Demand and supply of energy peat in Finland by 2020

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Summary

The demand for energy peat is estimated to grow from the level of 17-27 TWh in recent years to 31 TWh by 2020 in Finland. The increase is due to the fact that many new large CHP (combined heat and power) plants of municipalities and industry are being constructed or under the planning phase. The present peat production area is 60 000 ha, of which 44 000 ha has to be replaced by 2020. The new production area required is 61 000 ha, roughly equal to the present area. In the future, energy peat could also be used as an additional or primary fuel to produce second generation liquid biofuels for the transportation sector.

Key index words: Energy peat, energy production, combined heat and power, liquid biofuels

Introduction

Peat covers 6 % of both the primary energy and electricity demand in Finland. Wood fuels cover 20 % of the primary energy demand and 10 % of the electricity consumption in Finland. The bioenergy share of total primary energy consumption has slowly increased; being now above 25 %t it is one of the highest figures in the European Union. Most bioenergy is used in large scale combined heat and power (CHP) production in the emissions trading sector, which is a unique situation in Europe. Peat enables stable quality and availability of fuel mixtures for large scale energy production.

The use of peat for energy in Finland has increased significantly during the last two decades (Fig. 1). Peat is the main fuel in many CHP plants in municipalities. Industry has also steadily increased its use of peat. The use of peat for condensing power production has varied significantly depending on the electricity demand and market price. The total use of energy peat has varied from 17.2 to 27.5 TWh in the last ten years.

The future demand of energy peat in Finland by 2020 was studied by VTT Technical Research Centre of Finland in 2007. The additional production area required was estimated, and the balance of the demand and supply of energy peat was also analysed in each region of Finland.

Methods

The demand of energy peat and other fuels was estimated for the years 2010, 2015 and 2020 plant by plant for more than 150 sites in Finland. The reference data of the fuel consumption was for the year 2005 (Fig. 2). The estimation was based on the existing information on planned plants and plants under construction. The largest energy

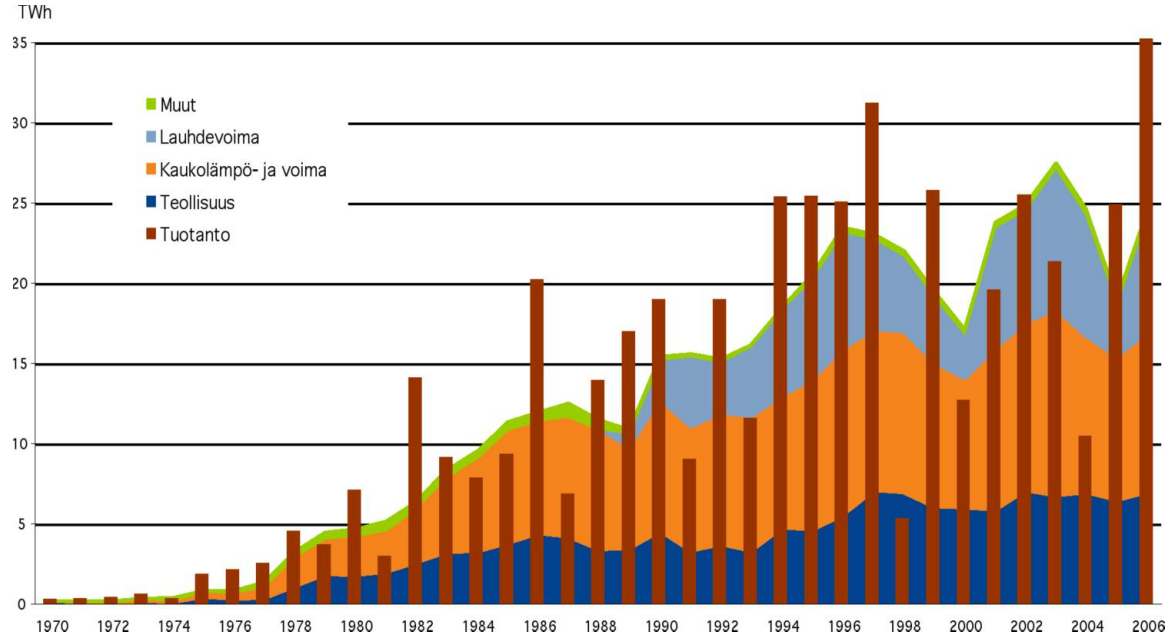

Figure 1. The production of energy peat within years 1970-2006 with bars and the use of energy peat in different sectors. From the bottom: Industry, District heating, Condensing power, Others in the same years. Source: Pöyry.

companies were interviewed and additional data were obtained from fuel suppliers, energy associations and other stakeholder groups. The operational data on existing plants and their operating lifetime were provided by the databanks of VTT. Most of the plants were combined heat and power plants, but also largest heating plants were studied plant by plant.

The demand for peat depends on the price levels of alternative fuels, emissions trading and taxes, subsidies and other incentives in the energy market. The demand for energy peat was estimated by taking into account the availability of other biomass-based fuels, such as residues from the forest industry, forest chips and agri-biomass within reasonable transportation distances of each plant. The use of those biomass-based fuels was assumed to increase according to the national targets of the present energy strategy from 2005. Peat was assumed to retain its present relative competitiveness compared to coal. Changes in district or process heat demand were also estimated for each plant.

The data relating to existing peatlands were provided by the Association of Finnish Peat Producers. The production area was 59 400 hectares in the beginning of the harvesting period of 2005. The share of the production area is 1 % of the area of geological peatlands in Finland. The typical annual production per hectare has been 360 – 440 MWh, and the average annual value for the years 1995-2004 was 400 MWh/ha. The production in 2005 was 21.6 TWh.

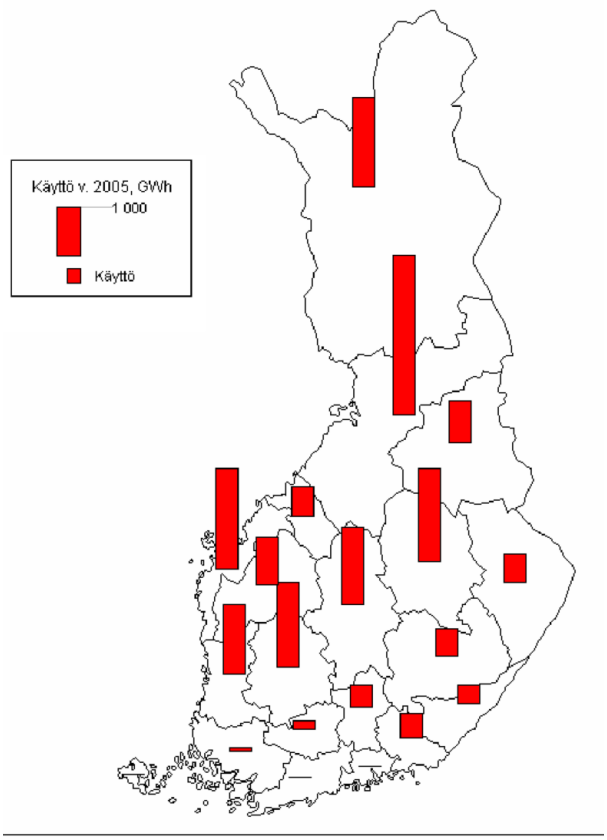

Figure 2. Use of energy peat in the regions of Finland in 2005.

Results

Demand for energy peat

The demand for energy peat is estimated to grow from a level of 17-27 TWh in recent years to 31 TWh by 2020 in Finland (Fig 3.). Several new large CHP (combined heat and power) plants of municipalities and industry are being constructed or under the planning phase. The production of condensing power using peat is estimated to slightly decrease in the same period. The use of forest chips, biogenic waste and energy crops was assumed to increase significantly according to national targets.

Need for new production areas

The present peat production area is 60 000 ha, of which 44 000 ha has to be replaced by 2020. The new production area required is 61 000 ha and roughly equals the present area (Fig. 4). The balance of the demand and supply of energy peat was also analysed in each region of Finland. The demand for energy peat does not change evenly in all regions, and significant differences exist. Some regions import large quantities from neighbouring regions, and some regions have a larger production than demand.

Production of liquid biofuels

In the future, energy peat could be used as an additional or primary fuel to produce second generation liquid biofuels for the transportation sector. One of the most promising

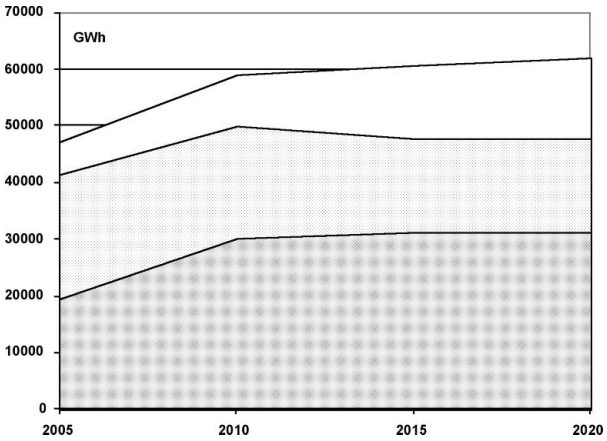

Figure 3. Estimated use of energy peat (at bottom), wood residues and forest chips in 2005-2020.

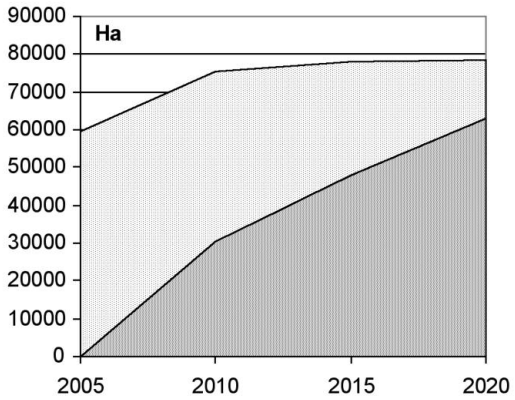

Figure 4. Demand for new production area (bottom) and the total production area in 2005-2020.

routes for the production of transportation fuels from biomass feedstocks is the so-called syngas route. Biomass is converted into synthesis gas, which is predominately a mixture of hydrogen and carbon monoxide. The syngas can then be converted into any one of a number of products. Products which can be used as transportation fuels include methanol, dimethyl ether, Fischer-Tropsch (FT) hydrocarbons, methane and hydrogen. Both the gasification and synthesis steps yield significant amounts of by-product energy in the form of either steam or fuel gas. Thus, integration of the conversion process with the energy system of a pulp and paper mill or a CHP plant of a municipality is highly beneficial. On the other hand, to compete with other routes, the minimum capacity of a biosyngas plant is about 200 MW (feedstock) so, in general, a significant amount of solid biomass, such as forest residues or peat, will need to be imported to the plant.

If from two to four plants were built that would use peat for 70 % of their fuel demand, the demand for energy peat would increase by 1.8-3.6 TWh/a. Each plant would produce 106 000 toe of FT diesel which would cover about 2.5 % of the fuel demand in the transportation sector in Finland.

Conclusions

Peat is an important local fuel in Finland, used especially for combined heat and power production in municipalities and industry. The demand for peat will increase significantly by 2020, although the use of forest chips, agrobiomass and biogenic waste was estimated to increase according to the national targets. The demand for new production areas is large, and the preparation of new production areas must be intensified.

Acknowledgements

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