Energy consumption by energy wood supply

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Abstract:
The energy consumption by energy wood supply has got increased focus the last years. The input of energy compared to the output is of interest when calculating the energy account for different energy sources. The aim of this study was to determine the energy consumption of different forest fuel supply chains – stemwood, small diameter trees and logging slash. The results showed that the direct input of energy compared to the energy content of the fuel was approximately 3.2 % for stemwood, 2.8 % for small diameter trees and 2.5 % for logging slash.

Keywords: energy consumption, forest machines, energy wood supply

1 Introduction

Renewable energy resources, including biofuels, have received considerable attention in recent years. The amount of energy used to harvest and transport biomass in relation to the amount of energy harvested is an important factor in the assessment of energy gain this energy carrier represents. The aim of the study was to determine the energy consumption of forest fuel supply chains. Three different chains were analysed: stemwood, small diameter trees and logging slash. The entire chain from harvesting to final delivery to energy plant was included. By-products from forest industry and stumps were not included in this task. The indirect energy use, like construction of machines, roads etc., were not taken into account.

2 Material and Methods

By comparing different logistic chains and systems, it was possible to analyze which operations that was more energy effective than others. The analysis was based on previous research of productivity and fuel consumption of harvesting, chipping and transportation of industrial wood and forest fuel. Out of that data, the total energy consumption for the whole chains were calculated.

Three different forest fuel assortments were determined:

- Stemwood
- Small diameter trees
- Logging slash

Regarding energy value of the forest fuel, and the diesel fuel for the machines, following presupposes were made:

- Energy value fossil diesel fuel: 10.1 kWh / litre (www.energilink.tu.no)
- Energy value wood: 2 MWh / m3 solid

3 Results

The results showed that the direct energy consumption by harvesting and transportation of forest fuel is rather low compared to the energy output of the fuel. For a typical supply chain from forest to energy

plant, the input versus output of energy was approximately 3.2 % for stemwood, 2.8 % for small diameter trees and 2.5 % for logging slash.

Figure 1 shows the consumption of diesel fuel for the different operations in the supply chain. Stemwood got the highest number, mainly due to the extra operations when the is being processed in a terminal.

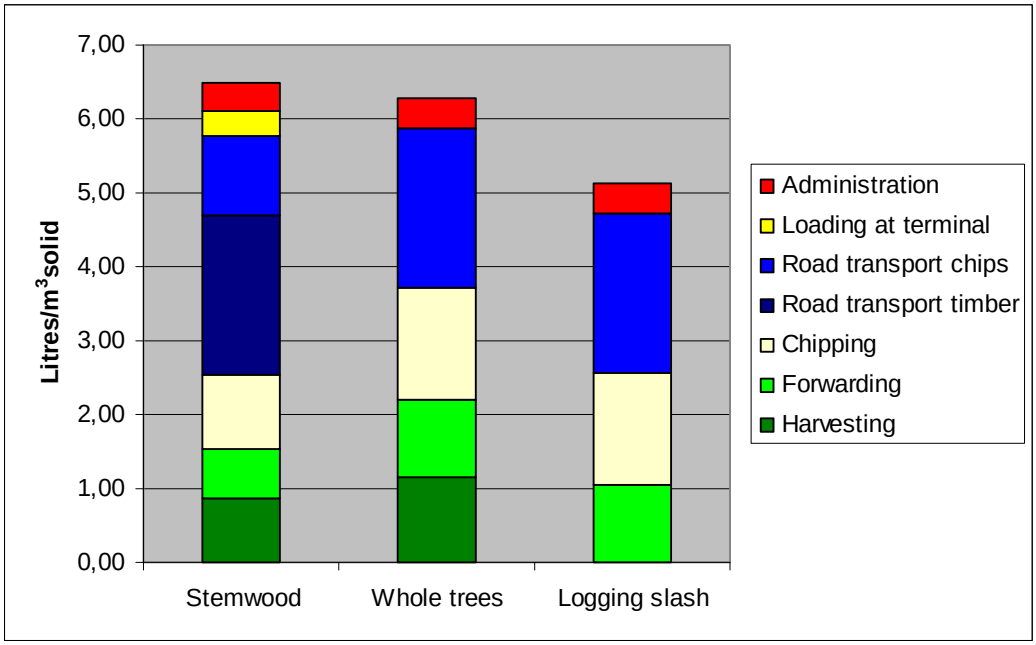

Figure 1: Consumption of diesel oil divided on different assortments. Litres of diesel / m3 solid of wood supplied.

Figure 2 indicates that the input of energy is rather low compared to the energy value of wood, no matter what assortment that are being supplied.

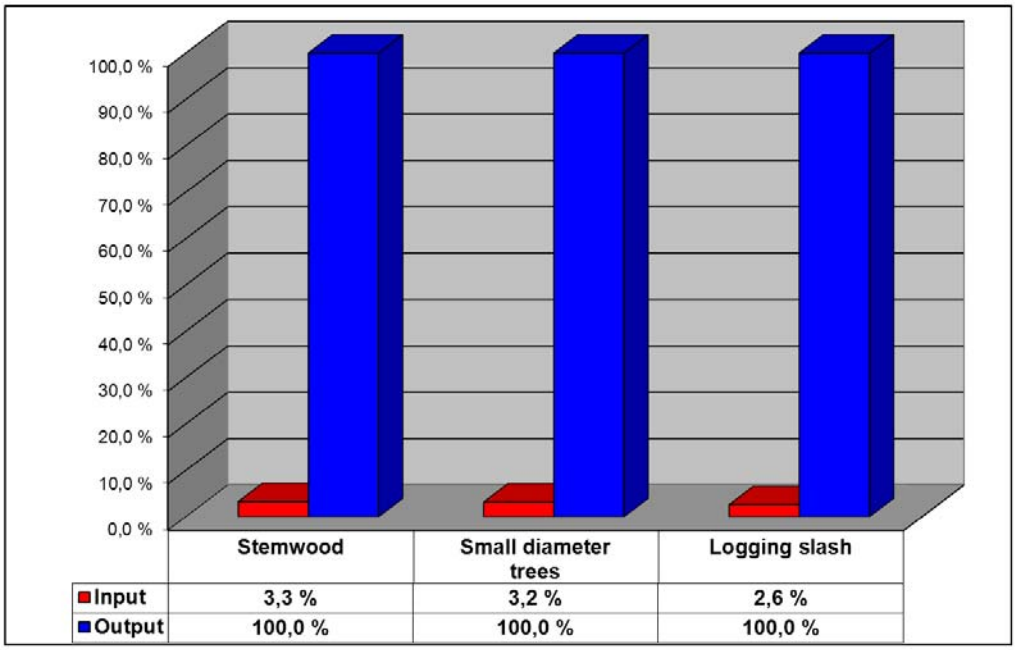

Figure 2: Percentage input of energy versus output, divided on the different assortments.

4 Discussion

It is important to notice that there are a number of uncertainties when calculating the fuel consumption of the various supply chains. For instance varies transport lengths, which affect consumption significantly. In addition, it is important what the energy content of the product harvested and transported represents. It will include a huge difference between harvesting stemwood of oak, which has high energy content, compared with harvesting small diameter trees of spruce with low middle dimension. In addition, there are variations between seasons, for example consumes forestry machines more fuel in the winter when there is a lot of snow.

Summarized, following two main conclusions can be made:

- Low input versus output of energy
- Road transportation consumes a high share

5 References

Asikzinen, A., Laitila, J. (2006): Energy wood logging from early loggings by harwarder method.

Brunberg, T. (2006): Skogforsk Resultat 22/2006: Bränsleförbrukning hos skördare og skotare.

Kärhä, K. (2006): Whole-tree harvesting in young stands in Finland.

Löfroth, C. (2008): Presentation, Skogforsk Utvecklingskonferens 2008.

Nordfjell, T. (2007): Presentation in “Advancing Forest Technology” course, Swedish University of Agricultural Sciences.

Pelkonen, P. (2006): Presentation in ”Production and use of energy biomass” course, University of Eastern Finland.

Petterson, M. (2006): Grotskotning – Driftsuppföljning og tidsstudie.

Webpages:

http://energilink.tu.no/no/diesel.aspx. 2008.05.28.

http://www.skogoglandskap.no/nyheter/2008/miljoeffekter_ved_bruk_av_tre. 2008.05.23.