AVAILABILITY AND USE OF WOOD-BASED FUELS IN FINLAND IN 2020

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ABSTRACT: In Finland the overall usage target set for forest chips is 12 million m3, i.e. around 24 TWh by the year 2020. The objective of the research carried out by Metsäteho Oy and Pöyry Energy Oy was to produce a total analysis as realistic as possible of the possibilities of increasing the use of wood-based fuels in Finland by 2020.

The research shows that the growth objective set in the long-term Climate and Energy Strategy can be attained through the supply and demand for wood-based fuels. However, realizing this potential would require major investments in the entire forest chip production system, because the competitiveness of wood-based fuels in energy generation is currently not at a sufficient level.

The emission trading has a strong influence on the competitiveness of wood-based fuels and the use of such fuels in energy plants. Increasing the proportion of wood-based fuels is very difficult at the current price level of the EU emission allowances (10 €/t CO_2). A strong increase in the use of wood-based fuels would require a price level of over 25 €/t CO_2 of emission allowances.

Considering the huge resources required by the forest chip production system and the current low competitiveness of forest chips, it is estimated that the use of forest chips in Finland will reach the level of 20 TWh at the earliest by the year 2020.

Key words: Energy wood, Forest chips, Wood-based fuels, Potential

1 INTRODUCTION

The renewable energy target set in the EU Climate and Energy Policy is to increase the share of renewable energy sources to 20 % of total final energy consumption by the year 2020 in the EU. In Finland, this target means increasing the proportion of renewable energy sources to 38 %. [1] Wood-based fuels are the most important renewable energy source in Finland, and forest chips are considered to be one of the most significant wood fuel source in the future [1].

In the Long-term Climate and Energy Strategy in Finland [1] it is estimated that the primary use of wood-based fuels should be 93 to 97 TWh by the year 2020. The overall target set for forest chips in 2020 is around 24 TWh (12 million m^3) [1], while the domestic annual use of forest chips in 2007 was approximately 6 TWh (Chart 1).

The objective of the research carried out by Metsäteho Oy and Pöyry Energy Oy was to produce a total analysis as realistic as possible of the possibilities of increasing the use of wood-based fuels in Finland by 2020. The research was carried out on the boiler and supply source levels.

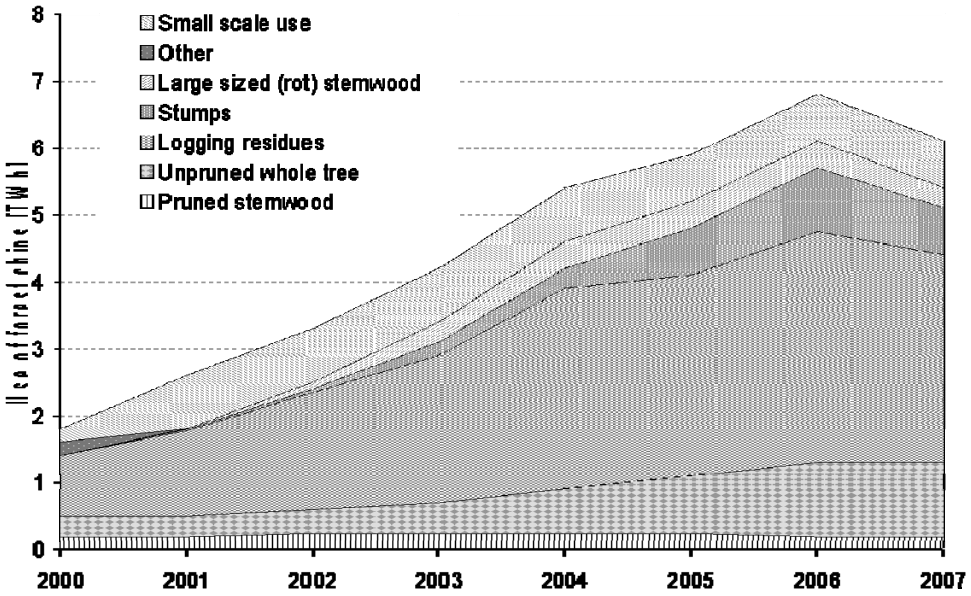

Chart 1. Use of forest chips in Finland 2000-2007

2 MATERIAL AND METHODS

Two different scenarios for the development of forest industry production up to the year 2020 were created in the research; Basic scenario and Maximum scenario. The roundwood consumption and demand of the forest industry were constructed based on the scenarios. Domestic industrial roundwood cuttings were 58 million m^3 in 2007, 57 million m^3 in the Basic scenario, and 68 million m^3 in the Maximum scenario in 2020. It was assumed that the import of roundwood to Finland will be significantly at lower level.

The production of by-products (bark, sawdust and waste wood chips) and black liquor for energy generation were estimated to fall in the Basic scenario (55 TWh) compared to the year 2007 (62 TWh). In the Maximum scenario, the energy use of by-products also declined but the use of black liquor increased slightly, aggregating 63 TWh.

The cuttings by The Forestry Centre and further by municipalities in 2020 were allocated applying the latest National Forest Inventory data by the Finnish Forest Research Institute and the Stand Database by Metsäteho Oy. Stand Database included more than 150,000 thinning and final cutting stands harvested by Metsäliitto Group, Stora Enso Wood Supply Finland, UPM Forest, and Metsähallitus in 2006 and 2007. The calculated small-diameter wood supply potentials were based on the 10th National Forest Inventory data of the Finnish Forest Research Institute.

Pöyry Energy Oy's Boiler and Energy Plant, Pellet, and Forest Industry Databases create a basis to research the demand and supply of wood-based fuels in the study. The Pöyry Energy Databases include almost all current plants and factories, as well as those under planning and construction, and outline future plants. The calculations were carried out by Pöyry's wood fuel supply and demand model (Figure 1).

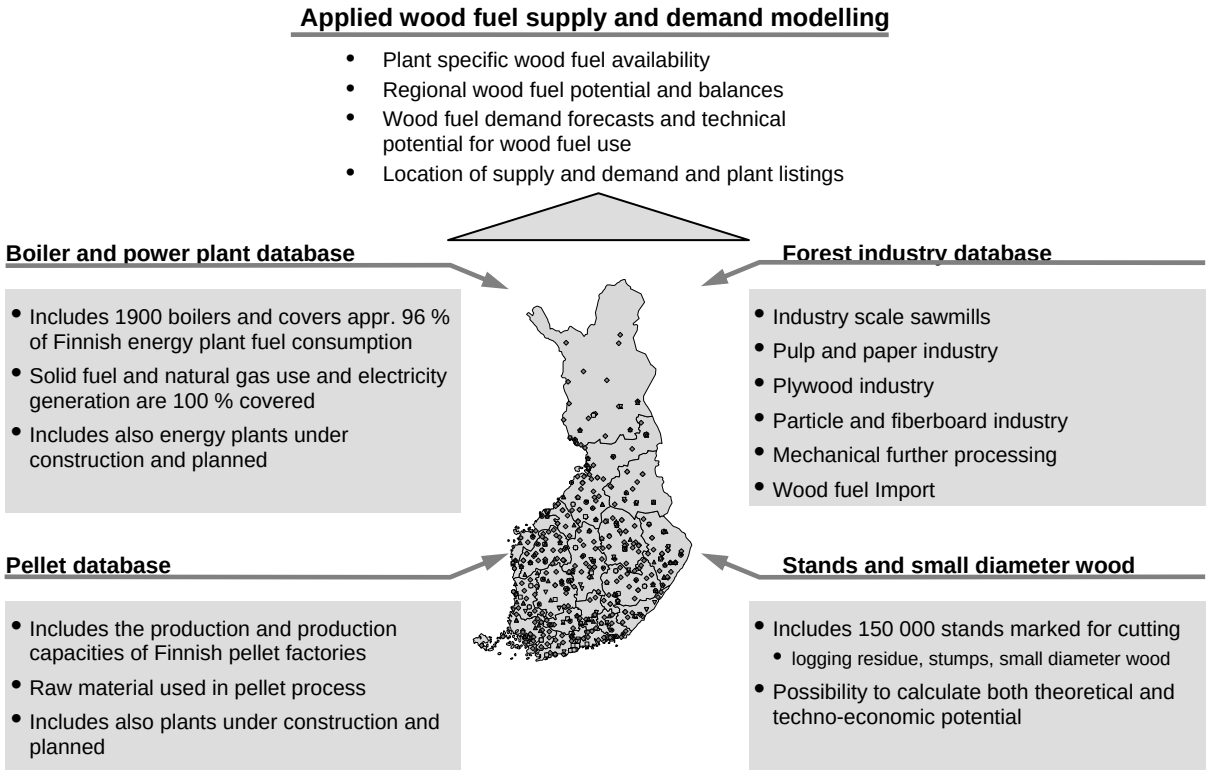

Figure 1. Pöyry's wood fuel supply and demand model.

3 RESULTS

Technical potential for the use of solid wood-based fuels in energy production was estimated to be around 53 TWh in Finland in 2020. Wood chips and small roundwood can cover at the maximum 28 TWh of this amount.

Theorethical procurement potential for logging residues are 105 TWh in the Basic scenario and 115 TWh in the Maximum scenario in 2020. Techno-ecological potential for logging residues are 43 TWh in Basic skenario and 48 TWh in the Maximum scenario in 2020 (Table 1).

The use of solid wood-based fuel in energy production in the Basic scenario increases in total to 44 TWh in 2020. This is due to the increase in the use of forest chips which climbs up to 27 TWh (~5 TWh in 2007), while the supply of industry by-products fell to 17 TWh from the level of 2007 (19 TWh). The biggest increase in the use of wood fuels is at district heating power plants (CHP). In the overall use of on forest chips, the proportion of stumps increases significantly. Also, the price of the most expensive consignment rises clearly over 20 €/MWh. There are notable differences between the regional costs of transported wood fuel prices (Chart 2). In the northern part of Finland the wood fuel price rises relatively fast compared to western and southern Finland. Also, a large part (nearly 10TWh) of the wood fuel deliveries are at the same level as the pulpwood price today.

The emission trading has a strong influence on the competitiveness of wood-based fuels and the use of such fuels in energy plants. When the price for emission allowances lowers below 20 €/t CO_2, the deliveries of wood fuels for energy plants decreases significantly. Respectively, when the price of emission allowances exceeds over 30 €/t CO_2, the use of wood fuels by energy plants does not significantly increase any more. The effect of emission trading focuses particularly on the most expensive wood fuel fractions, i.e. small-diameter thinning wood and stump and root wood.

If the use of forest chips increases extensively, it will cause heavy demand for new labour and forest chip production machinery. If the production and consumption of forest chips increases 20 TWh (basic scenario), the production machinery requirement would be 1,500 machines and trucks. The total machinery investment cost would be €420 million (VAT 0 %) and the calculated labour demand 2,700 machine operators and drivers (3,400 labour years).

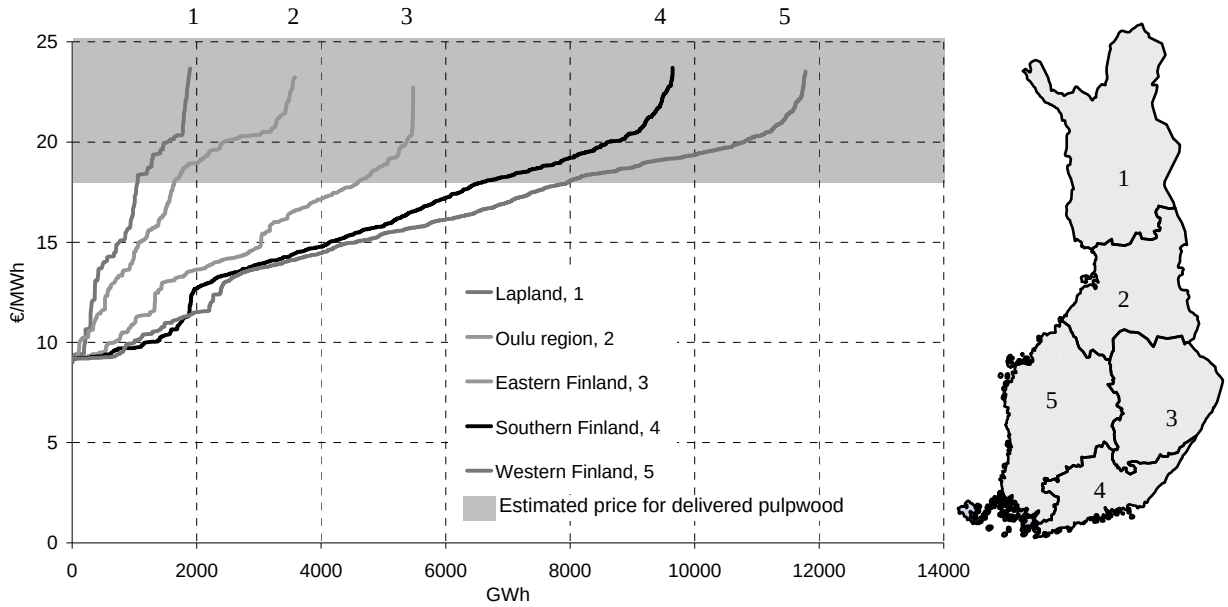

Chart 2. Costs of transported fuelwood. Based on supply chain costs without margins

Table 1. Use of wood-based energy with different price levels of emission allowances.

	Basic scenario			
	10 €/t CO_2	**20 €/t CO_2**	**30 €/t CO_2**	**40 €/t CO_2**
	[GWh]	[GWh]	[GWh]	[GWh]
Forest chips	**10 860**	**21 790**	**26 970**	**28 140**
Logging residues	8 670	10 310	10 310	10 680
Stumps	2 010	8 330	9 240	10 760
Smallwood	180	3 150	7 420	6 700
Side products	**14 540**	**17 090**	**17 170**	**19 440**
TOTAL WOOD-BASED ENERGY	**25 400**	**38 880**	**44 140**	**47 580**

Also, the support by the Finnish State for producing chips from small-diameter wood from young stands has a very strong impact on the usage volumes of small-sized wood chips in 2020. The effect of supports on the harvesting volumes of small-diameter wood chips points out when the price for emission allowances is at a low level. When the price is low (10 €/t CO_2) and there is no support for energy wood harvested from young stands, there is no possibility to harvest small-sized wood chips for energy generation. Correspondingly, when the support for small-sized wood chips is 8 €/MWh under low price for emission allowances, it is possible to raise the use of small-diameter wood chips to 2.7 TWh. Respectively, when the price for emission allowances is high (30 €/t CO_2) and the support for small-diameter wood chips recovered from young stands is 4 €/MWh, it is possible to increase the use of small-sized wood chips up to 7.4 TWh in 2020

4 CONCLUSION

The research showed that the growth objective set in the Long-term Climate and Energy Strategy [1] can be attained through the supply and demand for wood-based fuels because, for instance, in the Basic scenario the techno-economic supply potential of forest chips is 28 TWh in 2020 (Chart 3). However, realizing this potential would require major investments in the entire forest chip production system, because the competitiveness of wood-based fuels in energy generation is currently not at a sufficient level.

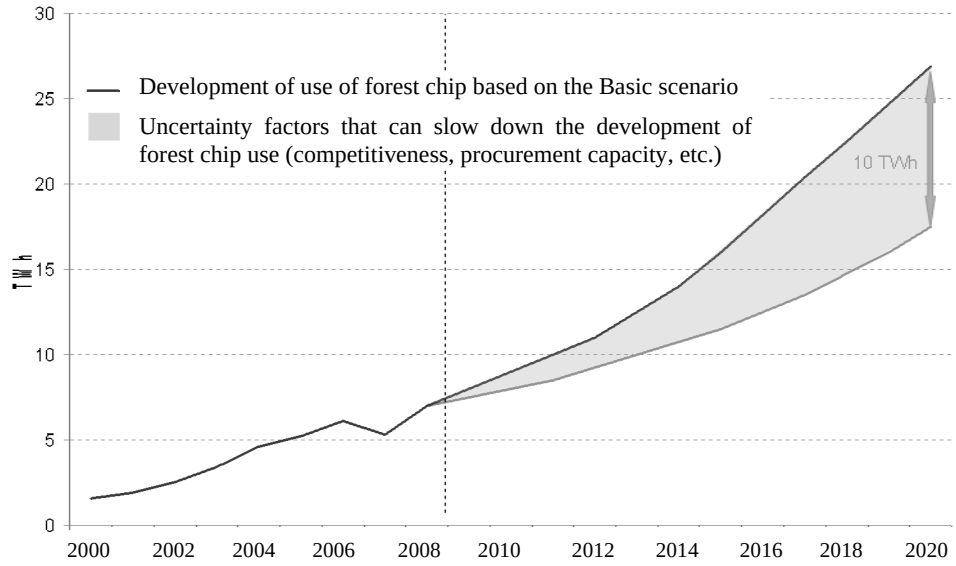

Chart 3. Development of use of forest chip based on the Basic scenario.

Considering the huge resources required by the forest chip production system and the current low competitiveness of forest chips, it is estimated that the use of forest chips in Finland will reach the level of 20 TWh at the earliest by the year 2020. Therefore, in practice it is not possible to achieve the set targets of renewable energy with wood-based fuels in Finland if the competitiveness of wood-based energy does not improve strongly. This competitiveness could be obtained with 25 €/MWh or higher emission prices or corresponding methods to improve the position of wood-based fuels in energy production.

Certain measures will be needed for improving operation environment in the field of forest chip production. And measures are needed immediately if, even in theory, the set targets could be possibly reached.

5 REFERENCES

[1]. Long-term Climate and Energy Strategy. Government Report to Parliament 6 November 2008. Publications of the Ministry of Employment and the Economy, Energy and climate, 36/2008.