Technology for forest residues at fuel terminal

Arvo Leinonen
Technical Research Centre of Finland (VTT), P.O. 1603 FIN-40101 JYVÄSKYLÄ, Finland
Fax: + 358 14 672 597; arvo.leinonen@vtt.fi

The main idea in development of integrated wood and peat production is to utilize the infrastructure of the peat production also for wood harvesting. The main characteristic of the production concept is the fuel terminal, located at the peat production area or close to it. There are plenty of suitable places for the terminals because the number of peat production areas in Finland is hundreds of sites. Wood fuel is transported to the fuel terminal from the surroundings of the bog; there it is stored. Wood fuel is dried at the terminal over the summer, which improves the quality of the fuel. Chipping of wood fuels and the delivery of it are carried out in autumn or in winter by the peat transportation system. Additionally, the peat contractors are exploited in wood fuels production. Peat production areas and peat machines can be applied for drying and production of wood fuels. [1].

A three-year research, in which the integrated wood and peat harvesting concept was developed, was started in 1997. Different stages of the concept have been studied and developed in the research. The research in 1998 was divided into four sub-projects. These sub-project were: the survey of the wood energy reserves in the surroundings of the bogs, development of the fuel terminals, drying of the logging residues at the storage, storage of the logging residue chips, and utilization of pear contractors for procurement of energy wood. By the side of the research Vapo Oy has started the collection of the logging residues using the Terminaalihake (terminal chip) concept. In addition to this Vapo Oy has developed a HavuHukka logging residue trailer for forest haulage and the tractor chipper suitable for logging residue. [1].

Forestry Center Tapio has surveyed the wood energy reserves at the surroundings of the designed terminals. On the basis of the energy wood resource data the terminals can be established on sites which have largest amounts of raw materials. The largest energy wood reserves are in the southern and central parts of Finland, i.e. at the areas where there are a lot of spruce dominant forests waiting for regeneration. Energy wood amounts per hectare varied significantly between the regions. The highest technically harvestible amounts of energy wood were nearly 0.9 solid-m^3 per hectare per year. This corresponds to about 27 000 solid m^3/a of logging residues at the forest area of 30 000 ha (at the distance of 10 km). The average technically harvestible amount of logging residues is about 50% of this. The maximum potential of integrated harvesting was 0.10 m^3/ha annually, and that of a young stands 0.08 m3/ha. [1].

VTT Energy and Vapo have developed terminals in co-operation. The information of the Forestry Center Tapio has been used in development. A peat production area is used as an energy wood processing terminal, there the storage and processing of energy wood, as well as the storage and delivery of the fuel chips to users is effective, in well control and all year round. It is possible to operate all year round because the road network of the peat production areas is good. By the side of a peat production area it is possible to use a timber collection depot as the site for a terminal. The requirements of the terminal operation, such as the location of the terminal in relation to the users and fuel reserves, as well as the requirements of the storage sites, the space requirements and the base material, have been studied in the research in 1997. Several terminals have been designed and constructed on the basis of these requirements. Field tests have been carried out at these terminals. The field tests have been concentrated on logging residues. The material flows, the times required by the working stages and the costs of different methods have been measured in the research, and the all year round operability of the terminals has been tested. [1].

Logging residues are dried at the mire-terminal. The objective is to reduce the moisture content of the logging residues below 40%, and hence to increase the calorific value of the logging residues. The researches at VTT Energy show that logging residues dry in a properly constructed storage during the summer under the set target (45 %). The siting of the stockpile has significant effect on the

homogenous drying of the logging residues. It is profitable to site the logging residue stockpiles on an open site into north-east/south-west direction so that the solar radiation hits the whole surface of the stockpile. A log-bed is used for intensifying the drying of the logging residues. Strong long-lasting rain will wet the whole stockpile, because of which it is profitable to cover the stockpiles. [1].

The disadvantage of the storage of logging residues at a terminal is the high dry matter losses. The objective, set for the research, is to develop the storage technology of logging residues so the dry matter losses during the storing remain as low as possible, and that the moisture content of the residues does not increase during the storage. VTT Energy and Vapo Oy have studied in co-operation the long-term storage (6 – 8 months) and short-term storage (1 – 3 months). The effect of storage time, the stockpile altitude, the covering of the stockpile, ventilation and compaction on the durability of the logging residue chips in the storage have been studied in the field tests. In total 16 stockpiles have been used in the research. It seems, on the basis of the results of the field studies, that the initial moisture content has significant effect on the durability of the chips in the storage. In long-term storage it is profitable to cover low stockpiles (3 m), but in the case of higher stockpiles (4.5 m) the coverage is unnecessary. It is profitable to make an uncovered stockpile as steep as possible and the surface if it as even as possible in order to eliminate the effects of the moisture. The chip storage, made in winter, the dry-substance losses are lower than in the stockpiles made in autumn because due to the snow and ice the microbial activity starts in winter 1 – 2 months later. However, in chipping, carried out in winter, the snow increases the moisture content of the chips. In short-term storage the initial moisture content has to as low as possible. Coverage if the stockpile is not necessary in short-term storage. [1] .

Vapo Oy Energy has constructed in 1998 12 HavuHukka trailers and acquired four tractor chippers for production of logging residues at terminals. Logging residues were collected in 1998 from 1500 ha of spruce-dominant final felling areas. The logging residues of spruce-dominant final felling areas correspond to about 150 MWh/ha. Forest owners have positive attitude for the collection of the logging residues, because it speeds up the regeneration of the forests. [1].

[1] Hillebrand, K., Flyktman, M., Kallio, E., Leinonen, A., Lindh, T., Marttila, M., Tiihonen, I. 1999. Seospolttoaineiden tuotanto terminaalilla (Production of multifuels on the terminal of peat production area). Jyväskylän teknologiakeskus Oy, Projektikirja 1993 - 1998), Osa II, Turpeen ja peltobiomassan tuotanto tuotanto. (Jyväskylä Science Park, Project book, Part II, Peat and field biomass production), p. 201 – 220.