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COMPARISON OF THE CONSUMPTION OF WOOD PELLETS BETWEEN LATVIA AND OTHER EU COUNTRIES

Agnese Krievina[1], Dr.oec.; **Ligita Melece**[1], Dr.oec.

[1] Institute of Agricultural Resources and Economics

Abstract. The paper explores the consumption of food pellets in Latvia by analyzing their production and consumption in comparison with other EU countries, exploring the role of wood pellets in heating, and studying the main support mechanisms. Suitable qualitative and quantitative research methods have been applied to the studies. The production of wood pellets is very developed in Latvia, though only 10% is consumed on the local market, mostly by households; the present use of wood pellets in the energy transformation sector is insignificant. The notable price advantage of wood pellets against natural gas and the current high share of natural gas in the transformation sector imply on great replacement opportunities for fuelwood in Latvia. The production and consumption of fuelwood in Latvia is mainly promoted by the investment support, which has contributed to the development of the consumption of food chips by heat and CHP plants. Despite the higher price of wood pellets compared to other wood fuels, technical properties make them generally a comfort and efficient wood fuel, which is confirmed by the broad use of wood pellets in Denmark and Sweden. Although wood pellets might not be the immediate substitute for fossil fuels in Latvia, in the light of the increased movement towards low-carbon economy, wood pellets allow replacing a great deal of currently used natural gas in the transformation sector.

Key words: wood pellets, RES, consumption, Latvia.

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Introduction

The Baltic States are among the leaders in the export of food pellets in the European Union (EU), accounting for almost 30% of the total EU export value in 2014. Moreover, Latvia is the single largest exporter of wood pellets in the EU, leaving behind such an important suppliers as Germany and Austria. The total EU's import demand of wood pellets, concentrated by the United Kingdom, Italy and Denmark, is met with the Baltic pellets to a considerable extent. The total export value of Latvian wood pellets was EUR 168.1 million in 2014, which is a notable contribution to the foreign trade balance of the country (Eurostat, 2015a).

Despite the availability and competitiveness on foreign markets, Latvian food pellets are currently scarcely used in the energy transformation sector on the local market. At the same time, Latvia is one of the few countries, whose possibilities (based on its current and planned policies) to reach the binding targets for renewable energy of 2020 have been questioned by the European Commission in its latest renewable energy sources (RES) progress report (European Commission, 2015). In its turn, the neighbouring Estonia is the first EU country to already fulfil its 2020 RES targets (Potisepp, 2015). Moreover, at the end of 2014, the European Council agreed on the 2030 climate and energy policy framework, setting the EU target of at least 27% for the share of RE consumed in the EU by 2030. Contrary to the targets of 2020, no binding national targets have been set, so as not to, inter alia, prevent Member States from setting more ambitious targets and supporting them in an appropriate way (European Council, 2014). For example, the Danish energy policy goals already envisage that the share of green fuels in electricity and heat consumption in Denmark is 100% by 2035 (Danish Energy Association, 2014).

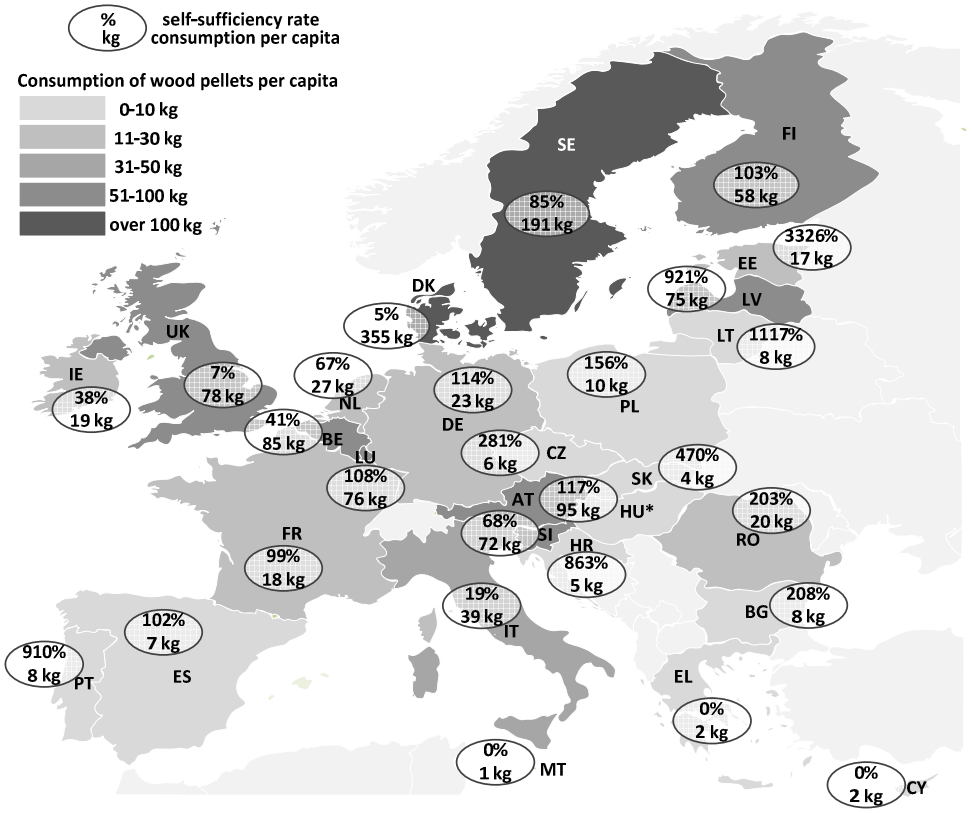
Considering the availability, wood pellets could be more widely used on Latvian market, thus, facilitating to the transition towards low-carbon economy, inter alia, greater energy security. Therefore, the objective of the paper is to explore the consumption of food pellets in Latvia, inter alia, the role of the support in its development.

Several tasks were set to reach the objective: 1) to analyze the production and consumption of wood pellets in Latvia in comparison with other EU countries; 2) to explore the role of wood

[1]Corresponding author. Tel.: + 371 67167913; fax: + 371 67541789. E-mail address: agnese@lvaei.lv.

pellets in heating in Latvia; and 3) to study the support mechanisms for RES promotion in heating in Latvia and other Baltic countries as well in the largest wood pellet consuming countries - Denmark and Sweden.

The main materials used for the studies are as follows: different sources of literature - research papers and reports of institutions and organizations; data from Eurostat and FAOstat databases as well as the Central Statistical Bureau (CSB) of Latvia data. Suitable qualitative and quantitative research methods have been applied to various solutions in the study: monographic; analysis and synthesis; data grouping; logical and abstractive constructional etc.



**consumption is calculated as production plus imports minus exports; self-sufficiency rate is obtained as production versus consumption; negative consumption obtained for Hungary*

Source: authors' calculations and construction based on Eurostat (2015a, 2015b), FAOstat (2015), CSB of Latvia (2015b) and Statistics Estonia (2015)

Fig. 1. **Consumption indicators of wood pellets in the EU countries in 2014**

Research results and discussion

1. Wood pellet production and consumption patterns in the EU countries

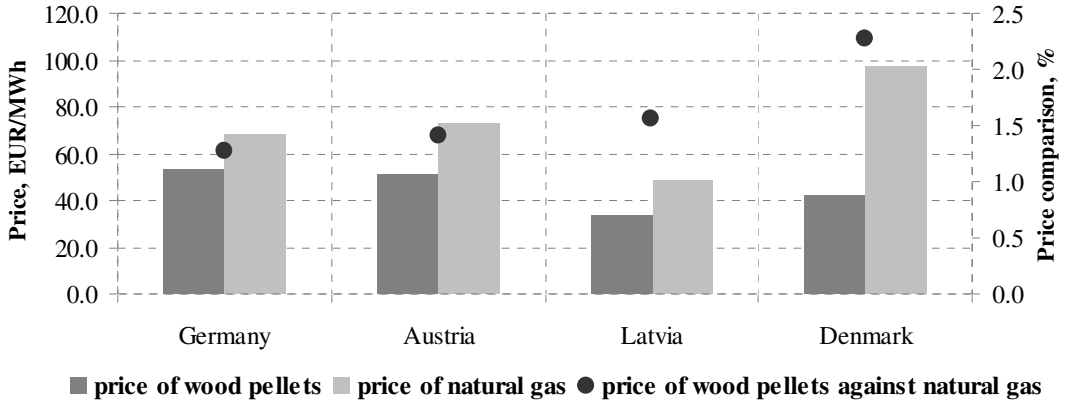
In order to compare the level of wood pellet production and consumption among the EU countries, the self-sufficiency rate and consumption of wood pellets per capita was calculated by the authors (Figure 1). The self-sufficiency in wood pellets is very high in all Baltic States, indicating on much more developed level of production than consumption in these countries. In Latvia and Lithuania, the production of wood pellets was about 10 times the level of their consumption in 2014, while Estonians consume only a very insignificant part of their wood pellet production. Moreover, the production of wood pellets is developed in general if measured by the quantity of wood pellets per capita in Latvia. The production of wood pellets in Latvia and Estonia exceeds 500 kg per capita, while the nearest followers – Sweden and Austria – do not reach 200 kg per capita; and the average indicator for the EU is obtained at somewhat 26 kg per capita. Also, in absolute terms Latvia is the third largest producer of wood

[1]Corresponding author. Tel.: + 371 67167913; fax: + 371 67541789. E-mail address: agnese@lvaei.lv.

pellets in the EU after Germany and Sweden, allowing it to be the leading exporting country in the EU. Considerably more developed production of wood pellets against the level of the consumption is also to be observed in Portugal and Croatia.

Due to the small production of wood pellets per capita, the lowest self-sufficiency in wood pellets amongst their producers is to be found in the largest importing countries - Denmark, the United Kingdom and Italy. Among them, Denmark has the distinctively largest consumption of wood pellets per capita in the EU – 355 kg. Wood pellets are intensively consumed also in Sweden (191 kg), and it exists along with a high consumption of other fuelwoods as well as comparatively very large consumption of nuclear power in the country's energy mix (Swedish Energy Agency, 2015). In Latvia, the consumption of wood pellets has been on a rise – in 2010, it was only 15 kg per capita, increasing to already 68 kg in 2012 and reaching even 75 kg per capita in 2014; the development has mainly taken place in the consumption of households.

To evaluate one of the main driving forces for consumption – price, wood pellet prices were analyzed against the prices of natural gas in some of the Baltic Sea region countries for which price data were available (Figure 2). The comparison of the available data reveals that there is very high stimulus to use wood pellets for energy production in Denmark as natural gas is about twice as expensive as wood pellets. It has been reported that in the Danish residential heating market very high taxes on oil and gas for heating have been significant drivers for pellet consumption. When the basic oil and gas prices are also high, pellet heating becomes very favourable (Pelletsatlas, 2009a). In Austria, the price of natural gas is about 40% higher than the price of wood pellets. According to Propellets Austria (2015), the price is where wood pellets display their true strength as no other comfort fuel can presently keep up with wood pellets in terms of price advantage, making this green heat economically attractive.



**pellet price (all taxes included): Germany, Austria order of 6 t; Latvia – average to end consumers; Denmark – for district heating, order over 5 t, data of 2013; natural gas (all taxes included) – domestic consumption, 20GJ < consumption < 200GJ, 2nd semester; conversion factor used for pellets 1t=4.8 MWh (used by FOEX)*

Source: authors' calculations based on DEPI (2015), proPellets Austria (2015), CSB of Latvia (2015b), Stelte et al. (2015), FOEX (2015), Eurostat (2015c)

Fig. 2. **Price advantage of wood pellets against natural gas in selected EU countries in 2014**

In Latvia, the price advantage of wood pellets is also significant – natural gas is by almost 60% more expensive, still wood pellets account only for a small share in heating. Compared to relatively less comfort fuelwood, wood pellets are about twice as expensive as firewood, and the price difference with wood chips is even more pronounced (CSB of Latvia, 2015b). Detailed

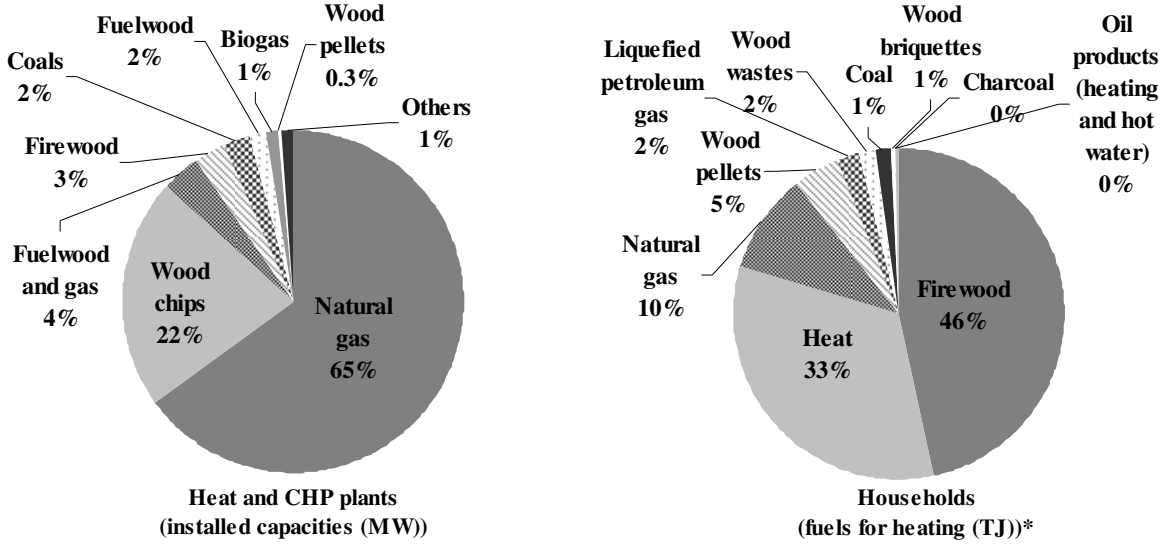
[1]Corresponding author. Tel.: + 371 67167913; fax: + 371 67541789. E-mail address: agnese@lvaei.lv.

structure of the fuel use in heating and the role of wood pellets in Latvia are discussed further.

2. Role of wood pellets in heating in Latvia

Only about 10% of the total wood pellets produced in Latvia are consumed on the local market. Out of the total gross inland consumption of wood pellets, only 6% are used in the production of heat and electricity (i.e. transformation sector), with majority of wood pellets being consumed by households (76% in 2014) (CSB of Latvia, 2015b).

According to the available data on household energy consumption mainly for heating purposes (without electricity used for heating as there are no detailed data available) in 2014 (Figure 3), wood pellets account for about 5% of the total household fuel use that equals 114 thousand tonnes. The consumption of wood pellets in households has been growing: only 14 thousand tonnes of wood pellets were combusted in 2010. Positively, the most important fuel used by households is firewood making almost half of the individual heating sector consumption and which can largely be linked with the low price of firewood. Another 1/3 of the total household energy consumption mainly for heating purposes is heat delivered through centralized heating systems. Therefore, larger utilization potential of wood pellets in household sector most probably firstly lies in the substitution of presently used natural gas, which makes about 10% of the total fuel consumption in individual heating, although, there has been a decreasing household consumption of firewood as well.



**household final energy consumption; electricity used for heating not included; oil products for heating from Household Energy Consumption Survey of 2010 (total household use of oil products very similar in 2014 and 2010)*

Source: authors' calculations based on the CSB of Latvia (2015b, 2013)

Fig. 3. **Structure of fuels used in heating in Latvia in 2014**

The structure of the installed heat capacity of heat plants and combined heat and power (CHP) plants by fuel type reveals (Figure 3) that plants using wood pellets as the main fuel account for less than 1% of the total heating capacities. The main fuel types used by heat and CHP plants are natural gas and wood chips; with natural gas accounting for almost half of installed capacities of heat plants and 78% of CHP plants (overall, natural gas accounts for 64% of the total fuel use by the transformation sector), thus, indicating on great replacement opportunities for fuelwood. Wood pellets are used as the main fuel by 41 heat plants, with the total installed heating capacity of 21 MW. The number and installed capacities of plants using wood pellets as the main fuel has been growing in Latvia: in 2007, there were only 11 heat plants having heat capacity of 9 MW. In total, only as negligible amount as 8 thousand tonnes of wood pellets

[1]Corresponding author. Tel.: + 371 67167913; fax: + 371 67541789. E-mail address: agnese@lvaei.lv.

were used in the transformation sector in Latvia in 2014.

There has been an increasing consumption tendency of fuelwood (mostly wood chips) in Latvia since 2012 (CSB of Latvia, 2015b). It has been due to a couple of fuelwood projects, the most important of which include transition of the centralized heating systems of three large Latvian cities to wood chips, introduction of new wood chip CHP plants as well as due to the start of new wood pellet production projects and modernization of energy sector of wood processing enterprises (CSB of Latvia, 2015a; Bumanis et al., 2014). Apart from other potential sources, Latvia still has large reserves of fuelwood export to be used in the local energy sector. Up to now, wood chips have been more preferred by heat and CHP plants than wood pellets, some researchers also do not consider wood pellets as the immediate substitution option for fossil fuel because their production includes additional costs and pellets is a product of high value added, the export of which has positive impact on the country's economy (Bumanis et al., 2014). Nevertheless, in the light of the increased movement towards low-carbon economy, wood pellet export offers the most substitution possibility – wood pellets accounted for 77% of the total Latvian fuelwood exports in 2014 and they could replace a great deal of currently used natural gas in the transformation sector, contrary to wood chips whose exports could replace only a small part of this fossil fuel (CSB of Latvia, 2015b).

Despite the higher price of wood pellets compared to other wood fuels, technical properties make them generally a comfort and efficient wood fuel preferred both by households as well as by large heating systems (Nunes et al., 2016; Trømborg et al., 2013). Wood pellets are the most highly refined form of solid wood fuel, whose high energy density translates into lower handling, transportation and storage costs, which is especially appealing in cases when cost efficient supply is a challenge due to storing limitations and long transportation distances; ability to be stored and economic transportation of wood pellets adds to the security of supply (Billington Bioenergy, 2015; Wood chips and…, 2015; García-Maroto et al., 2015; Mola-Yudego et al., 2014; Harrison, 2014; Trømborg et al., 2013). Being compact fuel, wood pellets are also easy to be stored and transported, making them a comfortable wood fuel for households (Thomson et al., 2015; Mola-Yudego et al., 2014). It has also been noted that wood pellets can be more affordable on a limited budget because they can be purchased in small quantities (Thomson et al., 2015). Due to their homogeneity and standardization wood pellets are suited to be used in combustion systems that are becoming fully automated, thus, requiring less man input (García-Maroto et al., 2015; Nunes et al., 2016; Wood chips and…, 2015). Wood pellet boilers are generally cheaper than wood chip systems, moreover, wood pellets can be used in most wood chip systems, however wood chips generally can't be used in pellet only systems (Wood chips and…, 2015; Billington Bioenergy, 2015). In addition, wood pellets have a clear burning and present the reduction of ashes (Mola-Yudego et al., 2014).

The broad use of wood pellets in Denmark and Sweden also confirms their advantages and preference. In Denmark, contrary to the situation in Latvia, wood pellets are used in all sizes of combustion plants - more than 60% of the total wood pellet consumption in Denmark refers to district heating and mainly CHP plants, and about 30% is consumed by households (Stelte, 2012). Considering that Denmark is an importer of fuelwood (Danish Energy Agency, 2015), it is rather rational that wood pellets as the fuelwood with low transportation costs is preferred to reach their RES targets. At the same time, Sweden, which is one of largest wood pellet producers, is also a large wood pellet consumer - wood pellets are used in all sizes of combustion

[1]Corresponding author. Tel.: + 371 67167913; fax: + 371 67541789. E-mail address: agnese@lvaei.lv.

plants, about 40% of which are consumed by large district heating plants and CHP plants (Pelletsatlas, 2009b; Nunes et al. 2016). Denmark and Sweden both are early adopters of wood fuels (Olsson and Hillring, 2013), the utilization of wood pellets in the district heating sector started already the 1980s (Pelletsatlas, 2009a, 2009b). Moreover, it is considered that biomass in CHP plants replacing coal and gas is a key measure and an inexpensive way to achieve Denmark's CO2 reduction goals; and, therefore, it is planned that in the future wood pellets will represent most biomass used in the CHP plants, while wood chips will primarily be used in small and medium-sized CHP plants (Danish Energy Association, 2014). This implies that already large consumption of wood pellets in Denmark is going to become even larger.

3. Support to RES in heating

The use of RES in heating in Latvia is mainly stimulated in the context of energy-efficiency, which, inter alia, includes the transition from fossil fuels to RES and the efficient use of them and the produced heat. The main support instrument used is investment support. Cohesion Fund 2007-2013 provided investment support for the increase of the efficiency of heat supply systems, covering also displacement of fossil fuel. In 2014-2020, it is planned to continue to support the increase in the energy efficiency of centralized heat supply systems, including the promotion of the transition to RES as well as increase the efficiency of buildings, inter alia, supporting the use of RES in public and residential buildings. There have also been project calls within Climate Change Financial Instrument (CCFI) (state budget programme, started in 2009) targeted at transition from fossil fuel to RES in heat supply systems as well as the use of RES by households. As regards the production of bioenergy, investment support to production of fuel of agricultural and forestry origin has been granted within RDP 2007-2013 as part of rural diversification measures to new and existing rural enterprises. There have also been support measures in Latvia promoting the use of RES in CHP plants, with the emphasis on bioelectricity generation (Melece and Krievina, 2015). The consumption of fuelwood in households for the household needs is also stimulated by lower VAT tax rate (RES LEGAL, 2014).

The available data do not allow making a thorough analysis of all supported medium and large investment projects in heating by fuel type, however, the overall tendency has been that wood chips have been the most popular type of fuelwood among heating and CHP plants using fuelwood, which is confirmed by the analyzed fuel use structure. At the same time, there is quite detailed data available on the approved RES projects for households within CCFI. The use of wood pellets can be indentified in about 70% biomass projects (without mixed technologies) planned by households. Though, biomass projects account only for about 20% of all household projects, with solar and heat pumps being the most preferred RES technologies by households applying for the support (LEIF, 2012).

As regards the situation in other Baltic States, in Lithuania, there are three main instruments used to promote RES in heating: guaranteed purchase of heat from independent RES producers (meeting lower price, quality, supply security, environmental and consumers demand criteria); subsidies from the Lithuanian Environmental Investment Fund; and environmental pollution tax relief for solid and liquid biomass. Similarly like in Latvia, in Estonia, RES in heating are promoted mainly by investment support. The investment support is round-based and can be granted for the construction of RES CHP plants, reconstruction of boiler-houses to make them operational for RES and for the reconstruction of the district heating network to improve energy efficiency. Additionally, RES investment supports are made

[1]Corresponding author. Tel.: + 371 67167913; fax: + 371 67541789. E-mail address: agnese@lvaei.lv.

available for the owners of private houses and apartment buildings (RES LEGAL, 2014).

Table 1

Decomposition of the end-price of natural gas in selected EU countries in 2014

Indicator	Latvia	Lithuania	Estonia	Denmark	Sweden	EU-28
Price (excluding taxes and levies)	79%	83%	79%	39%	55%	77%
Taxes and levies	21%	17%	21%	61%	45%	23%
Price (all taxes and levies included)	100%	100%	100%	100%	100%	100%

**natural gas – domestic consumption, 20GJ < consumption < 200GJ, 2nd semester*

Source: authors' calculations based on Eurostat (2015c)

In Denmark and Sweden, mainly tax mechanisms are used to promote RES in heating. There are several taxes on the production, supply and use of energy sources for heating in Denmark but RES do not classify as the objects of these taxes. Denmark also supports the use of biogas for heating through a direct premium tariff of used biogas. Similarly, in Sweden, energy and carbon dioxide taxes are levied on the supply, import and generation of fossil fuels for heating purposes but RES are exempt from these taxes; heat producers using RES are exempt from a nitrous oxide tax as well. As regards households, labour costs relating to the installation or replacement of RES devices are eligible for income tax deduction in Sweden (RES LEGAL, 2014). The burden of taxies and levies are very high in Denmark and Sweden, from Table 1 it can be seen that taxes and levies make even 60-45% of the end-price of natural gas in these countries in comparison with 21% in Latvia. It has been noted that the carbon dioxide tax introduced in Sweden in 1991 was the main driver for large scale facilities for converting from fossil fuel to solid biofuels, and the high fossil fuel taxes are the basic mechanism that still supports the strong development of biomass markets in district heating and individual households (Pelletsatlas, 2009b). Biomass use in CHP plants is also stimulated by premium tariff in Denmark and quota system in Sweden (RES LEGAL, 2014).

Conclusions, proposals, recommendations

1) The production of wood pellets is very developed in Latvia, which is characterized by per capita production of wood pellets exceeding 500 kg (Sweden does not reach 200 kg per capita) and also in absolute terms Latvia being the third largest producer of wood pellets in the EU after Germany and Sweden. The production of wood pellets in Latvia is much more developed than their consumption, allowing it to be the leading exporting country in the EU.

2) Only about 10% of the total wood pellets produced in Latvia are consumed on the local market, mostly by households. The present amount of wood pellets used in the energy transformation sector is insignificant. However, the notable price advantage of wood pellets against natural gas and the current high share of natural gas in the fuel consumption structure of the transformation sector imply on great replacement opportunities for fuelwood.

3) Wood chips are the most important fuelwood used by heat and CHP plants in Latvia. However, despite the higher price of wood pellets compared to other wood fuels, technical properties (high energy density and associated lower handling, transportation and storage costs; homogeneity and standardization allowing automatization etc.) make them generally a comfort and efficient wood fuel preferred by households as well as by large heating systems, and which is confirmed by the broad use of wood pellets in Denmark and Sweden.

4) The production and consumption of fuelwood in Latvia is mainly promoted by the

[1]Corresponding author. Tel.: + 371 67167913; fax: + 371 67541789. E-mail address: agnese@lvaei.lv.

investment support, which has contributed to the development of the consumption of food chips by heat plants and CHP plants. The similar support mechanism is also applied in other Baltic countries. In its turn in Denmark and Sweden, fossil fuels are highly taxed in contrast to fuelwood and it has been a strong driver for the transition to solid biomass.

5) Although wood pellets might not be the immediate substitute for fossil fuels in Latvia, in the light of the increased movement towards low-carbon economy, wood pellet export allows replacing a great deal of currently used natural gas in the transformation sector, contrary to wood chips whose exports could replace only a small part of this fossil fuel.

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[1]Corresponding author. Tel.: + 371 67167913; fax: + 371 67541789. E-mail address: agnese@lvaei.lv.

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[1]Corresponding author. Tel.: + 371 67167913; fax: + 371 67541789. E-mail address: agnese@lvaei.lv.