

# Bioenergy in Finland



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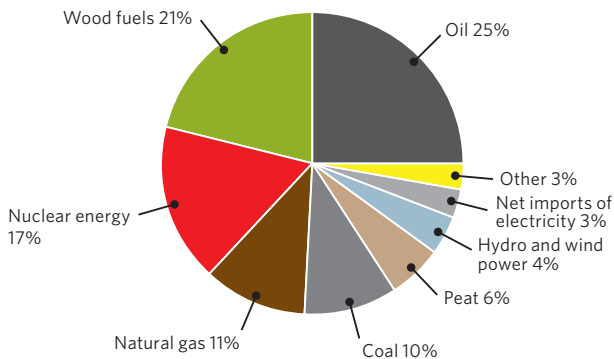
Finland is known as one of the leading countries in the world in the production and utilisation of renewable energy. Bioenergy is our most significant source of renewable energy, accounting for approx. one-fifth of Finland's total energy consumption.

In order to curb climate change, production of renewable energy must be increased from the present level, also in Finland. This requires a sharp increase in the use of bioenergy in particular.

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## Total energy consumption 2008

In 2008, total energy consumption in Finland was 1 410 PJ (392 TWh, 33 Mtoe) and electricity consumption 87 TWh.



Source: Yearbook of Energy Statistics 2009. Statistics Finland



**Chippers and crushers with novel constructions operate either at the roadside, at intermediate fuel terminals or at power plants.** Photo: Pekka Rötönen

Finland has a target to increase the share of renewable energy from 28,5% in 2005 to 38% by 2020. This is equal to 124 TWh, the increase being 37 TWh during the same period. About 80% of the Finnish renewable energy comes from bioenergy.

In Finland half of the heating demand is covered by district heating. It is produced in forest industry plants, CHP plants in cities as well as in small-scale regional heating plants.

Production of forest energy and field crops requires a diverse and technically demanding stock of equipment and well-designed logistics chains year around. Those we have in Finland.

# Efficient heat and power production

Biofuel provides the best energy efficiency in combined heat and power production (CHP). Heat and electricity are produced simultaneously with the same amount of fuel.

The heat and steam energy produced this way is directed to industrial processes or to district heating networks in population centres. Mixed combustion of biomass and fossil fuel in major power plants reduces their greenhouse gas emissions in relation to the mix used.



**Andriz, Recovery Boiler, UPM Ltd, Pietarsaari Finland.**

Photo: Timo Vesterinen

Good Finnish examples of combined heat and power generation using biofuels include the black liquor recovery boilers in pulp mills and the large mixed combustion boilers for solid fuel, used in the forest industry and in cities.

In 2010, about 70% of the Finnish bioenergy is produced by the forest industry, which in Finland has developed progressive bioenergy processes based on black liquor, bark and saw dust. Biogas plants can produce CHP energy efficiently on a smaller scale.

# Biomass Heat Entrepreneurship, a new business model

Several municipalities in Finland today have biomass district heating systems. In the early 1990s, farmers formed and started new kinds of enterprises: they became heating entrepreneurs, supplying customers with heat produced from wood fuels.

Today, a heating entrepreneur/enterprise is a co-operative, a limited company or an entrepreneur consortium, which sells bio-based heat energy.

The heating enterprise typically operates locally and the main fuel is wood. The fuel comes from local forests or from industrial wood residues from the local wood-processing industry, such as saw mills. The heat entrepreneur operates the heating plant and earns an income based on the amount of heat generated. The price of heat energy is usually bound to the price of light fuel oil and to some common price indexes.

In 2010, about 200 heating entrepreneurs are supplying heat to almost 500 locations, such as schools, district heating networks and industrial buildings and processes. The average size of a plant is 800 kW.



**In 2010, about 200 heating entrepreneurs are supplying heat to almost 500 locations in Finland.**

Photo: Kimmo Haimi

# Biomass into liquid and gas for the needs of transport

Finland is aiming for a 5.75% share of renewables in transport fuels in 2010, rising to at least 10% by 2020, whilst the newest target is 20%.

In order to reach these targets, we need raw materials for renewable fuels from many different sources. Bio oils, solid biomass and industrial alcohols may be used as raw material for transport fuels.

Ethanol to be used as a transport fuel is manufactured with technologies that have been developed in Finland, for example, from sorted biowaste derived from the food industry and from households, or by the latest method, agro biomass.

The forest industry and its co-operation partners use bio-refinery solutions for testing the production of raw material for biodiesel through wood biomass gasification and chemical reprocessing.



Biogas is also suitable for use as transport fuel.

Biogas is produced in landfills, and in the reactors of wastewater treatment plants and biogas plants of various sizes, utilising agricultural wastes. Gas is used in local heat production, in more extensive combined and heat and power production (CHP) or as transport fuel.

**Stora Enso is working with Finnish oil company Neste Oil to jointly develop technology to produce next generation renewable fuel made from wood residues. The demonstration plant has been integrated into Stora Enso's Varkaus Mill. Photo: Stora Enso Ltd**





**Good quality of chips ensures smooth and efficient energy production.**  
Photo: Kimmo Haimi



**Covering must be wide enough to guarantee the first-class quality of wood fuel and chips during winter and rainy periods.** Photo: Tanja Lepistö



# Wood biomass rules

The majority of Finland's renewable energy is produced from forest-derived biomass. Approx. 60% of renewable energy is produced in the pulp production and bark combustion in the forest industry.

Fuel procurement for major biomass power plants of the forest industry and cities is a demanding logistical entity, which is managed by forest machinery and transport companies specialised in the field.

The forest industry receives its timber and energy biomass as so-called integrated procurement. This means that industrial pulp wood and energy biomass are harvested and transported to the plants using mainly the same equipment.

Major CHP plants buy their fuel through logistics companies, while the fuel for heat entrepreneurs' plants is procured from nearby forests and delivered by shareholders.

The use of firewood in the heating of detached houses also plays an important role in Finland's energy economy. Firewood constitutes the third largest use of bioenergy after the forest industry and major biomass power plants.

# From the stump and field to the boiler

Efficient biomass harvesting techniques have been developed in Finland, and there are strong companies operating in the industry.

Integrated in the harvesting of industrial wood, harvesting of wood biomass from the forests takes place mechanically. Trees are debranched immediately after felling, and the branches fall into heaps next to the machine. The branches are moved into larger heaps by the side of the forest roads to wait for chipping.

In the forest, the heaps can also be baled to facilitate transportation to the power plant. Small trees from first thinnings are harvested as whole trees, and the trunks including their parts are transported to the side of the road to dry and wait for chipping.

The branches, or the whole trees, are chipped for combustion by the side of the road directly onto the wood chip platform of a lorry, and transported further to the warehouse of a power plant or heating plant.

Biorefinery plants also use branches as raw material in liquid biofuel production.

Reed canary grass grown in the fields is harvested dry in the spring, and usually compressed into large bales. These bales are stored with care to wait for transportation to the power plant where they are crushed and then combusted amongst wood chips or peat.



Photo: Olli Toivonen / Vastavalo

# More information

Growing Power brochure gives more detailed information about Finnish bioenergy solutions. It is available in PDF format on Internet, see [www.tekes.fi/en/community/Publications](http://www.tekes.fi/en/community/Publications)

CLEEN Oy, the energy and environment strategic centre for science, technology and innovation, [www.cleen.fi](http://www.cleen.fi)

[www.cleantechfinland.fi](http://www.cleantechfinland.fi)

VTT Technical Research Centre of Finland, [www.vtt.fi](http://www.vtt.fi)

Finnish Forest Research Institute, [www.metla.fi](http://www.metla.fi)

Statistics Finland, [www.stat.fi/energy](http://www.stat.fi/energy)

Ministry of Employment and the Economy, [www.tem.fi](http://www.tem.fi)

Ministry of Agriculture and Forestry, [www.mmm.fi](http://www.mmm.fi)



The Bioenergy Association  
of Finland  
Vapaudenkatu 12  
FI-40100 Jyväskylä  
Finland

Tel. +358 (0) 207 639 600  
Fax +358 (0) 207 639 609  
[www.finbioenergy.fi](http://www.finbioenergy.fi)



Urho Kekkosen katu 4-6 A  
P.O.Box 489  
FI-00101 Helsinki  
Finland

Tel. +358 (0) 424 2811  
Fax +358 (0) 424 281 299  
[www.motiva.fi](http://www.motiva.fi)