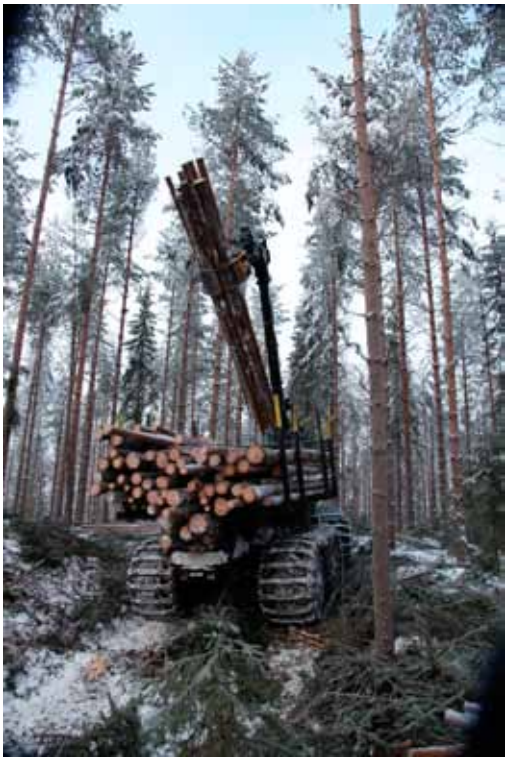
The technology to produce renewable biofuels from wood exists and, with management practices and tools already developed, the sustainability of wood-based raw material can be guaranteed.

Forest of biofuels

Forests have provided us with raw material for many different industries, including energy, for centuries, as well as their other ecosystem services like oxygen production and purification of water. During their growth, forests provide a significant carbon sink and, as a land use form, they offer high carbon storage. Producing wood raw material for renewable fuels creates value for local stakeholders and also provides valuable environmental benefits at the global level.

The Global Forest Resources Assessment 2010 estimates the world's forests store 289 gigatons of carbon in their biomass alone. According to the State of European Forests report, prepared by Forest Europe, UNECE and FAO, the carbon storage of European forests was 10 gigatons of carbon in 2010. The carbon storage had grown by almost 30% compared to 20 years ago.

Commercial forest management aims to maximise the amount of wood harvested taking into account sustainability requirements. This also leads to increasing carbon storage of forests. According to Finnish Forestry Research Institute, better forest management practices have contributed to almost doubling the annual increment between 1960 and 2010 in Finland.



A harvester processing logs in a forest

Certification promotes sustainability

Environmental sustainability of forest management has been a focus for several decades. One important tool for developing and implementing sustainable management practices is certification.

FSC and PEFC, international forest management standards, are continuously reviewed and the increasing knowledge of environmental and societal impacts continuously improves the forest management practices. Forest certification guarantees transparency and annual independent verification of the management practices.

The world's total forest area is over 4 billion hectares and covers 31% of total land area. Globally, the total area of certified forests, based on international forest management standards, is 440 million hectares. According to FAO and UNECE Forest Products Market Review, the share of certified forests exceeded 10% for the first time in 2013.

In North America, the share of certified forests is 35% and in western Europe 60%. Companies that focus on certification can achieve higher percentages. UPM, a Finnish forestry company, has certified 100% of its own forests for example.

FSC and PEFC forest management standards set sustainable forest management practices agreed at international level. These standards are based on the three pillars of sustainable development: environment, social and economy.

The basis of the standards is legal compliance. Hence third party verification also covers meeting regulatory requirements. In addition, the international level requirements include, for example, protection of ecologically important areas, taking into account workers' rights and consultation with local stakeholders.

As the forest ecology and societal practices differ, the standard requirements are agreed in detail in each country. As an example, the Finnish PEFC criteria include requirements on protecting water systems, ensuring the vitality of forest carbon sinks and promoting multipurpose use.

To enable certification of final products, international standards require transparent and verified chain of custody of wood starting from point of origin. This covers traceability of wood sourced from certified forests as well as other harvesting. When final products are certified, the source of all material delivered to a mill is known.

Depending on historical development, ownership of forests may be very shattered. Of the five million inhabitants in Finland for example, over 700,000 are owners. On average, a regeneration site is around 1.5 hectares and UPM signs over 30,000 wood purchase agreements annually to source wood for its mills.

To enable detailed planning and traceability, UPM has an information system which includes location and environmental values of each site, as well as data on harvested wood delivered to a mill via trucks.

Wood-based biofuels: an insight

Globally, 80% of energy is produced by burning fossil fuels. When considering energy security, environmental impacts and availability of resources, wood-based biofuels are a competitive option for forest rich areas, such as Europe and US.

Cellulose, the main component of wood, is the most abundant polymer on earth and it is not part of the food chain. Wood-based biofuels create less greenhouse gas (GHG) emissions during their lifecycle and require less water to produce than conventional biofuels.

Some studies regarding the GHG emissions for wood-based biofuels raised questions

about carbon debt. As pointed out in a recent US sustainability report by the US Industrial Pellet Association (USIPA) and the European Biomass Association (AEBIOM) , studies finding long carbon debt repayment times for wood-based biofuels generally assume forests are managed and harvested purely for bioenergy, which is not the case.

Forest owners consider market prices and the time value of money to determine the financially optimal time to harvest. Therefore the more valuable products, such as timber and pulpwood, drive the decision to harvest, not the lower value products like forest residues. Thus, wood-based biofuels can be produced from forest residues of existing activities in forests, already managed for these purposes.

In addition to unprocessed forest residues, such as tree tops and branches, feedstock can also be processed residues such as chips, bark, sawdust, black liquor and crude tall oil. Studies also often incorrectly assume that forests are slow growing, they were previously unmanaged, had high original carbon stocks and that they would maintain these stocks over time.

The USIPA/AEBIOM study further argues that bioenergy using biomass from existing sustainably managed forests realises absolute GHG savings from year one because forest carbon stocks are maintained or even increase over time, and fossil fuel burning is simultaneously avoided.

Carbon debt and foregone sequestration in realistic bioenergy scenarios are small compared to the carbon savings achieved over time. Furthermore, there is a critical difference between a small and temporary carbon debt, and the permanent fossil carbon emissions savings achieved by use of bioenergy rather than fossil fuels. In view of the fact that the annual net growth in these regions far exceeds total removals, carbon stocks are clearly not declining due to bioenergy.

The University of British Columbia has recently released a report on wood-based biofuels showing how production cost savings can be achieved, which can enable these biofuels to become a commercially competitive alternative to traditional fuels.

According to the report, large scale production can lead to operational cost savings and help the industry make the necessary improvements to compete and survive without government support. Existing pulp and paper integrates offer possibilities for conversion into biorefineries, based on the existing infrastructure and raw material supply chains.

To minimise the production costs of wood-based biofuels, logistics and integrate benefits must be in place. For example, at UPM, wood as a raw material is used as a basis for many different businesses: logs are used for sawn timber and plywood and lignin and fibrils are used to create new products are two examples.

The company has also traditionally used the residues of pulp and paper processes – bark, sawdust and black liquor – in energy generation in the power plants of pulp and paper mills. UPM aims to become a major player in biofuels and considers several forest biomass fractions and residue from existing wood processing industry as suitable and sustainable feedstock for biofuel production.

Driver´s seat in wood-based biofuels

EU 2050 energy scenarios are based on the premise that biomass will be critical to decarbonisation. The EU's renewable energy directive favours advanced biofuels, which are produced from lignocellulose, waste and residue-based raw materials.

The residue and waste streams of an existing industry, such as forests, offer feasible and sustainable raw materials for biofuel production. A recent report by the European Climate Foundation, in conjunction with the biofuels industry and certain NGOs, concluded that converting all sustainably available forestry, agricultural and municipal wastes and residues in the EU to biofuels could cover up to 16% of road transport fuel by 2030.

Biofuels tackle the oil dependence of the transport sector, which is one of the most serious issues affecting EU energy supply security. Demand for advanced biofuels will increase in the coming years as the EU's target cannot be reached with current first generation biofuels alone. The debate on food-vs-fuel and ILUC impacts of first generation methods continue to attract attention.

A significant part of European forest resources is not utilised and the forest area keeps expanding. A wood-based renewable diesel plant of 100,000 tonnes uses an estimated amount of 1 to 1.5million m^3 of wood annually. It is likely that, by the end of the decade, there will be no more than a maximum of five such plants operational in Europe, therefore using an estimated 1% of European wood harvesting at the most.

The technology to produce renewable biofuels from wood exists and, with the management practices and tools developed for years, the sustainability of wood-based raw material can be guaranteed. Various biomass assessment studies indicate there is a substantial quantity of sustainable biomass available for energy production.

Wood-based biofuels produced from raw materials originated from sustainable forest management is among the most promising lower risk biofuel feedstock – and will soon become a reality. The world´s first biorefinery producing wood-based renewable diesel at commercial-scale is due to be opened this summer by UPM.

It will use crude tall oil, a residue of pulp production, as a feedstock and is integrated into its existing pulp and paper mill in Lappeenranta, Finland. Annual production is pinpointed at 120 million litres of renewable diesel for transport.

For more information:
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Taking shape: the UPM Lappeenranta facility in Finland