

# Forest-based Bioenergy Production and Use

## Country Report in a Nutshell – Norway

### Promotion of wood and bioenergy

The forest-based sector in Norway is highly export oriented and is going through a process of transformation. Global competition is increasing all the time in many segments of the present range of products. The forest as a versatile resource is attracting more and more attention. The way forward for the forest-based sector in Norway lies in developing products with a higher added value, having a strong customer focus and including socio-economic elements.

The Norwegian forests represent the largest potential for supply of raw material for production of bioenergy. The production of bioenergy could be more than doubled by increased harvesting for energy purposes. To stimulate farmers and forest owners to produce, use and supply the market with bioenergy - both as solid fuel and heating solutions - the Bioenergy Scheme was established in 2003. With increased attention on climate change and the role of forests as a source of carbon neutral energy, the budget of the programme has been considerably increased over the last years. The aim is to reduce the use of fossile fuels, diversify the energy supply and to provide a basis for economic development in rural areas.

The utilization of bioenergy in Norway has increased from about 10 TWh in 1985 to 16 TWh today. Bioenergy currently accounts for about 7% of the total inland energy consumption. In Norway, a proposed target for bioenergy has been set to increase the use of bioenergy by 14 TWh by 2020, which is close to a doubling from current use (16 TWh/year). In relation to this, a medium-term target exists by 2012 to generate 4 TWh of heat from bioenergy. A general ambitious target is 30 TWh more renewable energy and energy savings compared to 2001 by 2020.

### New policy developments - climate

- The White Paper on Norwegian Climate Policy was adopted by the Norwegian Parliament with several amendments 28 March 2008 (The Climate Agreement)
- Target to become carbon-neutral by year 2030 and to reduce the annual greenhouse gas emissions by 15–17 million tons of CO<sub>2</sub> equivalents by 2020, including carbon uptake in forests
  - In 2005 the Norwegian greenhouse gas emissions was 54 million tons CO<sub>2</sub> equivalents.
- The green house gas reduction targets will be reached through broad and general economic measures, CO<sub>2</sub>-emission credits and CO<sub>2</sub>-tax, and a set of specific measures within different sectors and industries
  - Measures in the field of renewable energy and energy efficiency will play an important role for fulfilling the green house gas reduction targets

### New policy developments - Bioenergy

- *The government has sett a national target of 14 TWh/50 PJ increased use of bioenergy by 2020 (White Paper on Norwegian Climate Policy)*
- A strategy plan following the target was launched 1 April 2008
- The main strategy is to increase the use of bioenergy for heating followed by a balanced increase in the supply of wood and forest based fuels
- The strategy will be supported by the following range of measures:

- Establishment of a bioenergy forum lead by the Minister for Petroleum and Energy
- Regulatory energy and climate planning by all municipalities
- Compulsory instalment of water born heating systems in public buildings above 500 m<sup>2</sup>
- Removal of compulsory reduction in transmission tariffs for spot electricity used for central heating
- Continued investment support for district heating, central heating based on renewable energy and conversion of fossil fuel based heat production in industry
- Increased investment support for pellet stoves in private households
- Prohibition against instalment and re-instalment of oil-burners in new and existing buildings
- Increase budgets for R&D in the field of renewable energy
- Development of efficient logistics and supply changes for forest and wood waste based fuel
- Various information and advisory measures

#### Norway's forest volume is increasing

Forests cover approximately 40 % of the Norwegian mainland, and approximately 120.000 km<sup>2</sup> is regarded as forested area and other wooded land. By area, 78% is owned by private individuals.

For many years fewer trees have been taken from Norwegian forests than the annual increment allows. This means that the total biomass of forest is increasing, - creating considerable amounts of wood reserves which could have been utilized to by local establishments. The annual increment today is about 25 million m<sup>3</sup>, while the total annual harvest is only about 10-11 million m<sup>3</sup>. Abandoned farm land naturally turns into broad-leaved forest stands and is considered a problem because the frequency of scenic views has decreased.

The most important *potential* energy wood resources in Norway are as follows: a) logging residues from clear cuttings, b) whole trees from young dense stands and from abandoned farm land, and eventually c) stumps from clear cuttings. At present these marginal resources are still utilized to a limited extent in Norway due to low profit for both the forest owner and the contractors. The methods most often used are mobile terrain chippers, accumulative felling heads and multi-tree handling, bundling of whole trees and GROT (branches and tops) etc. – new methods that hopefully will lower the harvesting and handling costs in the future.

The supply of forest fuel in Norway is still associated with high harvesting and transportation costs, particularly in the case of whole tree harvesting in first thinnings. Today, the fuel chips from first thinnings are not competitive without subsidies. Shortage of skilled entrepreneurs and a lack of harvesters suitable for harvesting of small trees cause low profit margins for the operations, and these problems remain major challenges for the future.

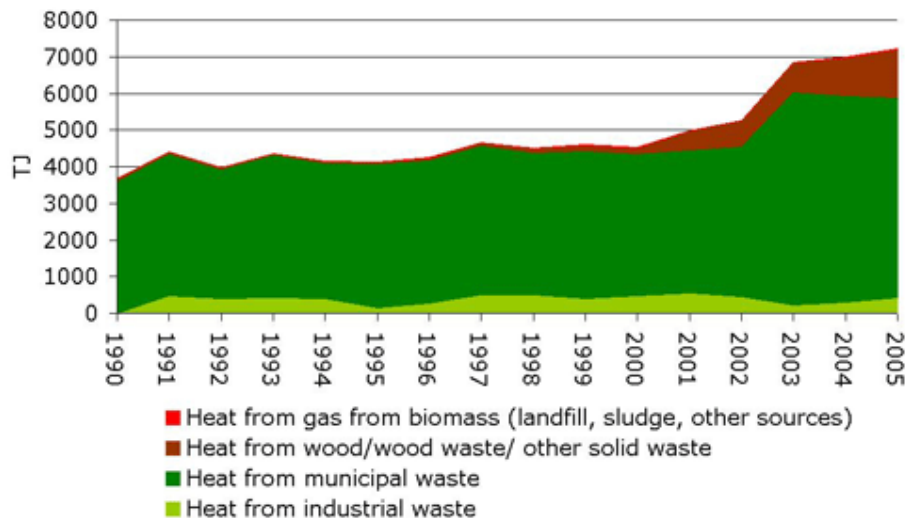
#### Bioenergy use

The forest-based industry in Norway provides a very effective platform for the generation of energy in combination with the production of fibres and “green” chemicals. There is, as part of this, an emerging *bio-refinery concept*, which foresees a new balance in the use of wood for lumber, pulp, green chemicals, liquid biofuels, and green energy. In this context, the sector has the potential to deliver increased amounts of energy as a by-product of industrial processing, and for wider use than just a source of local heat.

In Norway today, bioenergy is used primarily for heating purposes, and the use of firewood in separate wood stoves is still very common. The use of district heating systems has been limited to areas in the larger cities. Limiting factors are a widely distributed population and the rocky landscape, which makes the building of distribution infrastructure expensive. Industrial use of heat is still secured by local electrical or oil fired boilers. District heating has and is expected to increase significantly. District heating plants are planned in many cities and in most cases the plants will be based on energy from biofuels and waste. Central heating of apartment buildings, public buildings, institutions etc. is also becoming more usual and will give bioenergy sources the chance to compete with electric heating.

Municipal waste produces the bulk of bioenergy heat in Norway, increasing by 52% over the period from ca. 3,600 TJ in 1990 to ca. 5,500 TJ in 2005. Industrial waste and heat generated from biogas represent a stable minor share of overall bioenergy heat production. Heat generated from wood and wood waste has increased significantly since 2000 and represents today 18% (1,316 TJ) of bioenergy heat produced in Norway.

Gross heat production from bioenergy in Norway, 1990-2005



Source: Statistisk Sentralbyrå, 2006

Historically, biomass has been a major fuel for heating. However, due to past low electricity prices electric space heating dominates and Norway has a very limited use of thermal based furnaces for heating in the households as is seen in the other Nordic countries.

Since 1997, the Authorities have provided subsidies to use bio-energy for heat production (district heating). District heating only makes up 2% of the energy supply for heating in Norway unlike in the rest of the Nordic countries. Heat based on industrial waste wood resources is mainly used in wood industries as process heat. 1/3 of the final biomass use is based on industrial waste wood. The other 2/3 is for heat in households.

*Power production and biofuels for transport* are so far of insignificant volumes. Norway has had access to inexpensive hydroelectric power in abundance, but the increasing need can no longer be covered by domestic production.

## Bioenergy and biofuel projects 2008

- Innovative concept for cost-effective distributed energy production from waste and biomass
- Cost effective utilization of bioenergy ACOM
- Socio-Economic Drivers in Implementing Bioenergy Projects
- Reduction of emissions from stoves and fireplaces
- Modular bio-micropower station
- Enabling small scale biomass CHP in Norway
- Biomass gasification in a TGA
- Energy-effective dewatering and drying of sludge
- LTL – biofuel from lignin
- Synthetic biodiesel from biogas
- Biofuel in ships
- Second generation biofuel - technology development and impacts on biomass markets
- Production of liquid biofuel from Nordic wood material
- E6 as biogas road, biogas in Fredrikstad
- Etanol from cellulose-based waste

## Enovas\* programs for renewable heat and bioenergy

\*Enova manages the Energy Fund and finances programs and initiatives that support and underpin national objectives

- Program for establishment of new district heating
  - Investment support
- Program for expansion of district heating infrastructure
  - Tendering process
- Program for conversion to and establishment of heating centrals based on renewable fuel
  - Investment support
- Program for investment in small scale applications in households
  - Fixed investment support
- Program for demonstration and introduction of new energy technology
  - Investment support
  - Subprogram in collaboration with the Norwegian Research Council

*Approx. 1/3 of Enovas total budget, ca. 100 million US\$ pr. year*

## Challenge

The forest's role as a supplier of biomass for energy is growing in importance, and Norway assume that the forest-based sector is particularly well placed to contribute to sustainable development. Through major technological improvements in bioenergy conversion to heat, biofuels and power, it would be possible to a) accelerate the decrease in the share of fossil fuels used in the forest-based industrial sector, b) significantly increase the electricity-generation efficiencies of large-scale combined heat and power (CHP) plants fired by forest-derived fuels and c) considerably increase the amount of heat produced from forest biomass in small-scale industrial, communal and household plants. Accordingly, it will be crucial in Norway to secure a high-quality raw-material supply, and Norway is planning for R&D projects to improve wood-supply systems and forest management models.

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