is as good as that prepared in saplings;

Industrial production of bio-fuel from small round wood in undergrowth takes place in private forest sites in small amounts, mainly in combination with logging residue collection in clear felling sites.

Technology:

Undergrowth is usually cut with hand powered tools and is handpicked at the sides of the lanes; however, in Latvia various types of felling heads attached to agricultural tractors and old harvesters are used;

The effectiveness of this technology is limited by the small dimensions of undergrowth trees, thus, a significant increase in productivity may only be obtained by introducing new technologies. For example, use of sawing and wood accumulation equipment that can be attached to tractor frame.

Characterization of forest infrastructure and growth

Potentially important type of resources, which may provide supply of high quality bio-fuel, while the production organization is largely dependent on road construction and logging operations; therefore, this type of resources is not used efficiently enough;

Industrial production of bio-fuel from drainage ditch and forest road growth is carried out both in state and private forest sites, however the actual amount of bio-fuel produced has not been estimated.

Technology:

Logging is done with manual power tools or mechanically with harvesters; firewood assortment is usually prepared manually.

The effectiveness of this technology is limited by the small dimensions of undergrowth trees, thus, a significant increase in productivity may only be obtained by introducing new technologies. For example, use of sawing and wood accumulation equipment that can be attached on the tractor frame.

Characterization of solid bio-fuels from agricultural land

In the long term, potentially important type of resources, as the area of reforested agricultural land according to various calculations is from 150 to 350 thousand ha, while the actual biomass yield does not exceed 5.3 mil. m^3, therefore this cannot be considered a significant resource yet (Palejs, 2008).

Industrial production of bio-fuel is carried out on private sites, according to expert opinion (Palejs, 2008) in 2007 - 97 thousand m^3 (49 thousand t dry substance) of bio-fuel was prepared on agricultural lands.

Technology:

Logging is done with manual power tools or mechanically with harvesters, forwarder tractors or agricultural tractors.

The effectiveness of this technology is limited by the small dimensions of undergrowth trees and the uneven growth (the aim of the logging usually is growth removal, therefore the shrubbery must be removed), an increase in productivity may be obtained by using combined sawing and chipping or packing equipment that can be attached on the tractor frame. (Lazdiņš, 2009).

2.1 Bio-fuel sector in Latvia

In Latvia, forests take up about 50% of the state territory and the fuelwood harvesting potential is 2 480378 tons of dry matter per year of the 13146 GWh in year. The weighted average of dry matter harvest is 18.1 t/ha. The combustion energy is 19.08 GJ/t of dry matter. The weighted average potential energy of fuelwood to the area of the logging and forest development area is 344.6 GJ/ha (Lazdiņš, 2009b). The wood bio-fuel resources are evaluated based on their accessibility, as it directly influences the possibilities and costs of wood bio-fuel production. The importance of timely and reliable information for strengthening sustainable forest management and forestry sector planning and policy formulation is well recognized and used in wood biofuel sector. (Joint Forest Sector, 2001) Climate change is caused by greenhouse gas emissions stemming largely from the energy system (from combustion of fossil fuels, such as coal, lignite, oil and gas). CO2 emissions from fossil fuel combustion represent between 70

and 80% emissions in the developed countries. (Capros, P. et al, 2008) We are able to decrease the use of fossil fuels in Latvia, by using more of different kind wood biofuels.

The classification of wood bio-fuel based on their accessibility is as follows:

Potential resources: The is the total amount of bio-fuel, disregarding the technical, economical and other obstacles for the preparation of the bio-fuel and assuming that the economic activity in the forest (e.g. tending of young stands) is subordinate to the fuel sourcing.

Technically available resources: The amount of bio-fuel that can be obtained with the currently available technologies without causing damage to the economic value of the forest. Technically available resources do not include technological losses in the production process.

Economically available resources: Bio-fuel production of which is economically advantageous (the product cost is lower than fuel cost).

Sustainability criteria (Directive 2009/28/EC of the European Parliament, 2009) – non-sustainable bio-fuel is such bio-fuel that is obtained from the forests on peat soil by transforming the forest, as well as in protected nature areas, if the bio-fuel extraction negatively affects the protected area.

Table 3. shows the timber potential in timber cube meters per year used for energy production. It revealed that approximately 50% of wood bio-fuel in Latvia is obtained from firewood, low-value round timber and logging residue. The use of these resources is dictated by economic factors that relate to the comparatively easy extraction of fuelwood products from the existing forestry processes. In the current forestry activities fuelwood is a production byproduct, which improves the economical results of the basic production (Informative report, 2013).

Wood is the most important local fuel in Latvia. The proportion of wood fuel of the primary energy resources in Latvia in 2004 was 30% of the total energy resource consumption, while in 2013 the proportion had reached already 37%. (Informative report, 2013) Wood fuel is used for centralized, local and individual heat supply. The proportion of renewable energy sources used in Latvia is presented in Figure 1.

Table 3. Wood bio-fuel potential of Latvia

Type of fuelwood	Potential, mil. m^3/year	Potential, PJ
Firewood (low-value round felling site assortment)	1,8 - 2,4	12 – 16
Logging residue (tree crown part in felling sites, young stand tending)	1,8 - 2,7	12 – 18
Undergrowth timber	0,3 - 0,75	2 – 5
Stumps	0,1 - 0,4	0,7 – 3
Annual natural withering	~ 0,3	~ 1,5
Wood processing residue	1,6 - 4,5	14 – 37
Recycled wood in landfills	~ 0,3	- 2
Total:	6,2-11,35	44,5 – 82,5

(Energy Development Guidelines 2007– 2016)

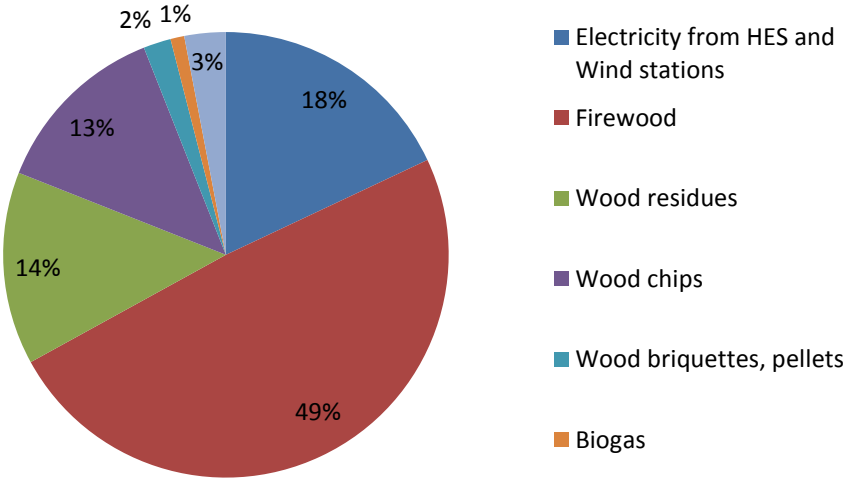

Figure 1 The proportion of renewable energy sources used in Latvia in 2011, (CSB data, 2011)

The information from the Central Statistical Bureau in Fig.1. confirms that of all renewable resources in 2011, wood makes up 75%. Central Statistical Bureau data show that of total

energy resource consumption in 2011, renewable resources (RR) have been used to produce 60GJ in 2011 (66 GJ in 2010).

In line with the European Parliament and Council directive on the promotion of the use of energy from RR, Latvia must ensure that the proportion of energy from RR from the gross final energy consumption in 2020 is 40% (in 2009 34.3% were reached, while in 2010 – 32.6%).(Directive 2009/28/EC of the European Parliament)

The main types of RR in Latvia are fuel wood and hydro-resources that made up one third of the total energy resource consumption in 2011. To a lesser degree wind energy, biogas, biofuel and other biomass was used. Solar energy is currently used only in very small amount in a form of pilot projects.

The proportion of fuelwood in the energy resources used in Latvia has traditionally been rather large due to its availability. Of the energy resources produced in Latvia, fuel wood takes up 75-80%.

2.2. The development of wood bio-fuel in Latvia

Initially, for several centuries, in Latvia wood bio-fuel was used in two ways: as firewood for heat supply and as charcoal for metal smelting, forging and glassmaking. Both charcoal and firewood were used in the production of construction materials (brick and lime making). Since the 20th century, wood bio-fuel has been used in the production of bio-gas. Wood bio-fuel has been and remains the most important bio-fuel energy resource in Latvia, based on both the amounts available and its utilization. Wood fuel takes up a stable spot in the country's energy balance. Its proportion in the heat energy production is on the rise and constantly exceeds 30% (Updating of the possibilities, 2009). In the last two decades, the number of wood bio- fuel utilization areas has been growing, as it is used as a renewable energy resource in cogeneration plants for the heat and electricity cogeneration, replacing coal, fuel oil and gas. Biomass could be used to supply heat to the DHN as alternative to the CHP plants. (Pöyry .,2009)

The energy production from forest products has been steady, due to an increase in fossil fuel prices, as well as the normative adopted by the EU and Latvia regarding the utilization of renewable resources. As demand for renewable energy is growing, bioenergy from solid biomass fuels is changing from its traditional role as a locally utilized form of energy into an internationally traded energy commodity both in Latvia and EU. (Olsson, O.,2009) The energy production from biomass, including wood bio- fuel, is becoming more favorable, although wood biofuel is a logging product and wood processing residue that has been used more fully only in the last decade. Within the future rural development policy will encourage Member States and regions to give renewable energy projects a high priority within their programmes for rural areas. This trend will increase the possibilities of renewable resources. (Energy for the future, 1997)

To increase bio-energy production development, it has been set as a priority in several important international policy documents that have been adopted also by Latvia. These include:

1) White Paper of the European Committee or report COM (97) 599 "Energy for the Future: renewable energy sources"'

2) Green Paper COM (2000) 769 European strategy for the security of energy supply;

3) European Commission report COM (2004) 366 on the use of renewable resources in EU;

4) UN Convention on climate change (United nations framework, 1992) and Kyoto protocol on decrease of greenhouse gas emissions (Greenhouse gas emissions,2010);

5) The Directive 2001/77/EC of September 27, 2001 of the European Parliament and of the Council on the promotion of electrical energy from renewable sources. (Directive of European parliament, 2001)

The EU Green Paper now include a new chapter on 'Heating and Cooling', which adds heating and air conditioning to electricity and fuel production and consumption priorities. This means that the corresponding EU funds are directed towards the use of renewable resources in the heating and cooling. It is noted that, on average, 50% of the energy in the EU countries is used for heating or cooling/ conditioning (Updating of the possibilities, 2009).

In line with the UN General convention on climate change, there are growing efforts of the countries to decrease their environmental impact, as well as fuel import from politically unstable regions. (Updating of the possibilities, 2009). As a result, the bio- energy demand has grown, as well as bio-fuel production in the Baltic Sea region and in Latvia. This is due to two main reasons: first, the large volume of available resources from forest and related processing plants. Second, there are various stimulating payment systems in use to decrease the utilization of fossil fuel and other non-renewable energy resources.

The development of fuel wood consumption depends on the extent it will be possible to switch from the extensive use of fuel wood to rational and effective use of technologies. The proportion of wood in household consumption exceeds 50%, while industrial consumption (mainly, wood processing companies) is about 25% (Jaunbelzere, 2013) The fuel wood use is relatively evenly dispersed among all regions. Currently, there are 1450 boiler houses in Latvia that utilize wood in heat production by stoking wood or woodchips. Wood processing plants use processing residue (bark, shavings, chips, remnants) as energy sources. As for the household use – stove or central wood heating is still quite widespread. Gradually, the use of briquettes and pellets in the heating of individual houses is increasing. Currently overlooked are the opportunities of simultaneous heat and electricity production or cogeneration, as well as the use of logging residue.

Wood is used for centralized, local and individual heat supply. For centralized heat, supply firewood, wood cutoffs, fuel woodchips, wood briquettes and wood pellets are used, whereas

households prefer firewood, wood cutoffs, wood briquettes and pellets (Jaunbelzere, 2013) The utilization of wood in the central heating supply in Latvia currently is divided into two basic directions:

Woodchip burning mainly using effective imported technologies that are often introduced with the support of various foreign funds and state grants, often involving Latvian scientists and researchers. Large investments are attracted to the implementation of these projects. Even though the resulting heat energy price has a large proportion of capital costs, the heat supply companies are finding ways of decreasing heating prices for the end users; fire wood burning in considerably cheaper, yet less effective plants made in Latvia. The consumption of wood biomass products are presented in Table 4.

Table 4. The consumption of wood biomass products in Latvia from 2005 to 2011

	Firewood(solid)	Chips	Shavings	Pellets/ briquettes
	1000 m^3	1000 m^3		1000 t
2005	5127	1804	3142	28
2006	5113	2039	3023	26
2007	5046	2165	2616	30
2008	4880	1961	2287	30
2009	5426	2386	2868	26
2010	5073	2528	2951	53
2011	4439	2418	2988	53

(Monitoring of the use of wood for biomass, 2012)

The Table 4. shows the decrease in the fire wood consumption over the years. This may be due to the increase in use of automatic heating equipment that is powered by pellets. Nevertheless, the main reason for fire wood consumption decrease is the loss of private residents in the country area due to extinction or migration to cities or abroad. For the same reason the inland woodchip consumption has increased. It has been slowly growing, however, in the past two years (2012-2013), when large cogeneration plants started operation in Latvian cities (e.g. Kuldiga, Jelgava etc.) utilizing wood biofuel (woodchips) as electricity generated from such resources has a very high state granted purchase price, but the generated heat is distributed for the heating of these cities.

The total energy resource consumption in Latvia in 2012 was 183 PJ, which is a 0.9% decrease from the previous year. Compared to 2011, the total energy resource import has grown by 3.9%, while the export has grown by 10.9%, as the operational data of the Central Statistical bureau (CSB data, 2011) revealed.

3. Wood bio-fuel production and foreign trade

3.1 Production of wood bio-fuel in Latvia

In total, since 2005 the wood bio- fuel production volumes in Latvia have grown, but not at the same rate across all types of biofuel as shown in Table 5.

Table 5. Wood bio fuel production dynamics in Latvia (CSB data, 2011)

Type of wood bio-fuel	2005	2006	2007	2008	2009	2010	2011	2012
Fire wood, thousand solid m^3, including:	8 886	8 964	8 595	8 307	9 708	9 551	9 437	9 829
Wood cutoffs, thousand bulk m^3	3 416	3 300	2 830	2 473	3 016	2 765	3 123	3 490
Fuel woodchips, thousand bulk m^3	3 945	3 668	3 280	3 311	3 696	4 078	4 129	3 952
Wood briquettes, TMT	3 4	3 2	3 7	2 9	3 2	4 6	7 4	9 3
Wood pellets, TMT	2 87	4 15	4 61	3 78	5 26	6 16	7 22	1 048

From Table 5, it is possible to conclude that the total production volume of fuel wood has not grown considerably from 2009 to 2012.

3.2 Export of wood bio-fuel in Latvia

Since mid-90s wood fuel has been exported to various countries in Europe and the wood export has been growing. In 1994, when Latvia started to use more fuel woodchips, the price in the local market was up to 4 times higher than firewood, due to increased demand in the local and foreign market and insufficient production capacities. In the following years the woodchip price started to drop, but the firewood price increased. Lately there has been a relatively rapid increase of woodchip, pellet, briquette, firewood and wood shaving price increase (Renewable energy in Latvia, 2008).

Latvia is the largest woodchip exporter among the Baltic counties. Estonia is slightly behind in numbers, while Lithuania has the lowest results. In 2011, Latvia exported 635 000m^3 of woodchips – 10% more than in 2010, yet 25% less than in 2005. In 2011 Latvia, produced 1.65 mil.m^3 woodchips (Jaunbelzere, 2013).

The firewood export volumes are very different in Latvia, compared to Lithuania and Estonia – the volumes are much higher. In 2011, Latvia exported 722 thousand m3 of firewood (Table 6.). The export volume of wood shavings in Latvia is decreasing every year, in 2011 it was 36 thousand m3. If we look at the value regarding pellet export from 2005 to 2011, the largest export amount was reached in 2011 – 664 thousand m3. In 2011, Latvia exported 56 thousand m3 of wood briquettes.

Table 6. Wood bio-fuel export (CSB data, 2011)

Types of biofuel	2005	2006	2007	2008	2009	2010	2011	2012
Wood biofuel, thousand solid m³, including:	1782	1798	1705	1608	1949	2378	2361	2278
Firewood, exported, thousand solid m³	372	418	450	495	740	805	722	297
Wood cutoffs, thousand bulk m³	307	208	226	151	127	131	89	286
Fuel woodchips, thousand bulk m³	2112	1684	1340	1209	1111	1588	1438	1227
Wood briquettes, thousand t	25	18	15	17	24	30	56	61
Wood pellets, thousand t	285	418	425	381	476	590	664	902

Table 6. reveals a rapid increase of wood pellet export that could be explained by its high demand and high price in the international markets. The share of wood bio-fuel exported to other countries in relation to volume produced in Latvia is presented in Figure 2.

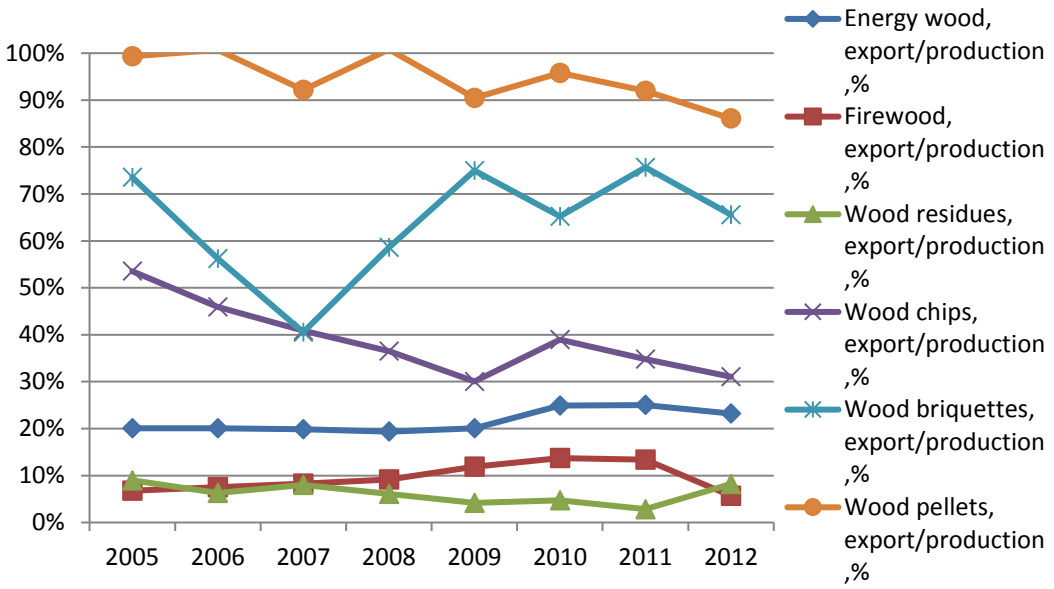

Figure 2. Share of wood bio-fuel export in % (CSB data, 2011)

Figure 2 shows that over 80% of wood pellets are exported, but, due to the introduction of automated heating boilers in Latvia, the domestic demand for pellets is growing and the export share is reduced. Also the wood briquette export numbers are quite high.

3.3 Factors affecting wood bio-fuel utilization and trade

The effect of regulatory environment on Latvia bio-fuel production

The regulatory documentation that affects wood bio-fuel production and utilization include EU regulations, national planning documents, laws and regulations of the Cabinet of Ministers. The planning documents are of state interest (NDP, LIAS [Latvian Long-term Development Strategy for 2030], state action plans) and of industry importance (Energy industry development guidelines, Renewable resource utilization guidelines, Energy strategy 2030). Several documents were developed before the economic crisis and these policies are now being amended, hindering the development of new documentation.

The state aid for fuel wood utilization in energy production is implemented by the use of mandatory procurement of cogenerated electricity and the EU co-funding for the development of cogeneration plants that use renewable resources. In considering the various ways in which to promote the development of renewable energy sources, the positive effects of competition should be taken into account. In order to make renewables more competitive, priority should be given to ways which let the market forces function to bring down the costs for producing renewable energy as rapidly. (White Paper, 1997) The support principles and mechanisms are defined by several regulations, the latest of which are:

- 10.03.2009. Cabinet Regulations No. 221. Regulations on Electricity Production and Price Determination upon production of electricity in cogeneration. (Cabinet regulations No.221, 2009)

- 16.03.2010. Cabinet Regulations No. 262. Regulations on the Production of Electricity Using Renewable Energy Resources and the Procedures for the Determination of the Price. Cabinet Regulation No. 262, 2010)

- 17.02.2009. Cabinet Regulations No. 165 Regulations on the activity 3.5.2.2: "Development of Cogeneration Power Plants using Renewable Energy Resources" to complement the operational program "infrastructure and services".(Cabinet Regulation No. 165, 2009)

The above mentioned regulatory documents have had a positive influence. However, a further increase in wood bio-mass utilization is encumbered by the existing normative base. From September 10, 2012 to January 1, 2016 businesses are not allowed to apply for the right to sell the electricity within the mandatory procurement or to receive granted payment for the electric capacity set up in the cogeneration plant. Thus, new projects till 2016 can only be based on the already granted rights (quotas) to sell electricity from renewable resources within the mandatory procurement. Also, to 2020 the maximal allowed fuel wood proportion in electricity production in Latvia is still significantly lower than that of northern European countries (Monitoring of the use of wood for biomass, 2012).

In line with the UN General convention on climate change, there are growing efforts of countries to decrease their environmental impact, as well as fuel import from politically unstable regions. As a result, the bio-energy demand has grown, as well as biofuel production in the Baltic Sea region and in Latvia. This is due to two main reasons: first, the large volume of available resources from forest and related processing plants. Second, there are various stimulating payment systems in use to decrease the utilization of fossil fuel and other non-renewable energy resources. In light of the aforementioned, to ensure efficient and sustainable harvesting and utilization of fuelwood, as well as to improve the environment protection regulations and to promote the development of the documentation governing other processes, there is a great necessity for a tight cooperation of forestry organizations and policy makers. The European Union's long-term strategy for energy supply security must be geared to ensuring, for the well-being of its citizens and the proper functioning of the economy, the uninterrupted physical availability of energy products on the market, at a price which is affordable for all consumers. (Energy security supply, 2000)

3.4 Production cost and price of bio-fuel in Latvia

As the production of biofuel is a business that cannot be directly supported by the state, for example, with state budget subsidies, the profit gained by the wood bio-fuel producer becomes very important. To make profit possible, the production costs must be lower than the sales price.

The sales price is set by the market demand, which is significantly growing every year. There are also some indirect state supports via AS Latvenergo.

The "green" energy procurement limitations in Latvia are generally related to the high costs of the produced electricity and, accordingly, the increase in tariff for the end consumer. Currently, the price of electricity from wood biomass in Latvia is calculated based on the natural gas prices (Cabinet Regulations No 262, 2010). With the increase in the natural gas prices, the consumer is forced to pay more for renewable resources as well. As a result, there is no sufficient competition between utilization of fossil and renewable energy.

The weighted average cost of wood biofuel in 2010 was 7.9 LVL or 11.24 EUR/ bulk m3 of wood biomass (Lazdiņš, 2009). Adjusted for inflation, to 2014 the cost would be 8% higher or approx. 12.14 EUR/ bulk m3. To lower the risks that are hindering the development or even decreasing the current level of development, it is important to understand factors influencing price of bio-fuel.

To a large extent, the factor affecting the wood bio-fuel prices is the regulatory environment (see previous section), as the state support for cogenerated electricity using RR has had the biggest impact on the price, especially woodchip price, due to the increased woodchip demand. The production and utilization of wood bio-fuel is affected also by the technological opportunities. In the last couple of years, improved and modern technologies have been used for bio-fuel raw material harvesting. This reduces the production costs. Bio-fuel production is also stimulated by the improvement in utilization technologies. This mainly concerns the implementation of automated heating systems and modern cogeneration plants. Automated heating systems are being used more and more widely in the EU, including in Latvia. This increases demand for pellets and increase their price, while woodchips are mainly purchased by cogeneration plants. In the last three years in Latvia three modern heating systems have been developed and are heating villages and cities utilizing woodchips, which are cheaper than pellets (considering energy value).

4. Material and methods

4.1 Identification of wood bio-fuel manufacturers in Latvia

During the preparation of the wood bio-fuel manufacturer survey, 107 companies that are working in this field were selected from a list of 500. To find such companies, the following data bases and information sources were used:

Republic of Latvia Register of Enterprises data base (RE)

LURSOFT IT, limited liability company, data base;

Central Statistical Bureau (CSB) data bases;

Publications and information on websites (reviews, advertisements etc.)

The manufactures of wood bio-fuel (firewood, wood chips, briquettes, pellets and charcoal) products were selected by the following NACE criteria in RE and LURSOFT data bases, i.e. main types of bio-fuel produced in Latvia:

16 Manufacture of wood and products of wood and cork; except furniture; manufacture of articles of straw and plaiting materials

1610 Sawmilling

1629 Manufacture of other products of wood; manufacture of articles of cork, straw and plaiting materials

32 Other manufacturing

3299 Other manufacturing

However, this classification was not sufficient to identify the companies and include them in the study sample. In addition, CSB data base was used. Information about the wood bio-fuel manufacturers are specified in CSB, as the manufacturers of fuel wood submit reports for the section “Renewable energy resource “Fuel wood””.

Nevertheless, also the information available in CSB is insufficient to select the necessary companies. The requisite additional information was obtained from publications, company catalogues, telephone books, reviews and web advertisements etc.

The identification of the companies was also cumbersome due to the fact that there is no actually working union, association or society that may provide information about the companies within the field. There have been attempts to create such unifying structural element, yet there have been no success so far.

All in all, 107 companies were selected randomly from a list of 500 companies which were reviewed and analyzed by their current company production status, representing sufficient proportion of wood bio-fuel manufacturer. Some of the 500 companies were not willing to participate in the survey, some were bankrupt, some were turned to different business sector.

4.2 Questionnaire design, administration and SWOT analysis

In order to carry out the research tasks, several complementary methods were used. The mapping of biomass producers was performed by survey principle. Also such methods as interview and observation were done.

Interviews were conducted with company managers or senior specialists. Questions that were used for the interviews include structured and unstructured questions. Twenty questions were used for the interviews, which includes closed and open ended questions.

The survey was carried out in close collaboration with the entrepreneurs. The interviewees include employees – senior specialists, and company owners. This study is based on analysis of 106 interviews and observations of the companies' work in Latvia. The research objects were subdivided into 5 groups, based on the type of the biomass company output:

Firewood manufacturers (chopped firewood) – 24 companies;

Pellet manufacturers Latvia – 18 companies;

Briquette manufacturers – 21 companies;

Woodchip manufacturers – 36 companies;

Charcoal manufacturers – 8 companies.

Both qualitative and quantitative methods were used for processing the data. The data were processed using Microsoft Excel.

SWOT analysis aims to identify the key internal and external factors seen as important to achieving an objective. SWOT analysis groups key pieces of information into two main categories:

Internal factors – the strengths and weaknesses internal to the organization

External factors: These are the opportunities and threats presented by the environment external to the organization.

5. Results and discussion

5.1 Wood bio-fuel production companies, characterization

The surveyed companies sell some of their products in the domestic markets, but most of the products are exported. Analyzing the proportion of products that are traded on the domestic and international market, the companies were divided into three groups based on production capacity (small, medium and large companies). The total number of people that were employed by the surveyed companies was 3218. Of all the companies 47% employed at least 10 people, 27% employed more than 20 people and 8% employed more than 50.

Woodchip companies generally employed up to 50 employees, 17 companies have up to 10 employees, two of the survey woodchip companies chose not to give this information. Briquette companies could be subdivided into two groups: companies with up to 20 employees (8 companies) and companies with 50-100 employees (also 8 companies). The surveyed chopped firewood companies do not employ more than 100 people. Most of the companies employ up to 10 people. One company chose not to disclose such information. The number of employees in pellet companies is very different, starting from the lowest number of people (up to 10) in 6 companies, and one company with over 200 employees. Two pellet companies chose not to disclose such information. The number of employees in charcoal companies does not exceed 50. One company chose not to disclose such information. The number and proportion of the number of employees in five types of biomass production companies is shown in Figure 3.

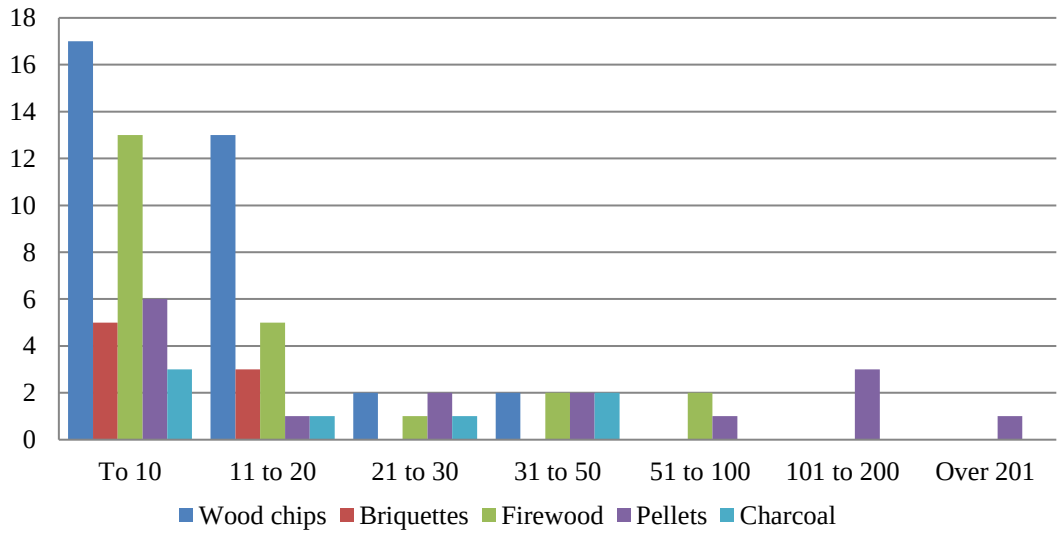

Figure 3. People employed in wood bio-fuel companies

Regarding sales of wood pellets on markets, 53% of the companies sell their products in both domestic and international market. Approximately 26% export all their products to other countries and 21% sell all their products in domestic market. The bio-fuel products are mainly exported to Norway and EU countries. In regards to scale of production in relation to market, greater percentage of large scale companies export their products to other countries (Figure 3). More small scale companies sell their products in the domestic market compared to medium and large scale companies

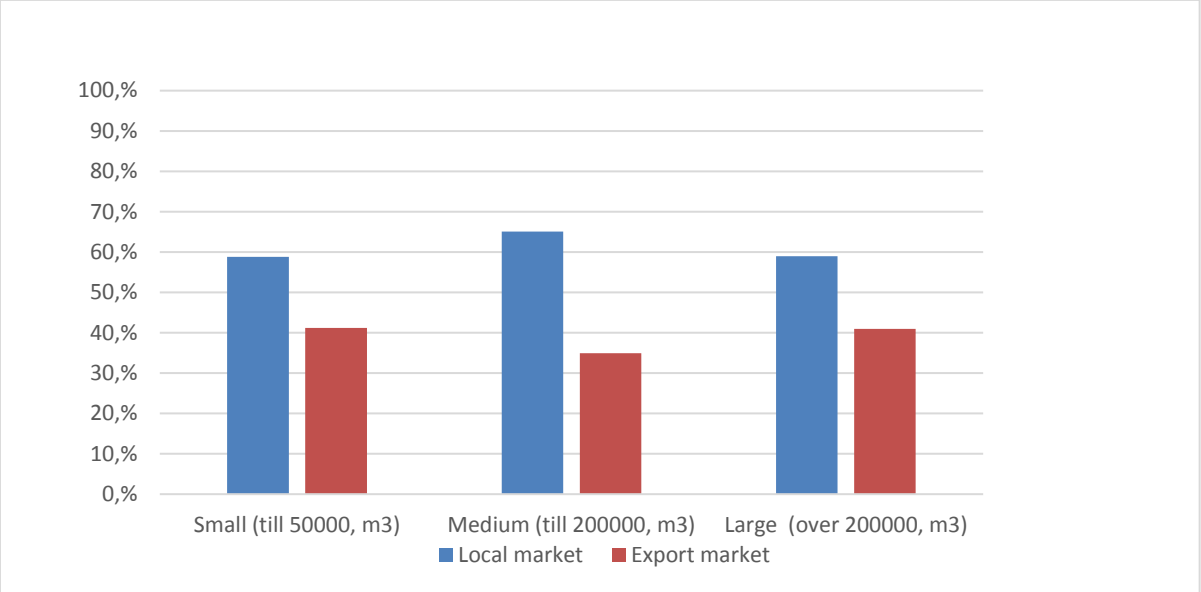

Figure 4. Woodchip sales in domestic and international market in relation to company

The results from this study showed that woodchips produced by companies in Latvia are used locally in heating and cogeneration plants, Medium scale companies had the greatest exports and the least quantity of woodchips traded on domestic market. The share of woodchips exported by both large and small scale companies is similar (Figure 4). Compared to wood pellets woodchip utilization has a greater potential in the Latvian market.

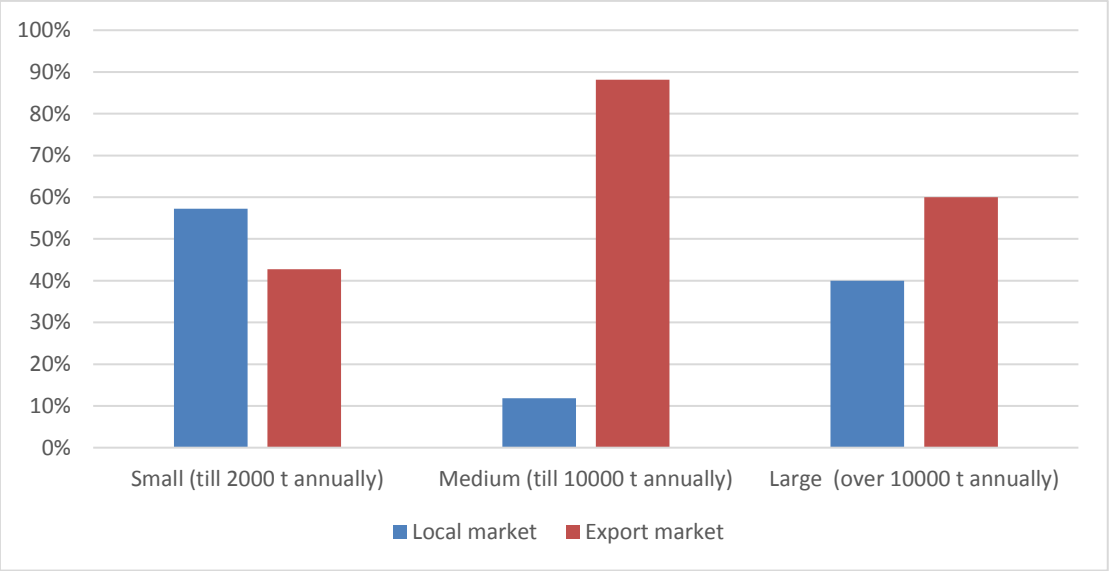

Figure 5. Briquette traded on domestic and international in relation to company capacity

The results showed that greater percentages of briquette produced by medium scale companies in Latvia are exported to other countries. Greater percentages of briquette produced by small scale companies are traded on domestic market (Figure 5). Sawdust is the primary material used for the production of briquette production therefore it availability must be accounted for.

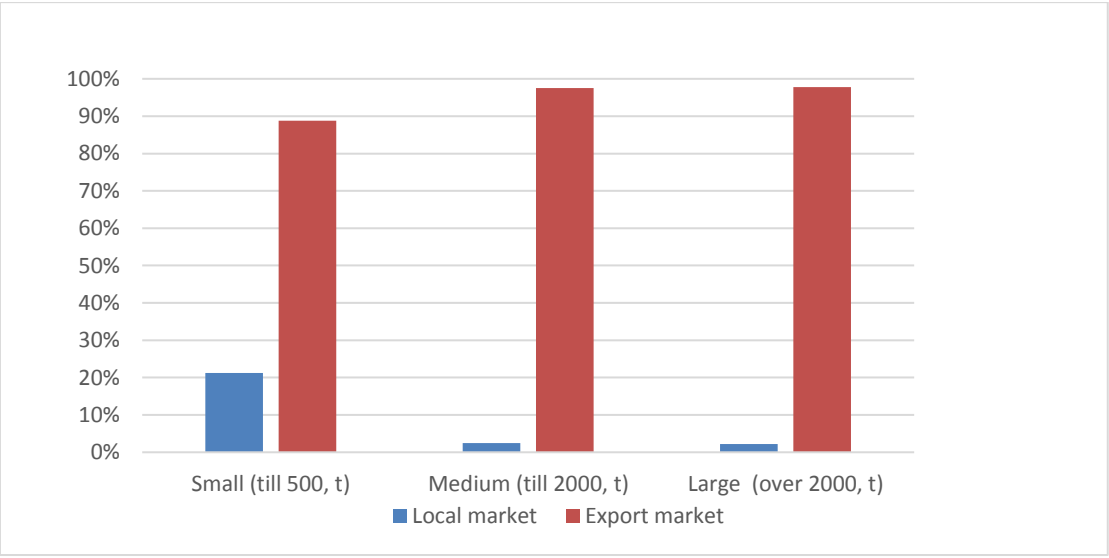

Figure 6. Charcoal traded on domestic and international market in relation to company production capacity.

The results revealed that nearly all the charcoal produced by the companies that were explored are exported to other countries and only little quantities are sold in Latvia (Figure 6)

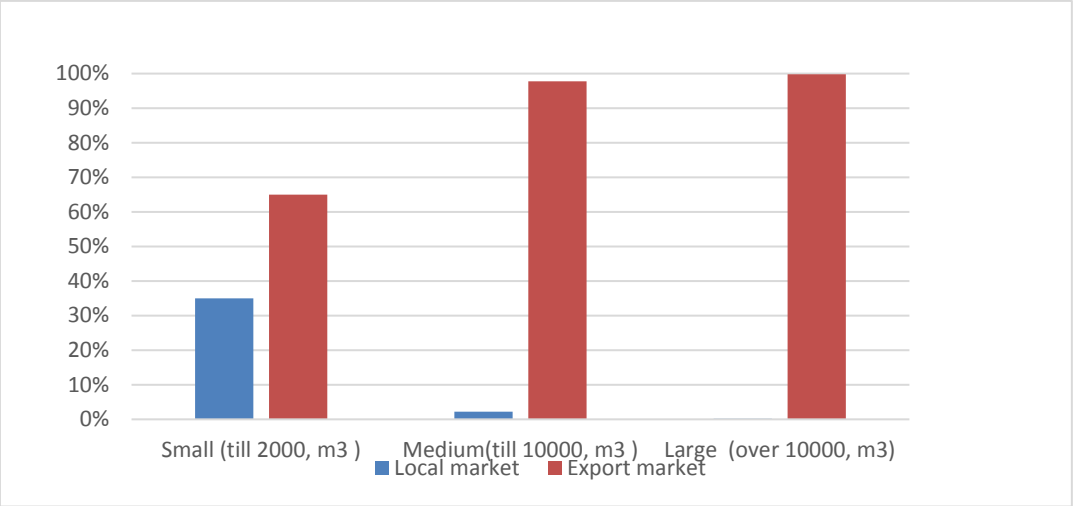

Figure 7. Firewood traded on domestic and international market in relation to company production capacity

The results showed that medium and large scale companies export almost all firewood to other countries for sale while small scale companies sell approximately 35% of the product in the domestic market (Figure 5.5)

5.2. Categories of tree species used in wood bio-mass production

Hardwood is mainly used in wood fuel production, except for the pellet manufacturing, where softwood is more widely used. The results showed that broadleaved tree species are mostly used in the production of firewood, wood chips and charcoal while conifers are mainly used for pellets (Figure 8).

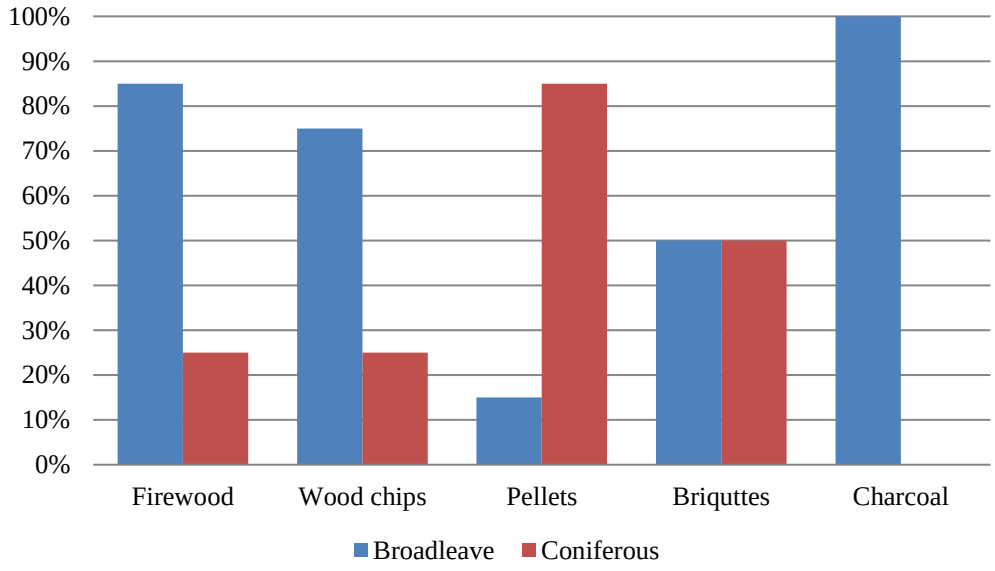

Figure 8. Categories of tree species used in production of bio-fuel

The firewood production is dominated by hardwood, 85%, solid hardwood, 10% and softwood, 5%. Mixed firewood is in high demand for export, mainly mixed birch and alder (Figure 8). Solid hardwood (ash, oak) firewood is prepared as firewood for fireplaces, while part of softwood is used for the production of kindling (i.e. material for fire lighting).

Woodchips are produced both from firewood and from stand residue (i.e. branches), as well as bushes and wood processing plant residue. The main raw material is hardwood (75%), including large proportion of bushes (osier). Softwood is used for the production of technical woodchips which is later used for various products. 85% of pellets are produced from hardwood material, while softwood is used for premium pellet production. In briquette production hardwood and softwood is used in equal amounts. Charcoal is produced from 100% hardwood material. Wood fuel is mainly produced from hardwood.

5.3 Sources of wood for bio-fuel production in Latvia

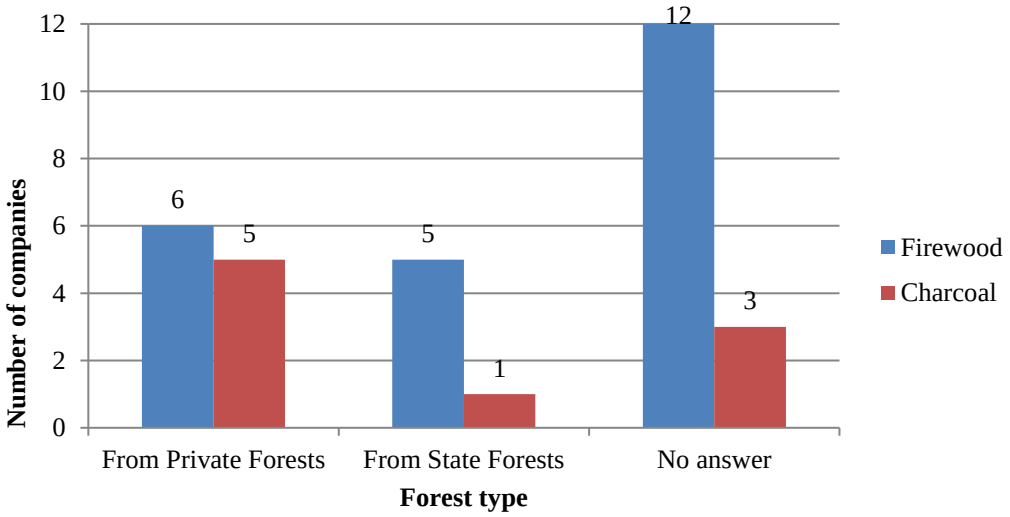

Figure 9. Sources of wood for charcoal and firewood production

Charcoal and firewood producers mainly use raw material from private forest owners. Nevertheless, the companies are not keen to disclose the sources of their raw materials (Figure 9). Woodchip producers use various sources of raw material. Most companies produce woodchip from logging residue – branches and wood processing by-products. Seven woodchip producers chose not to indicate the source of their raw material, see Table 3.

Table 7. Sources of raw material for woodchip production

Type of raw material	No. of companies
Private forests	4
Latvian State Forests	3
Various	1
Agricultural land forestation	9
Branches from logging	11
Wood processing residue (cutoffs)	13
Round timber firewood	9
No answer	7

Briquette and pellet production companies use raw material from Latvian sawmills. Two briquette producers and five pellet producers did not disclose the source of their raw materials. Four pellet producers import their material (see Table 7.)

Table 8. Sources of raw material for briquette and pellet production

Sources	Briquette producers	Pellet producers
Private sawmills	18	7
Latvian State Forests	3	1
Various/ Import	2	4
No answer	2	5

5.4 Production capacity of bio-fuel companies in relation to products

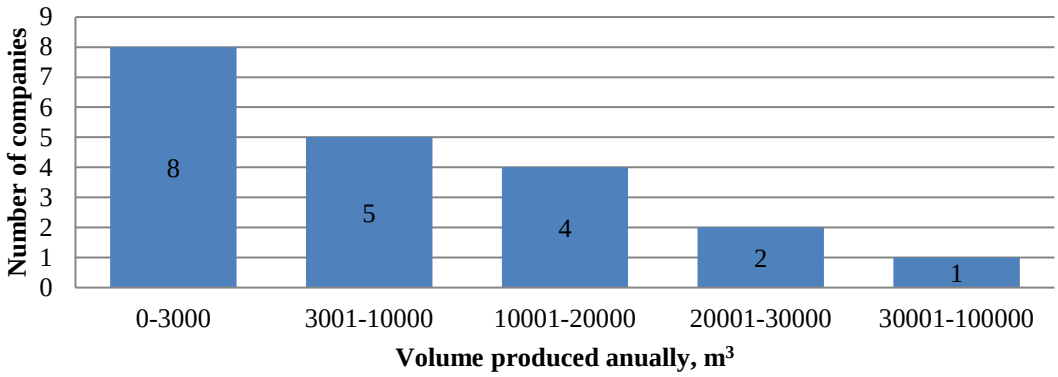

Figure 10. Firewood companies in relation to volume produced annually

Of the 20 companies producing firewood most of them had production capacity of 1 to 3000 m3, followed by 3001 to 10000, and only one company had capacity of more than 30,000m^3(Figure 10).

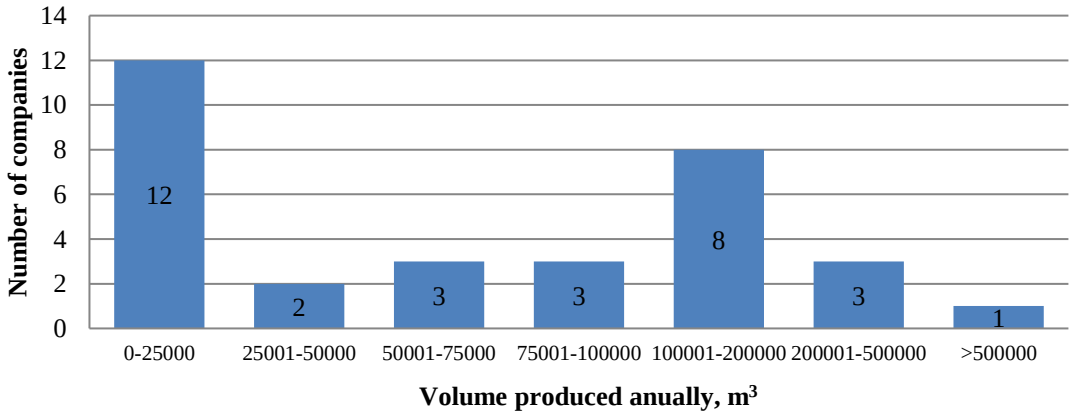

Figure 11. Production capacities of woodchip companies

Most of the companies producing woodchips had the capacity of 1 to 25,000 m^3 annually, followed by 100,001 to 200,000 m^3 and only one company had the capacity of more than 500,000 m^3 (Figure 11).

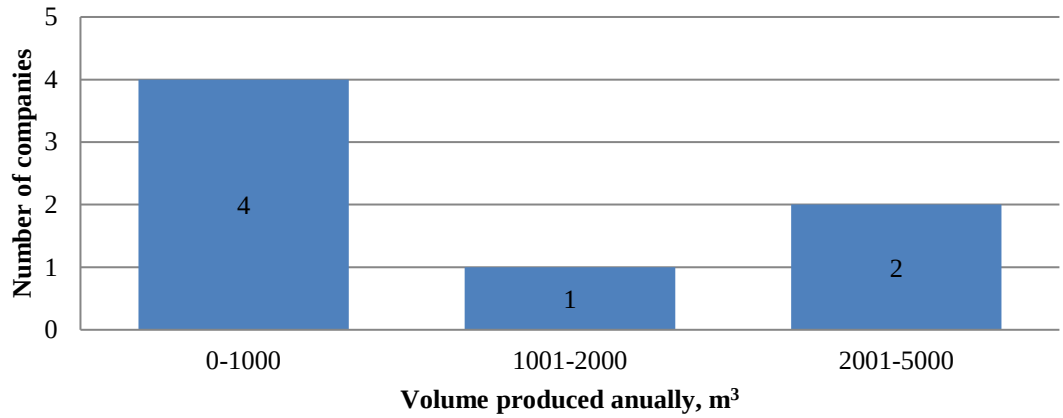

Figure 12. Production capacities of charcoal companies

Of the companies producing charcoal most of them had the capacity of 1 to 1000m^3, annually, followed by 2001 to 5000 (Figure 12).

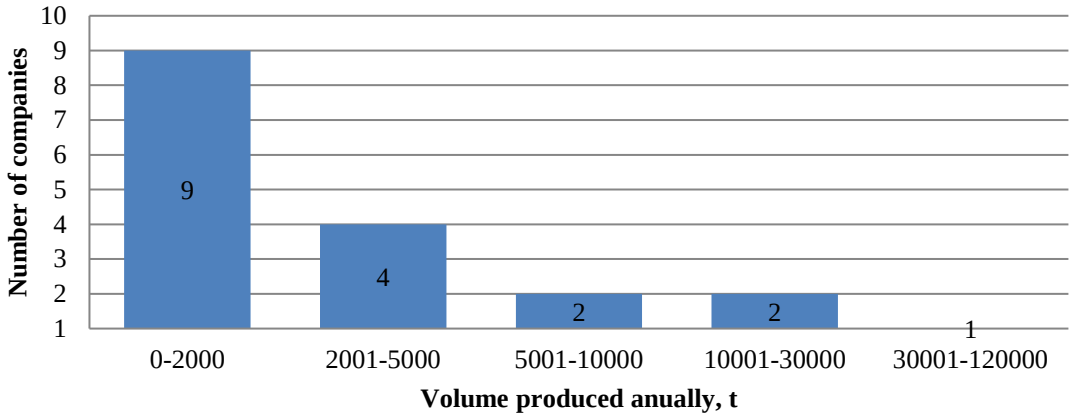

Figure 13. Volume of briquette produced annually

Of the 21 briquette producing companies studied most of them produce 1t to 2000 t annually, followed by 2001 t to 5000 t , and only one company produce more than 3000 t (Figure 13).

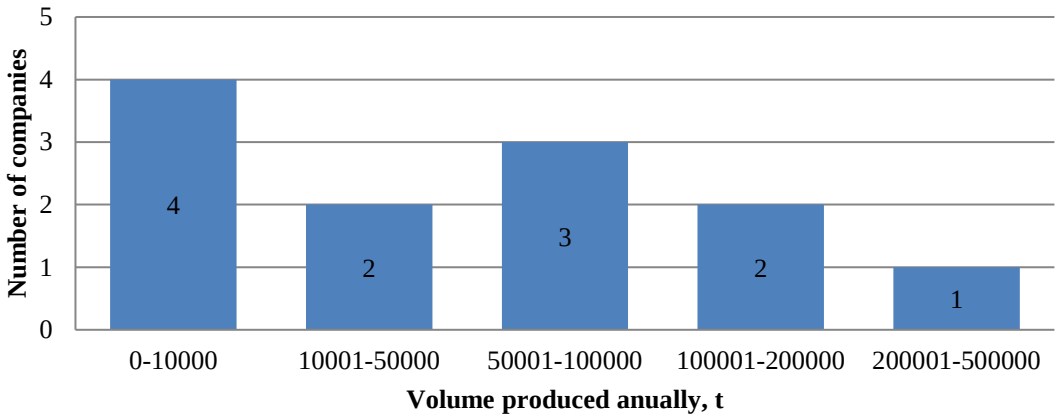

Figure 14. Volume of pellet produced by companies annually

Of the companies producing wood pellets four produce between one and 10,000m^3 annually, followed by 50001 to 100,000 (Figure 14).

5.4. Latvian wood bio-fuel product export countries

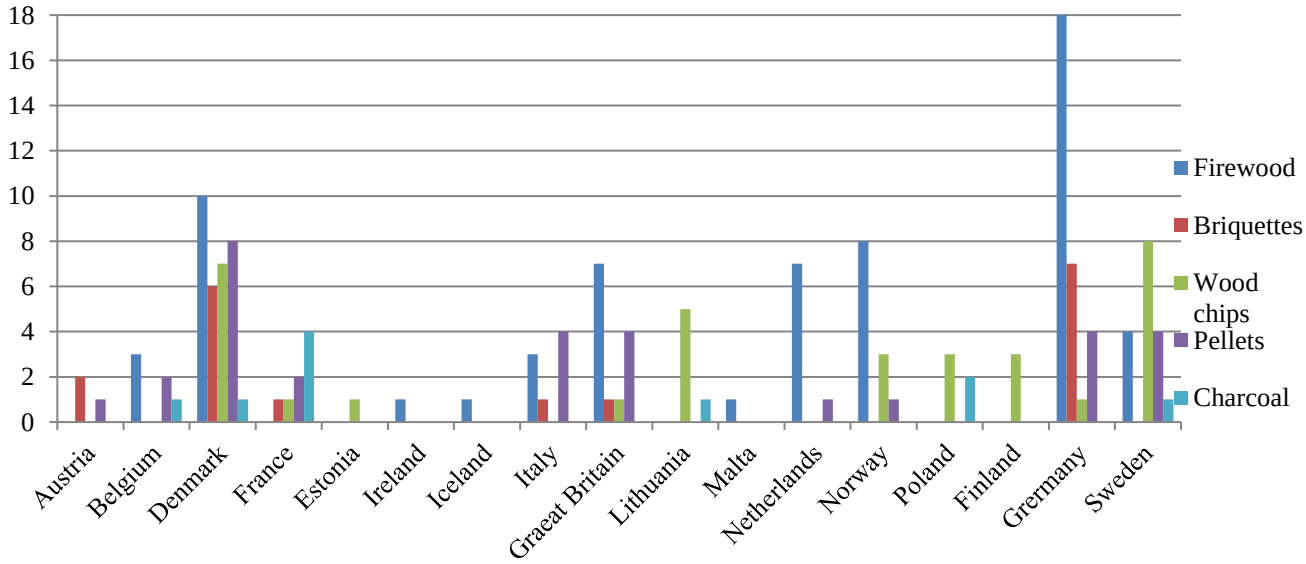

Figure 15. Wood bio-fuel exported by Latvian companies in relation to countries

The results showed that most of the Latvian companies producing firewood and briquettes export their products to Germany, followed by Denmark (Figure 15). For the case of woodchips, most of the companies export their products to Sweden, followed by Denmark. Most of the companies producing wood pellets export their products to Denmark, followed by Italy, Great Britain, Germany and Sweden. For the case of charcoal most companies export their products to France, followed by Poland. The results revealed that the most important markets for Latvian bio-fuel products in Europe are Demark, Germany, Sweden, Great Britain and France.

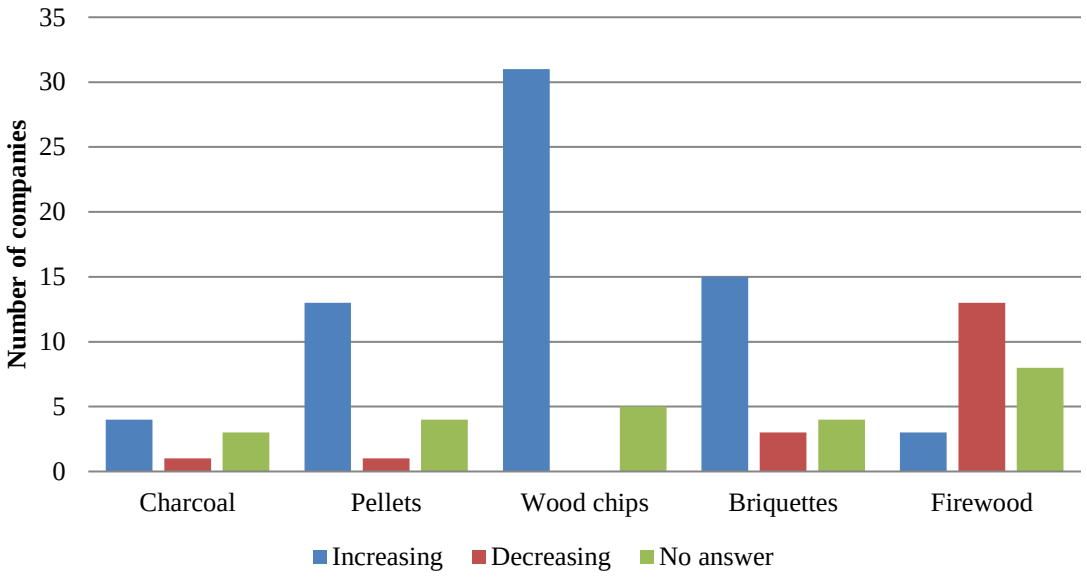

Figure 16. Perceptions of Latvian bio-fuel producers on domestic demand for their products in the next 5 years

The results showed that most of the Latvian bio-fuel producers were of the opinion that the demand for woodchips in the domestic market (i.e. within Latvia) will increase, followed by briquettes, wood pellets and firewood would be the least (Figure 16). Firewood would have the highest decrease in demand, followed by briquettes and charcoal and wood pellets the least. The results suggest that the companies are not sure about the future development in the firewood industry.

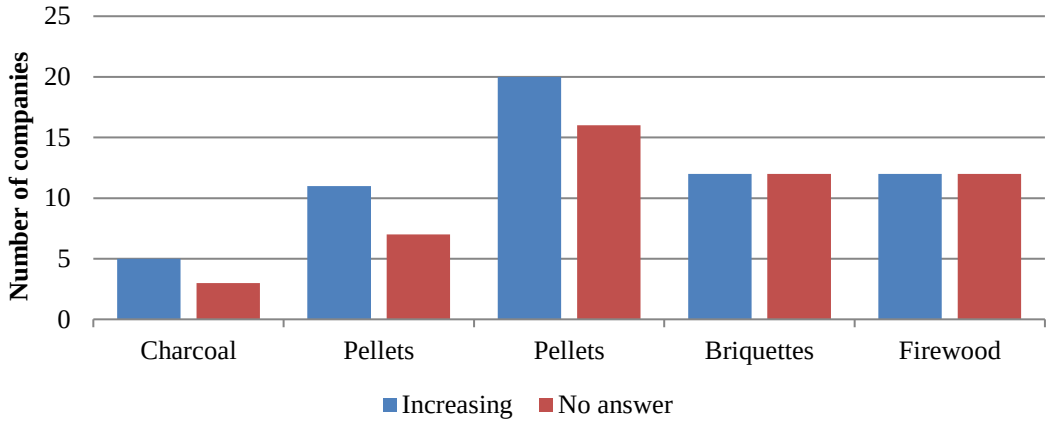

Figure 17. Perceptions of Latvian bio-fuel producers on demand for their products by European countries in the next 5 years

As can be seen in Figure 17, the results showed that Latvian bio-fuel producers have inconclusive opinion about bio-fuel demand in Europe. They either believe that there will be high demand or avoid the question about the future perspectives. Stable product sales in European market are expected by charcoal, pellet and woodchip producers. Briquette and firewood producers are not very sure about the prospective sales of their production in Europe.

5.5. Factors influencing production of bio-fuel in Latvia

According to briquette producers, the most important factors affecting briquette production are the seasonality of products and inadequate raw materials (Table 5.3)

Table 9. Factors affecting briquette production in Latvia

No	Opinion	No. of respondents
1	Seasonality of the product realization	5
2	Competition with pellet producers	1
3	Lack of raw materials, their price	5
4	Increase of electricity prices	2
5	Lack of qualified workforce	2
6	Long-term realization problems	2
7	No answer	3

The seasonal character of the product realization as a factor affecting the production is mentioned by those companies which have a current asset (CA) deficit or they lack CA and, therefore, the finished products in stock are a problem. As a result, the companies have limited resources for the supply of raw materials and the production must be limited or stopped altogether. The second most common factor affecting the production was "lack or raw materials and their price" and it was mainly mentioned by the companies also affected by the seasonal product realization. This second factor is, in fact, related to the lack of CA resulting from the seasonal product realization, even though it could be due to inability to enter into long-term material supply contracts.

Table 10. Factors affecting wood pellet production in Latvia

No	Opinion	No. of respondents
1	Lack of raw material	7
2	Intense competition, unstable market	2
3	It is easier to export rather than sell locally	1
4	Pressure from controlling institutions (FVS,SRS, LI)*	1
5	Storage deficit	1
6	No answer	6

* Food and Veterinary service, State Revenue Service, Labor Inspectorate

The most important factor affecting wood pellet production is inadequate raw material, followed by competition for resources with other bio-fuel products (Table 10). The lack of raw material is related to the limited CA, which prevents purchasing sufficient amounts of raw material – for the production volumes of one month. For three companies the lack of resources is not due to limited CA, but rather the inability to find long-term supplier, as the suppliers are not interested in contracts with a single purchaser, instead they are looking for the highest-paying customer.

The survey of 36 woodchip producers revealed that the most important factor affecting the production (mentioned by 10 respondents) is the seasonality and the low price of woodchips. One of the respondent also mentioned lack of sales market. Some of the respondents considered procurements and intense competition to be important factors (Table 11). Here, again, the

seasonality as a factor is related to insufficient CA, thus, the company has no liability reserves, as most capital shares are receivables, because most of the clients are large heating companies – also affected by seasonality and making their payments seasonally or at least "partially seasonally".

Table 11. Factors affecting woodchips production in Latvia

No	Opinion	No. of respondents
1	Transfer to the local market	2
2	Low qualification of the workforce, lack of workforce	3
3	Seasonality, low prices, high taxes	10
4	Procurements, competition	6
5	Quality requirements, low-quality raw material	2
6	Transportation and logistics companies' problems	1
7	Lack of sales market	1
8	Lack of current assets	2
9	No long-term agreements	1
10	No answer	8

According to the results presented in Table 12 the main factor affecting firewood production is the seasonality of demand the warm Latvian winters in the past few years. These factors were emphasized by 7 out of 24 firewood producers. Another topical factor is the intense competition, as well as the constantly increasing quality requirements from the consumers, while the demand remains unpredictable.

Table 12. Factors affecting firewood production in Latvia

No	Opinion	No. of respondents
1	Seasonality, weather conditions	7
2	Lack of workforce	4
3	Competition among producers	3
4	Increasing quality requirements	1
5	Unpredictable demand	1

Table 13. Factors affecting charcoal production in Latvia

No	Opinion	No. of respondents
1	National taxation policy	1
2	Rapid market changes, unpredictability	1
3	Competition with other EU countries	1
4	Lack of workforce	1
5	Loan inaccessibility, necessity to change the banking policy	3
6	Low production prices	1

Table 13 shows the opinions of 8 companies concerning the factors affecting the charcoal production. One of the main influences is the import of low-quality and cheap products in the Latvian market. The local producers are unable to compete with the cheap products.

6. Latvian wood bio-fuel production and sales SWOT analysis

The purpose of the SWOT analysis is to provide a summarized evaluation of Latvian wood biofuel production market, revealing its strengths and weaknesses, as well as assessing the potential development opportunities and threats from external factors.

The SWOT analysis has been carried out taking into consideration the data obtained in surveys and interviews which are part of this research, as well as expert opinion and the information available from the literature and the analysis of the regulatory environment.

The assessment of the internal factors of the bio-fuel market – strengths, weaknesses, as well as opportunities and threats are presented on Table 14.

Table 14. SWOT analysis – assessment of internal and external factors

Strengths	Weaknesses
1. Most of the energy resources produced in Latvia (≈ 99%) is renewable energy – wood fuel (82.3%), hydro energy and wind power (14.4%), biogas, straw, biodiesel and bioethanol. 2. Experience and professionalism of wood biofuel producers. 3. High quality products. 4. Relatively high level of the technological development of the production processes 5. Trained specialists for the needs of bio fuel producers 6. Well-grounded and duly implemented process of biofuel production policy planning and implementation. 7. Stabilizing role of AS, Latvijas valsts meži" (Latvian State Forests).	1. Large part of the energy produced from wood biofuel (28-30%) is exported, even though it could be used locally to replace fossil fuels. 2. The current state aid policy is not efficient enough, as the aid is granted indirectly – only cogeneration from RR receives support. 3. Lack of qualified workforce. 4. Low business profitability and insufficient financial resources. 5. Inability to realize the production at the price desired by the business.

8. State aid for the utilization of renewable resources, especially in cogeneration 9. High export market capacity	
Opportunities	Threats
1. To increase wood biofuel export volume, as the domestic demand grow below production volume growth. 2. Increase the production diversity of biofuel types. 3. Biofuel production development. 4. Increasing the quality of the professional training of wood processing specialists in the forestry industry. 5. Introduction of new technologies and innovation into the biofuel production processes. 6. State and the EU support for the improvement of the competiveness in the industry in general.	1. Force Majeure – natural disasters, fires. 2. Legislation changes – new unfavorable taxes or significant tax increase. 3. Changes in biofuel demand in the international markets. 4. Nonconformity of biofuel production technology to the production requirements. 5. Significant lack of qualified workforce, emigration. 6. Rapid decrease of fossil fuel, especially, natural gas prices.

6.1. Strengths

Most of the energy resources produced in Latvia (above 99%) is renewable energy – wood fuel (82.3%), hydro energy and wind power (14.4%), bio gas, straw, biodiesel and bioethanol. This means that more attention on a national level is brought to fuel wood as local source of renewable energy, which means more support from the state in terms of legislation, taxation and investments for the energy production from wood products, which, in turn, will stimulate domestic wood bio fuel demand and increase the profitability of its production. In addition, the professional experience of the biofuel producers resulting from the fact that wood biofuel has been produced in Latvia since the restoration of its national independence. This implies 23 years of continuously growing experience and adaptation to the latest technological achievements and innovation in the industry.

High quality finished products, resulting from the extensive experience and professional knowledge, implementation of modern production technology and intensive competition among the producers is another strength.

An important factor in wood biofuel production is the current level of technological development, as well as the legislative or regulatory aspects, which at national and at the EU level is dedicated to the promotion of the utilization of renewable energy resources. However, there are quite a large number of minor producers with an insufficient technological level and this assessment does not apply to them.

Training of specialists to meet the needs of biofuel producers is carried out by training wood processing professionals in several vocational institutions is a guarantee that there will be enough qualified workforce in the industry, even though their numbers are low due to emigration and other conditions (see Weaknesses and Threats).

The surveys and interviews reveal that the wood biofuel producers and industry experts highly regard professionals who have obtained higher education in relevant specialties in the Latvian University of Agriculture and Riga Technical University, as well as vocational training institutions. The experts have underlined the successful cooperation between the logging and wood processing industries, allowing for an effective access to the local wood resources for bio fuel production. Particularly important was the state aid during the crises, when the state increased logging volumes, ensuring wood for biofuel production.

Successful cooperation among the biofuel producers and with loggers to date and in future regarding common goals and common rules for reaching them is another important factor.

Even though during the crises the business financial indicators were with an downward tendency, wood biofuel producers were affected to a relatively lesser extent, which shows the extensive sales opportunities of the industry's products in Europe and the world. The professionalism, persistence, purposefulness and entrepreneurship are among the biggest strengths of this industry. This was also testified by the positive responses during the survey, when the producers were asked about the future perspectives – there were no plans for reduced production capacity.

Logging and woodworking industries have a stabilizing role in the wood processing market, they are and will remain an important factor in the supply of wood biofuel production with wood raw materials.

The state support for the utilization of RR, especially in cogeneration plants is also strength. State support for the high mandatory procurement price is so substantial that it even causes difficulties to supply cogeneration plants with enough woodchips for production. Of course, such increase in demand is one of the main strengths for bio fuel producers, as it guarantees stable realization for a sufficiently high price.

Extensive export market is another source of security: if the national government support will decrease, there is a foreign market with large market capacities for the realization of the produced bio fuel.

6.2 Weaknesses

Large part of the energy (28-30%) produced from wood biofuel is exported, even though it could be utilized locally to replace fossil fuels. This is a weakness, because in a case of economic crises the export capacities are quickly decreasing, as it happened during the previous crises, which may cause wood biofuel utilization difficulties. Long-term supply agreements with domestic clients would be a more stable option.

The state support policies to date cannot be considered to be sufficiently effective, as the support is granted indirectly – only to companies that produce energy in cogeneration plants using RR. State support should be received by all RR producers, thus, not only cogeneration plants utilizing RR, but also the RR products, e.g. wood biofuel, solar panel or wind turbine etc. products, would subject to lower VAT rates or would be completely exempt from VAT. Also, all types of direct aid would be valuable, for example, the investments from the EU funds could be partially supplemented by state co-funding.

Also the lack of qualified workforce is one of the factors accentuated by all subjects of this research. Even though the level of unemployment in Latvia is still relatively high, according to the data of National Employment Agency to March 31, 2014, the level of unemployment was 9.8%; however, a very low number of people with relevant experience and professional training are among the unemployed.

Low profitability and insufficient financial resources are always a weakness; however, the main issue associated to the low profitability there practically no finance accessibility, as the investors are not sure that the investment alone will solve the problems and wish to avoid the potential risk. Comparatively, large numbers of wood biofuel producers suffer low profitability and the following inability to attract additional financial resources and the development of these companies is hindered. However, the bio fuel producers are mainly small or medium companies operating in highly competitive market conditions, as the loggers and wood processing companies are trying to increase the wood raw material prices.

The supply of raw material to wood biofuel producers can be troublesome during fall and spring due to weather conditions and this aspect may differ from year to year. The timber removal problems are resulting from the poor condition of the forest road. Therefore, the wood processing companies are temporarily reducing production and there is less wood residue as necessary for the biofuel producers.

Inability to sell the products at desired prices threatens biofuel industry. The company, when planning its production activities, need to base its product price on the average market

price or the price stipulated in their long-term supply agreements. Inability to approximate the desired price to the average market price is evidence of the companies' difficulties to find adequate buyers or of inadequately high production costs, which can be prevented by production modernization and purchasing wood residue products at an appropriately low price.

6.3 Opportunities

In certain conditions wood biofuel export can be a weakness (see Weaknesses); nevertheless, traditionally it is considered to be an important aspect of the development of an industry or a country. Wood biofuel producers have vast opportunities in the export market, as this Latvian product has been recognized and demanded for years. Local market and export ensures stable sales, as 28-30% of the wood bio fuel, expressed in energy units (see Tab 14), is exported. The knowledge of the export markets allows increasing the wood biofuel export volumes, as the domestic consumption level is below the obtained production capacity, therefore, production is stockpiled.

By increasing the diversity of biofuel products, it is possible to improve the profitability of the companies, as well as reduce the effect of the wood suppliers' (loggers') work seasonality on the company cash flow. The increase in profitability may result in the increase of accessibility to financial resources. By reducing the company's dependence on the production and sales of one type of product, its sales market is improved, as the company can focus on those buyers and the sales of those products, which ensure the highest prices and profitability.

Wood biofuel production development is an opportunity, as the industry experts believe that market development opportunities are very promising, due to the EU policies for the promotion of the use of renewable energy resources.

Wood biofuel production, the competitiveness of its products and the further development can be promoted by the entering into the labor market of new professionals, who have obtained high quality education that is adequate to the labor market requirements, as well as the implementation of new technologies and innovation into the production processes.

The state and the EU support for the improvement of the competiveness in the industry by providing aid for the renewable energy users in production, is the most important factor for the biofuel production industry. It significantly increases the opportunities for investments and the EU funding for company modernization.

6.4 Threats

One of the main threats that are the most difficult to anticipate are various conditions affecting the wood raw material supplier (logger) and forestry industry, for example, various natural disasters. The detrimental impact of this factor is closely related to its unpredictable nature – rain and storms may disrupt the supply of harvested material. Also, forest fires, as well

as fire in the material and production storages can be a threat, which may affect one or several companies, even though the industry-wise impact is unlikely. This threat is not very probable, as, for example, massive rainstorms appear once in 10-15 years.

Well-grounded and duly carried out process of biofuel production planning and plan implementation is the bases for the reduction of such threat as unexpected legislative changes, which could increase the producers' tax burden.

Changes in demand for wood biofuel products in international markets may cause the demand to drop, as it happened during the 2009-2010 crises. This threat can be reduced by diversifying the types of production and entering into long-term supply agreements with domestic buyers and its foreign importers. The impact of this threat is limited by the stabilizing role of the state and AS Latvijas Valsts Meži (Latvian State Forests) in the planning and implementation of the general forestry policies.

Even though the current development level of the biofuel production technologies can be rated as sufficiently high, ensuring acceptable profit margin of 3-7%, the low profitability of some companies and the inability to invest into technological upgrades may reduce profitability even further, if outdated technologies are used in the production process. As a result, the company's ability to improve production efficiency, capacity and profitability is limited. This actor may be limited or prevented by using the opportunities for company modernization provided by the EU. The return of investments is significantly increased by the state support for the producers and users of renewable energy.

The companies generally believe that the wages they pay are in accordance with their employees' qualifications; however, there is a risk that the employee, upon reaching a certain level of professional qualification, can choose to leave the country and work abroad (Germany, Great Britain, Sweden, Finland etc.), where the average salary for the relevant positions is significantly higher. This threat can be prevented by ensuring competitive salaries and pleasant working conditions.

Even though the prices of fossil fuels, especially, natural gas prices, have been gradually increasing during the last 5 years, there still is a threat the natural gas price may significantly drop due to the discovery of gas fields in Canada, USA, Poland and other countries. If the gas price will return to the level of the previous decade (40-50% lower), the demand for wood biofuel, the production costs of which are relatively high, will reduce significantly. This threat may be limited by state aid programs for RR production.

6.5 Lessons that can be drawn from SWOT analysis

The lessons learnt from the SWOT analysis of the strengths of wood biofuel production and utilization are:

1. Most of the energy resources produced in Latvia (above 99%) is renewable energy – wood fuel (82.3%), hydro energy and wind power (14.4%), bio gas, straw, biodiesel and bioethanol.

2. Wood fuel at a national level is still considered to be the most important local renewable energy source, which allows hoping for increased state support in the form of legislation, taxation and investments for the energy production from wood, thus, stimulating the domestic utilization of wood bio fuel and increasing the production profitability.

3. Wood biofuel producers are experienced professionals, as the production of wood biofuel has been carried out in Latvia since the restoration of its independence. A high product quality is reached due to the utilization of modern production technologies and intensive competiveness among producers. An important aspect of wood biofuel production and market is the current level of technological development, as well as the legislative or regulatory environment, which at the EU and at the national level is devoted to the promotion of the use of renewable energy. However, there are quite a large number of minor producers with an insufficient technological level and this assessment does not apply to them.

4. Training of specialists to meet the needs of biofuel producers is carried out by training wood processing professionals in several vocational institutions is a guarantee that there will be enough qualified workforce in the industry, even though their numbers are low due to emigration and other conditions (see Weaknesses and Threats).

5. The surveys and interviews reveal that the wood biofuel producers and industry experts highly regard professionals who have obtained higher education in relevant specialties in the Latvian University of Agriculture and Riga Technical University, as well as vocational training institutions.

6. Even though during the crises the business financial indicators were with an downward tendency, wood biofuel producers were affected to a relatively lesser extent, which shows the extensive sales opportunities of the industry's products in Europe and the world.

7. Logging and woodworking industries have a stabilizing role in the wood processing market, they are and will remain an important factor in the supply of wood biofuel production with wood raw materials.

8. Wood biofuel production is stimulated by state support to the utilization of renewable energy resources, especially, in cogeneration.

9. State support for the high mandatory procurement price is so substantial that it even causes difficulties to supply cogeneration plants with enough woodchips for production.

10. Extensive export market is another source of security: if the national government support will decrease, there is a foreign market with large market capacities for the realization of the produced bio fuel.

The lessons learnt from the SWOT analysis on the weaknesses of wood biofuel production and utilization are:

1. Large part of the energy (28-30%) produced from wood biofuel is exported, even though it could be utilized locally to replace fossil fuels.

2. The state support policies to date cannot be considered to be sufficiently effective, as the support is granted indirectly – only to companies that produce energy in cogeneration plants, RR users or for the implementation of new technologies or innovations by attracting EU funding; however, there is no direct support in the form of tax reduction or subsidization.

3. The producers often encounter lack of qualified workforce resulting from the immigration of workers and the low motivation of young people to obtain vocational training.

4. Comparatively large part of wood biofuel producers suffer from low profitability and ensuing inability to attract additional financial resources, preventing company development.

5. The bio fuel producers are mainly small or medium companies operating in highly competitive market conditions, as the loggers and wood processing companies are trying to increase the wood raw material prices.

6. The supply of raw material to wood biofuel producers can be troublesome during fall and spring due to weather conditions and this aspect may differ from year to year.

7. Inability to sell the products at desired prices. Inability to approximate the desired price to the average market price is an evidence of the companies' difficulties to find adequate buyers or of inadequately high production costs, which can be prevented by production modernization and purchasing wood residue products at an appropriately low price.

Lessons learnt from the SWOT analysis of the opportunities of wood biofuel production and utilization are:

1. The domestic and international demand for wood biofuel is increasing every year.

2. Wood biofuel producers have vast opportunities in the export market, as this Latvian product has been recognized and demanded for years. Local market and export ensures stable sales, as 28-30% of the wood bio fuel, expressed in energy units, is exported.

3. The knowledge of the export markets allows increasing the wood biofuel export volumes, as the domestic consumption level is below the obtained production capacity, therefore, production is stockpiled.

4. By increasing the diversity of the produced types of bio fuel, it is possible to improve the profitability of the companies, as well as reduce the effect of the wood suppliers' (loggers') work seasonality on the company cash flow.

5. The increase of profitability may result in the increase of accessibility to financial resources. By reducing the company's dependence on the production and sales of one type of product, its sales market is improved, as the company can focus on those buyers and the sales of those products, which ensure the highest prices and profitability.

6. Wood biofuel production development is an opportunity, as the industry experts believe that market development opportunities are very promising, due to the EU policies for the promotion of the use of renewable energy resources.

7. Wood biofuel production, the competitiveness of its products and the further development can be promoted by the entering into the labor market of new professionals, who have obtained high quality education that is adequate to the labor market requirements, as well as the implementation of new technologies and innovation into the production processes.

Lessons learnt from the SWOT analysis of the threats of wood biofuel production and utilization are:

1. One of the main threats that are the most difficult to anticipate are various force majeure conditions affecting the wood raw material supplier (logger) and forestry industry, for example, various natural disasters. The detrimental impact of this factor is closely related to its unpredictable nature – rain and storms may disrupt the supply schedules of harvested material.

2. Also, forest fires, as well as fire in the material and production storages can be a threat, which may affect one or several companies, even though the industry-wise impact is unlikely. This threat is not very probable, as, for example, massive rainstorms appear once in 10-15 years. The threats may be limited by insurance.

3. Unexpected legislative changes, which could increase the producers' tax burden, are possible.

4. Changes in demand for wood biofuel products in international markets may cause the demand to drop, as it happened during the crises (2009-2010). This threat can be reduced or limited by diversifying the types of production and entering into long-term supply agreements with domestic buyers and its foreign importers.

7. Conclusions

1. The current state support policy cannot be considered sufficiently effective as the support is granted indirectly only to producers producing electricity in cogeneration plants using RR.

2. According to the Latvian State Forest Institute Silava data for 2012, the total growing stock of the Latvian forests is 633.48mil.m^3. The technically available fuel wood potential from logging, thinning, removing of forest infrastructure and agricultural land forestation is 2.5 million tons of dry matter every year. There is no precise calculation regarding how much of this volume is actually harvested every year, but based on the expert estimates (Lazdiņš. A. 2009b) it is about 60%, as stump harvesting and harvesting wood from thinned new stands currently is not economically viable.

3. Wood is the most important local energy resource in household heating in Latvia. In the last couple of years the utilization of wood biofuel in industrial companies is rapidly growing, as these companies use wood for electricity and heat production, but the produces biofuel production is exported.

4. Learning from the experience of Sweden and Finland, Latvia has great opportunities to improve its energy supply system with biofuel production products and become less dependent from gas and fossil fuel import. Promotion of the utilization of wood biofuel in energy generation in Latvia would be beneficial for the country's economy.

5. Wood biofuel producer survey indicated that the biofuel production in Latvia will increase. Of 107 companies surveyed, 60.7% of the companies intend to expand their production. This is due to increased woodchip demand for the recently developed cogeneration plants and city heating systems (in Liepāja, Kuldīga, Jelgava etc.).

6. Most of the respondents use hardwood (incl. bushes) for biofuel production – 85% for fire wood production, 75% for woodchip, 100% for charcoal, and over 50% for briquettes. Pellet production is an exception. This may be explained by the fact that softwood is mainly used for the production of chipboard and sawn timber production, while hardwood are either processed into wood biofuel (especially – alder, osier, birch, asp) or pulpwood (birch).

7. There are no stable and permanent sales opportunities in the domestic market for the biofuel producers, with the exception of woodchip companies. However, due to the rapid increase in woodchip demand, the companies may switch to woodchip production.

8. The survey results show that there are stable sales in the export markets and opportunities to increase export volumes. It would be preferable to find a sales market outside Europe. Wood biofuel producers have vast opportunities in the export market, as Latvian produce is demanded and recognized for years.

9. Domestic market and export ensure stable realization of the products, as approx. 28-30% of the wood biofuel, expressed in energy units, is exported. The knowledge of export market

allows increasing wood biofuel export volumes, if the domestic consumption is lower than the potential production capacity and the products are stockpiling.

10. Wood biofuel production development is possible, as the industry experts see market expansion opportunities due to the EU policies for the promotion of the utilization of renewable energy resources.

11. The main strength of wood biofuel production in Latvia is the technological infrastructure of fuel wood product processing ensuring products for both domestic and export markets. The main weakness is the availability and qualifications of workforce to ensure successful exploitation of the machinery and equipment. Difficult accessibility to finance resources and the tax burden prevents company development.

12. The consumption of wood biofuel products produced in Latvia can be increased both in the domestic and export market. The main threats to the industry are unpredictable tax policy in Latvia, as well as unpredictable weather conditions in Latvia, which influence both production and consumption in domestic and export markets.

8. Recommendations

1. To develop wood biofuel production in Latvia there is a need for increased direct state support in the form of tax reductions and accessibility to bank loans.

2. It is necessary to develop state aid program for the promotion of the competitiveness of wood biofuel production, the framework of which would allow company modernization, as well as support for the vocational retraining of the people employed in biofuel production and utilization industry.

3. The producers should diversify the types of wood biofuel production and enter into long-term supply agreements with local and foreign buyers to reduce the impact of the possible crises (recession) and seasonality to the production and realization.

4. Wood biofuel producers should develop industry cluster, which would actively deal with finding the most perspective export markets, informing the producers with demand trends in European and global regions, as well as the industry development (technological) opportunities and potential investors.

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