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## Scenario Analysis of Fuel-Pellet Production – The Influence of Torrefaction on Material Flows and Energy Balances

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The market for forest chip, forest residue and forest industry by-products is becoming more and more interesting due to challenging EU bioenergy strategies. The rapidly growing fuel-pellet industry, which today still relies mainly on high quality raw materials such as sawdust, is one of the sectors looking for a larger market share of raw biomass materials.

In 2005, pellet production in Europe was still at a rather low level; 2-3 million t of pellets were produced in about 200 pellet plants, meaning that 1-2 % of the harvested wood ended up as pellets. Similar quantities of raw material suitable for use in pellet factories (mainly dry and wet sawdust) could be found from among the by-products of the sawmill industry.

Pellet production capacity has grown rapidly in some parts of Europe. For example, in Germany it has grown from about 0.25 million t in 2005 to almost 3 million t at the end of 2008. Other countries such as Denmark and the Netherlands have been expanding pellet production capacity despite a very limited national forest biomass resource. New raw material approaches have already been introduced in these countries. Assuming a general annual growth in pellet production of 10 % (far less than the present growth rate), some 10-12 % of the harvested wood would end up in pellets by 2025 (Eforwood scenarios). Such developments would strongly affect the price of wood chips and the production of pulp and paper. Therefore, other biomaterial flows must be developed and introduced.

Studies carried out within the 'Eforwood' project focusing mainly on biomass flows, the potential for pellet production and on the energy balances of the process solutions studied are presented. A new biofuel upgrading technology, torrefaction, is described and analysed. The process allows a large range of low-grade raw materials to be used in the production of high quality fuel-pellets, the energy density and handling properties of which are significantly enhanced compared to conventional wood pellets. Torrefaction is expected to enter the commercial phase soon but has not yet been modelled within Eforwood. This technology will affect raw material availability, material flows and energy balances in both the transportation and production of fuel-pellets.