

ANALYSIS OF WOOD PELLET PRODUCTION IN LATVIA

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Abstract. The European Union has set a target of at least a 27 % share of renewable energy consumption by 2030. This objective has resulted in a surge in the production and consumption of wood pellets. The global production of pellets was approximately 31 million t in 2017, and Latvia was the third largest producer of wood pellets in Europe. Latvia shipped 90 % of its total wood pellet production abroad and consumed only about 10 % of the total in its domestic market. The research aim is to examine the production of wood pellets and identify opportunities for the expansion of wood pellet production in Latvia. The research found that in the period 2008-2017, the production of wood pellets increased four-fold in Latvia (to 1166 thou. t in 2017) and the consumption of wood pellets increased almost nine-fold (from 16 thou. t in 2008 to nearly 140 thou. t in 2017). However, the total consumption of wood pellets was low in Latvia, as there were No industrial consumers of this product. Households were the main consumers of wood pellets in the domestic market; therefore, almost the entire quantity of wood pellets was exported from Latvia to industrial consumers in Europe. Besides, wood pellets were also imported in order to be re-exported. Based on expert interviews and a SWOT analysis, the research designed the following strategies for the expansion of wood pellet production in Latvia: the expansion of torrefied wood pellet production, the promotion of wood pellet consumption by households and enterprises and the entry of new markets for the purpose of reducing the dependence of the wood pellet industry on the current export markets.

Key words: wood pellet, renewable energy.

JEL code: Q2, Q42.

Introduction

The use of wood pellets as an alternative to oil products for heating began during the energy crisis in the early 1970s. The very first wood pellet factory began operating in the USA in 1978, while in Europe this industry began developing faster in the early 1990s (Ericsson K., Nilsson L., 2004) when Sweden introduced a tax on CO₂ emissions from fossil fuels (oil products, coal and gas), which made the prices of renewable energy sources more competitive (Sun L., Niquidet K., 2017). Nevertheless, only a slight increase in the production and consumption of wood pellets was observed in the 1990s and early 2000s. The situation considerably changed when the Climate Change Act of 2008 was adopted, which stipulated that the United Kingdom would have to reduce its CO₂ emissions by at least 80 %, compared with the 1990 level, by 2050 in efforts to avoid global warming by two degrees.

A number of European Union (EU) policy documents have considerably contributed to increases in the output of wood pellets. The EU set itself the target of at least a 27 % share of renewable energy consumption by 2030 (Communication from the..., 2014). This initiative continues on the path set by the adoption of the legally binding target imposing 20 % of total energy consumption to derive from renewable energy sources by 2020 (Directive 2009/28/EC of..., 2009). Biomass, not the least woody biomass, currently accounting for around half of the total renewable energy consumption of the EU, plays an important role in attaining these targets (Jonsson R., Rinaldi F., 2017). These ambitious objectives have resulted in a surge in the consumption of wood pellets. However, many countries do not have sufficient domestic feedstock to meet renewable energy production targets and the European Commission estimates that 200-260 million m³ of wood will need to be imported in order to meet the EU target. With such large expected increase in demand, questions have arisen

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regarding the sustainability of foreign supply sources and the potential impact on pellet and other wood product prices (Johnston C. M. T., van Kooten G. C., 2016).

The global production of pellets was approximately 31 million tons in 2017. Latvia is the third largest producer of wood pellets in Europe (behind Germany and Sweden). Besides, one of the largest wood pellet factories in Europe is located in Latvia. Furthermore, Latvia is a significant European-scale wood pellet exporter, shipping 90 % of total production abroad and consuming only about 10 % in its domestic market. Domestic consumers are mostly households that use wood pellets for heating, yet there are no significant industrial consumers in the country. It could be explained by the fact that the use of wood pellets on an industrial scale is hindered by a lack of power plants running on coal, as Latvia produces most of the electricity from hydropower and natural gas, while small power plants run on woodchips or natural gas.

The research **aim** is to examine the production of wood pellets and identify opportunities for the expansion of wood pellet production in Latvia. To achieve the aim, the following specific research **tasks** were set: 1) to give insight into the production of wood pellets in Latvia; 2) to determine opportunities for the expansion of wood pellet production in Latvia.

To analyse trends in the production and consumption of wood pellets, the research employed statistical analysis methods – descriptive statistics and time series analysis. To identify challenges and opportunities for the wood pellet industry in Latvia, the research did four expert interviews with representatives of wood pellet producers (Byko-Lat Ltd and Latgran Ltd) as well as a representative of the Latvian Biomass Association and the EN plus certification system in Latvia and a representative of the Forest Department, Ministry of Agriculture. Based on the expert interviews and an analysis of documents, the research did a SWOT analysis and designed strategies for the expansion of wood pellet production in Latvia. During the research, secondary data was also gathered, for example, documents, annual reports, web-pages and so on to provide triangulation of reference materials for further analysis (Creswell J. W., 2003).

1. Characteristics of wood pellet production in Latvia

Over the last decade, the output of wood pellets significantly increased in Latvia. As the output rose, Latvia became the third largest producer in the EU behind Germany (1.9 mln. t) and Sweden (1.7 mln. t) (Global forest products..., 2016). Totally, 15 licensed enterprises having the licence to produce wood pellets, in compliance with the ISO 17225-2 quality standard, to be used for complicated heating equipment were registered in Latvia in 2018.

In the period 2008-2017, the production of wood pellets increased four-fold in Latvia. Two considerable increases in output were observed in 2009 and 2012, which could be explained by the growing demand in Western Europe. In 2016 and 2017, the output declined because of a decrease in market demand, which was due to an untypically warm winter in Europe and a sharp decrease in prices on wood pellets. Overall, the output of wood pellets grew in the analysed period of 2008-2017 (Table 1).

Table 1

**Output and consumption of and trade in wood pellets in Latvia
 in the period 2008-2017**

Indicator	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2017/ 2008, %
Output of wood pellets, thou. t	378	526	616	722	1048	1103	1381	1577	1517	1466	287.8
Imports, thou. t	2	1	7	3	34	41	88	127	171	187	9250.0
Exports, thou. t	381	476	590	664	902	1057	1290	1553	1627	1606	321.5
Total consumption, thou.t	16	13	31	33	136	96	150	150	140	138	762.5
Final consumption, thou.t	14	11	27	27	126	83	142	143	132	129	821.4
Total consumption as % of output in Latvia	4.2	2.5	5.0	4.6	13.0	8.7	10.9	9.5	9.2	9.4	123.8
Exports as % of output	100.8	90.5	95.8	91.9	86.1	95.8	93.4	98.5	107.3	109.5	8.6

Source: authors' construction based on CSB data

In Latvia, the total **consumption** of wood pellets increased almost nine-fold from 16 thou. t in 2008 to nearly 140 thou. t in 2017. The consumption increase could be explained by an increase in the number of wood pellet factories in Latvia, the popularity and availability of heating boilers running on wood pellets as well as ecological thinking. The total consumption of wood pellets rose at the highest rate in 2012 compared with 2011 – by 312.1 % or 133 thou. t. Over the next years, the total consumption of wood pellets was quite steady in Latvia – in the range from 100 to 150 thou. t a year. Nevertheless, the total consumption of wood pellets, compared with the total output of this product, has been low over the entire period of analysis (~10 % of the total output). In Latvia, households consumed wood pellets the most (up to 80 % of the total quantity). However, such a distribution of consumption was not observed for the entire analysis period. Before 2009 in Latvia, according to the CSB data, the consumption of wood pellets was considerably lower by households than by the commercial, manufacturing and construction sectors; for example, the consumption by households ranged from 14.29 % to 18.18 %, while that by the commercial, manufacturing and construction sectors accounted for about 80 % of the total. However, since 2010 a steady increase in the consumption of wood pellets by households has been observed, as heating boilers running on wood pellets became popular. This indicates a steady change in the consumer structure.

An analysis of **average prices on wood pellets for final consumers** reveals that the prices were volatile (from 121.00 EUR/t in 2010 to 151.00 EUR/t in 2015). The largest annual increase in price was reported in 2011 when the final price rose by 17 %. The price volatility was determined by changes in market demand, which was considerably affected by weather conditions. If a winter is cold, the demand for wood pellets is high, and the price increases significantly. Since the consumption of wood pellets by households comprises most of the total domestic consumption of this product in Latvia, the average price for final consumers is mainly affected by the sales price set for the households. For this reason, the average price for final consumers is related to the price set for households. The prices of wood pellets set for the commercial, manufacturing and construction sectors were lower than those for households almost in the entire period of analysis, which could be explained by price discounts set for businesses purchasing large quantities of this product (Table 2).

Table 2

Average prices of wood pellets for final consumers (VAT excluded) in Latvia in the period 2008–2017, EUR/t

Indicator	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2017/ 2008, %
Average prices for final consumers	134	137	121	142	134	124	134	151	116	123	-8.2
Manufacturing	122	139	134	137	125	114	124	139	112	113	-7.3
Construction	144	137	138	124	130	148	141	135	138	137	-4.9
Commercial and public sectors	128	114	115	134	141	148	165	151	127	130	1.6
Annual change in average prices for final consumers	-	2.2	-11.7	17.4	-5.6	-7.5	8.1	12.7	-23.2	6.0	-

Source: authors' construction based on CSB data

An analysis of the ratios of **exports** to quantities produced and consumed for wood pellets (Table 1) for Latvia allows concluding that the total domestic consumption was low because there were No industrial-scale wood pellet consumers. Households were the main consumers of wood pellets in the domestic market; therefore, almost the entire quantity of wood pellets were exported from Latvia to industrial consumers in Europe. Besides, wood pellets were also imported in order to be re-exported.

In 2017, 1466 thou. t of wood pellets were produced in Latvia, while the exports of wood pellets comprised 1606 thou. t. The domestic consumption of wood pellets amounted to only 138 thou. t or 9.4 % of the total output, which was a very low rate. The exports exceeded the output because wood pellets were also imported to be resold in foreign markets. Overall, the imports of wood pellets tended to increase in Latvia (Table 1). Over the entire analysis period, Belarus and Russia were among the main exporters of wood pellets to Latvia. In 2017, the imports of wood pellets from Belarus, Russia and Lithuania made up 90.69 % of the total quantity imported by Latvia. This allows concluding that there are import risks for Latvia, as the country depends on three large import markets. As regards the exports of wood pellets from Latvia, the main markets for the exports were Estonia, Denmark and the United Kingdom. Estonia and Denmark accounted for 80.13 % of the total exports of wood pellets in 2017.

2. Opportunities for wood pellet production in Latvia

To analyse the situation in the wood pellet industry in Latvia and identify the opportunities for the expansion of wood pellet production, the authors did a SWOT analysis and designed strategies. The SWOT analysis was based on expert opinions as well as an analysis of relevant documents and scientific literature.

Table 3

SWOT analysis with strategies for wood pellet production in Latvia

	Strengths and weaknesses	
	Strengths (S)	Weaknesses (W)
Opportunities and threats	New and environment-friendly fuel Raw material for pellet production are by-products of other industries and waste Production process is relatively simple and fast Energy density of wood pellets is high Latvia has a lot of forest resources for acquiring raw material Wood pallets are easy to transport; logistics and storage costs are low Developed logistics system Wood pallets are a fuel easy to use, even in densely populated places	Raw material production costs are high Wood pallets are a standardised product Wood pallets are a moisture non-resistant product Investments in production equipment and capacity enlargement are large Dust is produced in the manufacture, storage and logistics process Variable raw material quality High transport cost to deliver raw material
Opportunities (O)	SO strategy	WO strategy
Development of the forestry industry in Latvia Ratification of legal documents restricting emissions Non-renewable energy price hikes (excise tax) Increase in the demand for energy Increase in industrial consumption Stronger cooperation with current foreign partners and entry into new export markets Co-funding for buying woodchippers Support for production modernisation	In a short-term: To popularise the use of wood pellets by households, enterprises To increase wood pellet sales in densely populated places In a long-term: To promote the industrial consumption of wood pellets, gradually replacing fossil energy with renewable one	In a short-term: To promote the use of fibrous by-products and waste produced by local small enterprises and households as raw material To lower transport cost in total production cost, raw material should be supplied to the factory from the nearest locations In a long-term: To use the climate change instrument to modernise production, lower raw material production cost To contribute to the entry into new markets, thereby reducing dependence on the current export market To promote the production of torrefied wood pellets in Latvia
Threats (T)	ST strategy	WT strategy
Unfavourable weather conditions Growth of other industries using the same raw material Sustainable raw material available in limited quantities Variable quality and price of imported raw material (from Russia, Belarus) Overproduction Decrease in sales price Decrease in competitiveness with other energy sources Entry of new, more energy-efficient renewable fuels into the market Changes in policies on the forest industry Increase in the bureaucratic burden	In a short-term: Wood pallets (particularly torrefied ones) have a high energy density and are easy to transport; in case there is overproduction in Europe, the product could be sold in other markets In a long-term: To enhance technological and production processes, thereby making the final product more energy efficient and the production cost lower To strengthen cooperation with partners in various export markets, thereby contributing to sales stability in a long-term	In a short-term: To effectively operate in the market for standardised products, it is required to lower production cost by using the raw material available in the nearest locations in order to lower transport cost for low-energy-density raw material In a long-term: To strengthen cooperation with partners in the neighbouring countries by concluding contracts for the supply of raw material meeting the quality standards To invest more funds in research on the wood pellet industry and promotion of torrefied wood pellets

Strengths. Scientists stress the economic, social and environmental benefits of wood pellets (Vigants H., 2017). Use of wood pellets as a sustainable energy alternative is an effective instrument in the fight against climate change (Mola-Yudego B. et al., 2014; Sgarbossa A. et al., 2015). Also, it

represents a positive globalization of wealth and local employment creation (Nunes L. J. R. et al., 2016).

Even though wood pellet production requires costly equipment, the production process itself is relatively simple and fast, resulting in a high-energy-density product (10MJ/m³), which is 2.5-fold higher than that for firewood (4MJ/m³). Therefore, from the user perspective, wood pellets are a convenient fuel to be used in technologically advanced heating systems, which are autonomous and automated (Nunes L. J. R. et al., 2016). Furthermore, compared with firewood and woodchips, wood pellets require less storage space, and the transport of wood pellets is easier to do. In addition, the production of wood pellets is fostered in Latvia by the well-developed infrastructure and the favourable geographical location, which are significant factors making logistics cost lower.

Weaknesses. Even though the process of production of wood pellets is simple and fast, the production requires fibrous raw material of certain quality. The production of raw material requires time and financial resources. Besides, production equipment is technologically complicated and costly; consequently, beginning the production or increasing output capacity requires large investments. It is particularly difficult for small and medium enterprises to get funds for production modernisation.

Wood pallets are simple and convenient to store and transport, yet the pallets are not resistant to moisture. The assurance of quality of wood pallets requires regularly cleaning storage facilities and transport containers from dust. Besides, wood pallets are quite fragile – they may not be vibrated during the entire transport process. Because of vibrations, wood pellets get broken and their quality deteriorates, leading to a lower market price. Besides, an important role is played by transport cost. The longer the distance between a wood pellet factory and the site of raw material, the higher the transport cost. As pointed out by the experts, the most efficient solution is to transport raw material within a distance of 50-70 km. However, one can find that wood pellets are produced from both domestic and imported raw materials. Russia and Belarus accounted for the highest proportions of total raw material imports into Latvia, which were transported by railway because it was the cheapest mode of transport. Consequently, large quantities of wood (woodchips, pellets) were supplied, yet the quality of raw material imported from third countries was variable, and often a lot of impurities and foreign bodies were present, which did not allow manufacturing high-quality wool pellets. Consequently, raw material imports from Belarus have considerably decreased in recent years.

Opportunities. According to the State Forest Service, forests in Latvia occupy 3.38 mln. ha, the forest area comprises 52 % of the total land area. In view of the fact that in wood-processing, final products account for approximately 60 % of the total volume of logs, and 40 % are available for the production of renewable energy. Accordingly, as logging activity and the manufacture and exports of higher value-added wood products increase, the quantity of raw material available for wood pellet production increases proportionally, which can contribute to the sustainable development of the wood pallet industry in Latvia. Wood waste produced by households and small enterprises – in shrub clearings and forest management operations – could be used for wood pellet production as well.

At present, the quantity of wood pellets used for industrial purposes is very small (8 thou. t in 2017). A slightly larger quantity was consumed by the commercial and public sectors for heating purposes (27 thou. t in 2017). This means that at the national level, it is possible to increase the industrial consumption of wood pellets as well as the consumption of this product by the commercial and public sectors, as the sectors use other energy sources. The situation could be changed if making purposeful efforts. For example, financial support for enhancing or changing the heating system; in

the industrial sector, tax relief could be granted to the enterprises using a significant quantity of wood pellets for industrial purposes.

Since equipment for manufacture of wood pellets is technologically complicated and costly, a lot of funds are needed to purchase the equipment, which limits the growth of small and medium enterprises. A solution could be the efficient use of EU funding for business promotion and sustainability. At the national level, the growth of the wood pellet industry could be promoted by granting tax relief to the enterprises investing in modern technologies. To promote the availability of raw material on a national scale, the Climate Change Fund that co-funds the purchase of woodchippers by local governments and small and medium enterprises could be used, thereby increasing the availability of raw material and contributing to the sustainability of the wood pellet industry.

To contribute to the use of environment-friendly and efficient renewable energy sources by households, a zero value-added tax rate could be introduced for environment-friendly and efficient renewable energy sources at the national level, thereby motivating final consumers to choose the most energy-efficient kind of heating while also reducing environmental pollution.

Threats. In the wood pellet manufacture process, one of the most crucial factors is raw material – the availability and quality of it. To ensure the sustainability of the wood pellet industry, only by-products from other industries and waste, which are available in limited quantities in Latvia, may be used as raw material. If the wood-processing industry grows slowly in Latvia, the quantity of raw material for the production of wood pellets will be insufficient. To offset a lack of sustainable resources, the wood pellet industry will have to import the raw material from the nearest countries in order not to considerably increase transport and production costs. Nevertheless, importing raw material from the nearest neighbouring countries (Russia and Belarus) creates quality and price risks.

The wood pellet industry is considerably affected by weather conditions and the unpredictability of the weather. A long wet period makes forest paths difficult to drive for forestry machinery, which makes impossible to supply raw material neither for wood-processing nor wood pellet production. To avoid such situations, one of the solutions is to invest in the construction of raw material storage facilities, which allows supplying the raw material continuously. However, every enterprise has to individually assess the feasibility of a storage facility in a long-term in order not to incur extra costs that exceed those arising from downtime because of climatic conditions.

In view of the fact that the wood pellet industry grows in the whole world, technological advancements in the industry could result in cheaper wood pellets manufactured in other countries, allowing supplying this product at a lower price, which can increase imports of wood pellets for sales in Latvia instead of re-exports. The sales volume and final price of wood pellets could be affected by the modernisation of this industry and the consequent increase in the output of wood pellets in Europe as well as climatic conditions – warm winters –, which would lower the final price and reduce the profit margin.

Based on a SWOT analysis, the authors designed **short- and long-term strategies**. Of the strategies, three could be considered to be the most important ones. The first one involves the expansion of torrefied wood pellets in Latvia. It could be explained by the fact that the properties of torrefied wood pellets are better than those of raw biomass (higher thermal capacity, more moisture resistant), as well as CO₂ emissions and transport cost are lower (Manouchehrinejad M., 2018). However, the introduction of torrefaction technology requires large investments and, given the

favourable conditions for the production of regular wood pellets in Latvia, the interviewed experts pointed out that at present the manufacture of torrefied wood pellets was not economically feasible.

The second strategy entails promoting the use of wood pellets by households and businesses by means of support mechanisms. Since wood pellets are easy to transport, have a high energy density and produce little waste, it is possible to popularise their use in densely populated urban areas, thereby increasing the sales market for and the domestic consumption of wood pellets in Latvia. In a long-term, however, it is required to increase the domestic sales market for wood pellets by promoting the industrial uses of this product, which would considerably increase the consumption of it in Latvia. For enterprises, a new fixed investment is a serious decision, as the payback period of the investment is long. The opinion of the general public shifts towards gradual replacement of non-renewable fossil energy sources with renewable ones, thereby increasing the demand for wood pellets in the entire world. In Latvia, there are all the necessary prerequisites and preconditions for meeting the growing demand for energy – well-developed infrastructure (railway network, seaports), a relatively cheap workforce and the availability of raw material.

The third strategy focuses on the production and exports of wood pellets. To reduce the dependence of the wood pellet industry on current export markets, the producers have to enter new markets and strengthen international cooperation in a long-term. The entry into new markets reduces climatic or political risks, thereby contributing to market demand stability in a long-term.

Conclusions, proposals, recommendations

- 1) Latvia is the third largest producer of wood pellets in Europe. The production and consumption of wood pellets considerably rose in Latvia in recent years (in 2017, the production totalled 1166 thou. t, while the consumption amounted to 16 thou. t). However, the total domestic consumption was low, as there were no industrial-scale wood pellet consumers. Households were the main consumers of wood pellets in the domestic market, and almost the entire quantity of wood pellets (90 %) was exported from Latvia to industrial consumers abroad.
- 2) The increase in the production and consumption of wood pellets could be explained by the economic, social and environmental benefits of use of wood pellets. The production process of wood pellets is relatively simple and fast, resulting in high-energy-density pellets. It is a kind of fuel that is easy and relatively simple to transport. However, the production of wood pellets requires high-quality raw material that, in its turn, determines the need for appropriate storage facilities and transport. Furthermore, large initial investments have to be made to begin producing this product.
- 3) The imports of wood pellets into Latvia increased – mostly from Belarus, Russia and Lithuania (90.69 % of the total imports of wood pellets). This creates import risks for Latvia, as the country depends on three large import markets; besides, the quality of raw material imported from the third countries often does not meet the quality standards.
- 4) The research determined the following strategies for the wood pellet industry in Latvia: the expansion of torrefied wood pellet production, the promotion of wood pellet consumption by households and enterprises and the entry of new markets for the purpose of reducing the dependence of the wood pellet industry on the current export markets.

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