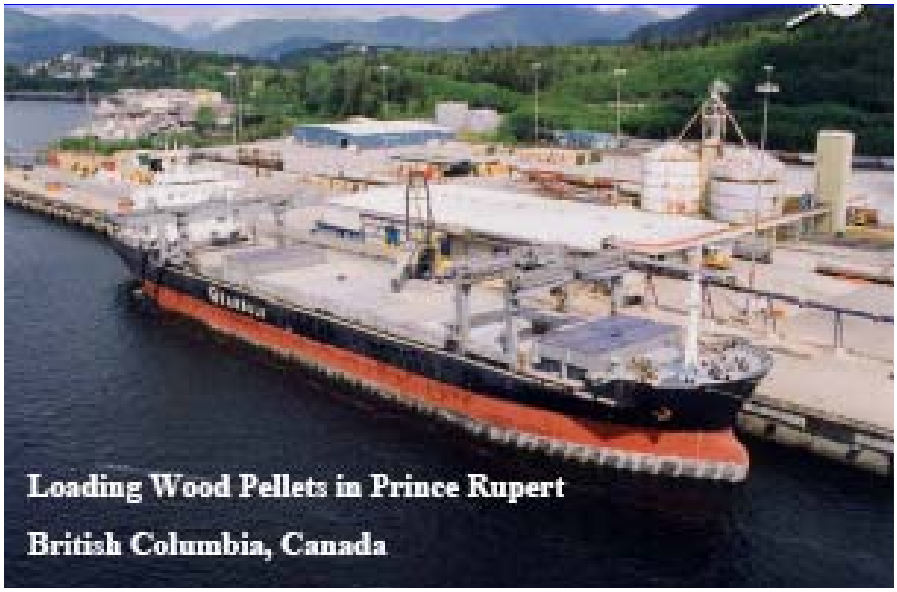
EUBIONET2

Factsheet 10 – the Netherlands

Wood pellets from Canada



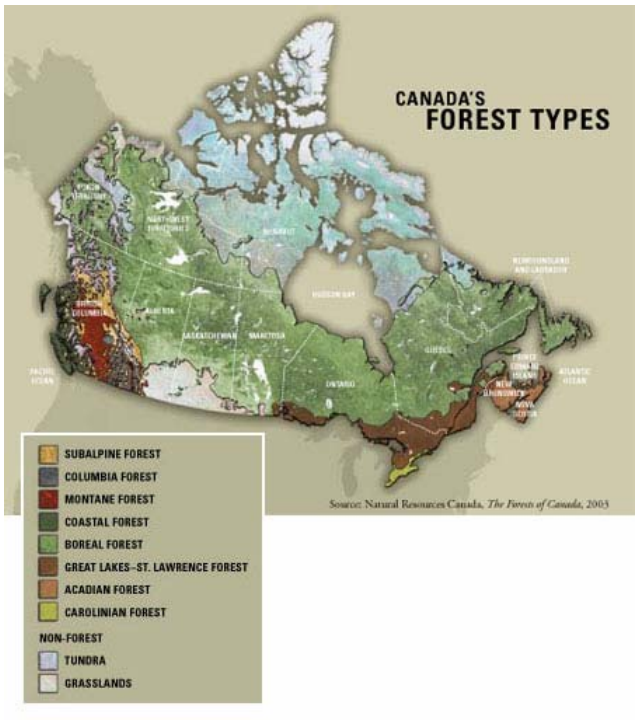
Availability of wood for wood pellets in Canada

In Canada the raw materials for wood pellets stem from two wood sources: saw mill residues (saw dust and bark) and 'standing dead wood'.

About 294.8 million hectares of Canada's forest are not reserved and could therefore be available for commercial harvesting. Just under half (143.7 million hectares) of these potentially harvestable hectares is subject to forest management and, of that half, 0.9 million hectares is harvested annually. Forestry industry is located primarily in British Columbia (33 percent of production); Quebec (28 percent of production) and Ontario (20 percent of production). Production is 80% coniferous wood. Major tree species are pine, Douglas fir, spruce, birch and Western Red Cedar. Terrain varies from mountainous in British Columbia to hilly in Quebec and Ontario. Of the 0.9 million hectares of forest harvested each year, 53 percent is regenerated naturally, 43% is replanted and four percent is direct-seeded.

As of June 2006, some 120 million hectares of forest were certified under one or more of the three forest specific certification systems available in Canada—Canadian Standards Association, Forest Stewardship Council and Sustainable Forestry Initiative. All standards used in Canada engage Aboriginal peoples and local communities and, for greater transparency, require annual audits and public disclosure of assessment reports.

Saw mills in which harvested/felled round wood are sawn into construction wood usually convert 65%–75% of the fresh round wood into saw dust, bark and other residues. The amount of residues is larger than required for board production and the surplus is or can be converted into pellets. Pellet producers prefer sawdust and shavings as raw material, which amount to approximately 15% of the felled tree. Canadian timber production amounts to 81 million m^3 annually, which means that theoretically 15% ÷ 30% = 40 million m^3 of sawdust and shavings are available annually.



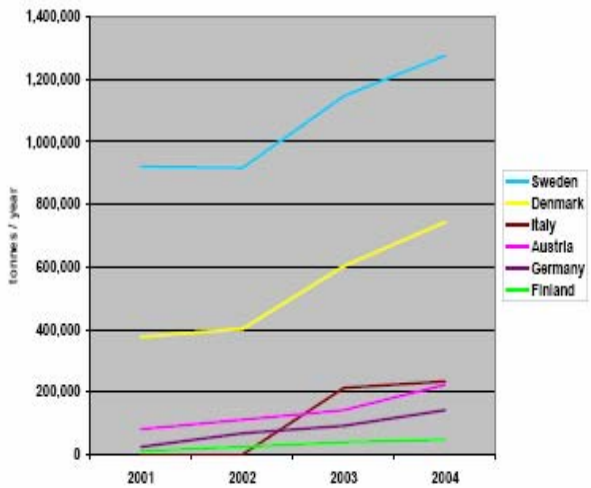
Apart from this standard industrial practice there is a more specific resource in the shape of standing dead wood in British Columbia on the Canadian West Coast. In the British Columbian forests more than 400*106 m^3 or Mtonnes of pine has been killed by the Mountain Pine Beetle. This wood is apparently unsuitable for the usual applications in timber and paper industry and is therefore harvested and processed into fuel pellets. Because Mountain Pine Beetle invested wood poses a high risk for forest fires clearing of affected area's is seen as a preferable.

Pellet production

Current and future market situation for pellet production can be characterised as follows:

Current situation

- Pellet production in Europe and North America currently amounts to approximately 4 Mtonnes annually, of which approximately half is produced in Europe and 1.2 Mtonnes in Canada.
- Pellet consumption in North America is approximately 1.6 Mtonnes, mainly for domestic stoves. Canadian 'surpluses' are exported to Europe.
- European consumption currently amounts to 2.2 Mtonnes. Consumption partly concerns utilization in domestic stoves – primarily Austria and Switzerland – but next to this a large percentage is consumed in local combined heat and power plants and industrial boilers, especially in Sweden and Denmark.
- Main consumers of imported pellets are Denmark and Sweden.



Future situation

- Consumption of wood pellets is expected to increase to approximately 10 Mtonnes in 2010, mainly due to the EU renewable energy targets, which require utilization of large quantities of biomass.
- The increasing consumption will be covered primarily by increased production in Canada. An increase from current level to 5.5–6.0 Mtonnes annually is expected.

Proof of the expansion of the pellet production industry is that four wood pellet producers in northern BC have tripled in size for the last 4 years running. Of the British Columbian production of 0.6 Mtonnes annually 90% is exported to Sweden.

Production technology and methods

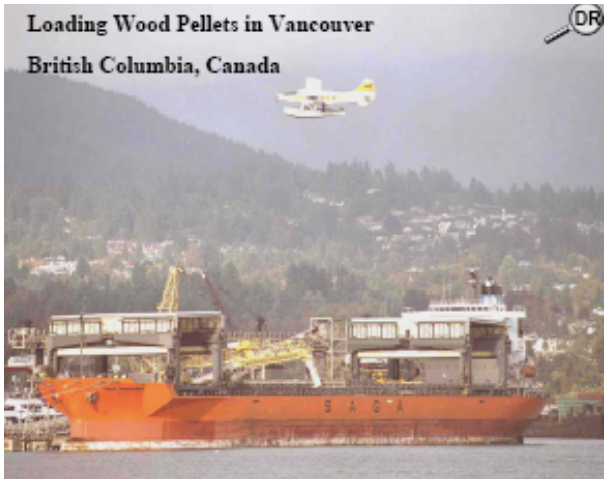
Wood for timber industry and standing dead wood are cut, disbranched and transported by truck to respectively sawing mill and pellet mill at 50–75 kilometres distance. Roots are left in place. Round wood is sawn into construction wood (lumber) and residues are subsequently transported by truck to the pellet mill at a distance of 50–75 kilometres.

Standing dead wood and shavings will be crushed into smaller particles with a hammer mill first. The crushed wood is dried, milled again in hammer mills and pressed through a mould at high pressure, plasticizing the wood. The plasticized mass is cut into pellets, which are screened for size, cooled and subsequently stored and transported to ports for export.

For drying approximately 20% of the saw dust is consumed.

Transport is primarily by railway in British Columbia, but may also be by truck in the Eastern Provinces.

The main ports for export in Western Canada are Prince Rupert and Vancouver. Major export ports on the Eastern coast are Quebec and Halifax.




1. Raw Material


2. Raw Material Infeed


3. Rotary Drum Dryer


4. Pelletizers


5. Screen


6. Storage

Production costs and purchase prices

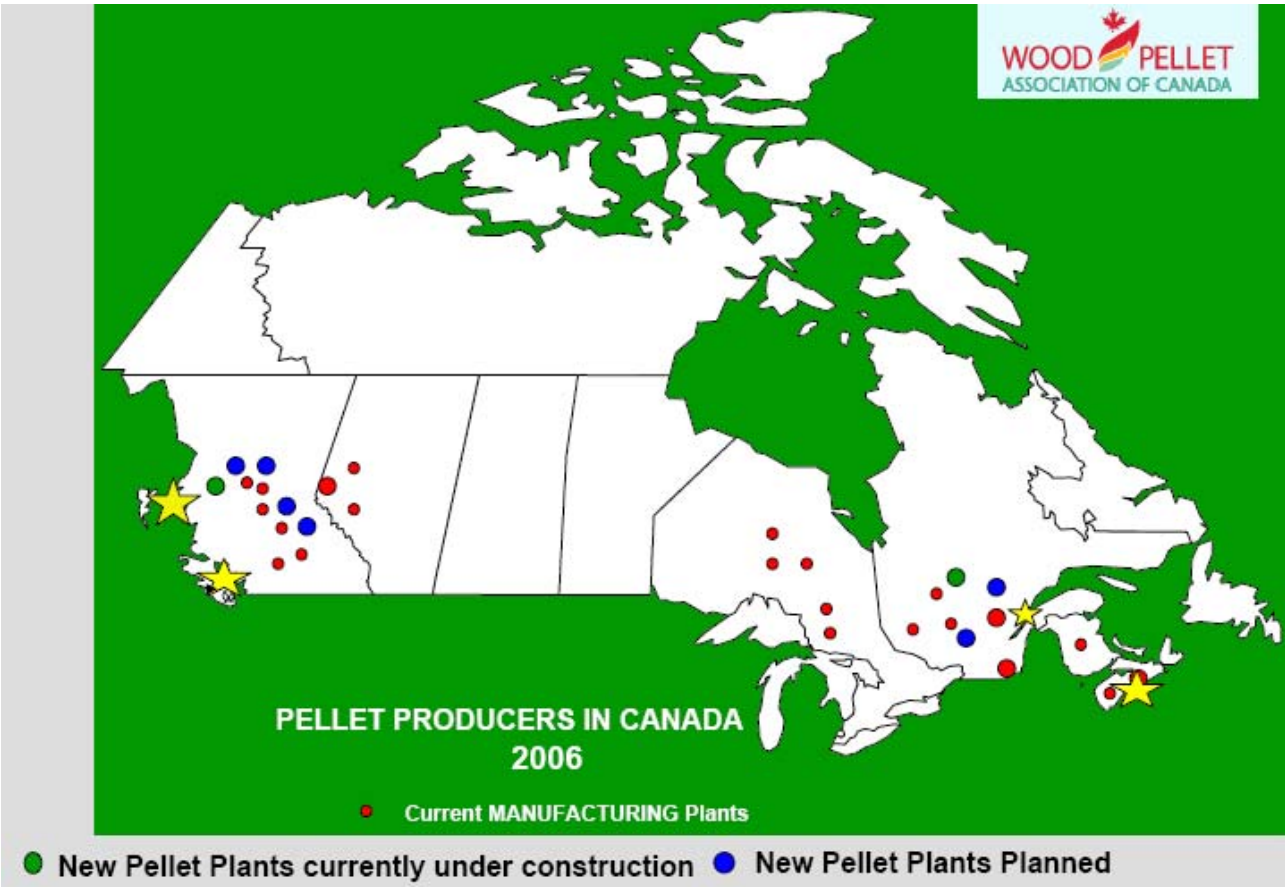
Mill gate prices for pellets (net caloric value 18.5 GJ/tonne) are given as approximately $100/tonne or approximately €80/tonne. Production costs however are estimated to be between $60 and $75 (€50–€60) of which $20–$30 for raw materials.

Transport to export port and ship loading amount to another €35/tonne and sea shipping by bulk carrier to Rotterdam will cost approximately €25/tonne, bringing total Rotterdam CIF price to €140/tonne. Scandinavian CIF tariffs are slightly higher because of the longer transportation distance. And inland prices will be also higher of course because of inland transportation. Prices known for Dutch power companies match well with the €140/tonne level. The European Pellet Centre site mentions prices of €140/tonne for large district heating power plants in Denmark and prices of approximately €180/tonne for large customers (> 5 tonnes per delivery) in Denmark, Sweden and Germany, delivery included.

Organization

In Canada five plants have a production capacity of over 80,000 tonnes, several plants have a capacity in the 200,000 tonne range. For comparison, average European plant size amounts to 7.5 ktonnes annually. Average plant size in Canada amounts to 50–60 ktonnes/annually. In Canada, pelletizing facilities have been designed to serve the export market and are located near world class sawmills that generate much larger volumes of sawdust, planer shavings and other whitewood residue compared to European sawmills. It seems that pellet mills are operating independently from sawmill and forestry companies.

Pellet plants are located primarily in British Columbia, Quebec and Ontario, the same Provinces where the largest part of Canadian forest industry is situated.



Marketing: input in power plants

In the Netherlands wood pellets and other biomass is cofired in power plants.

Cofiring of biomass in Dutch powerplants (quantities in ktonne)

Coal fired power plant	Input of biomass in 2005	Maximum permitted input in 2005
Maasvlakte	255	288
Amer	581	570
Borssele 12	129	120
Gelderland	54	60
Willem-Alexander	15,9	330
Hemweg		40

In case of cofiring of the pellets in large coal fired power plants, the pellets are typically added to the coal prior to milling and are milled together with the coal in the coal mills. The produced wood dust is pneumatically transported to the power plant together with the coal dust and co-combusted in the same burners as the coal dust. Grinding in the coal mills does however require pellets with a certain minimum hardness, which can be deducted from the density. Density should be higher than approximately 600 kg/m^3.

Cofiring without burner adjustment is possible up to 20–30% on energy base, as has been demonstrated at the Borssele 12 power plant. Higher percentages, up to 70–75% on energy base are possible but require installation of so-called multi-fuel burners. High co-firing percentages have been demonstrated in several plants, e.g. the Avedøre II plant in Copenhagen.

Cofiring in standard coal fired power plants requires investments of €120/kWfuel for fuel handling and intermediate storage and requires O & M costs of 1.2 €cent/kWh$_e$.

Amer power plant of Essent in Geertruidenberg (Rijkswaterstaat).

Fuel quality and specifications

For fuel pellets produced in North America typical specifications are

- A moisture content of 4.5%
- An ash content of 0.4%
- Net heating value of 18.5 GJ/tonne
- Density of 650–700 kg/m^3

Since the pellet market is international since as early as the late nineties specifications are comparable with those of pellets produced in Europe.

Recommendations of suitability

In the Netherlands more and more wood pellets and other biomass is used for co-firing in power plants. In the Northern part of the Netherlands permission is granted to build a so-called multi-fuel power plant. Also in the other plans for building new coal fired power plants in the Netherlands the input of wood pellets and other biomass plays an important role.

In building these plants and for the input in already existing plants it is important to make sure that the biomass will be delivered for many years. That's why it is recommendable to contract the biomass for a long period of time. Some firms buy or setup their own production system of biomass by buying forests or land and production facilities.

Alternative applications

Alternative applications for surplus forest industry residues (not processed into panel and board) could be conversion by pyrolysis into bio-oil. In Canada pyrolysis technology has been developed by DynaMotive into commercially available modular installations capable of processing up to 200 tonnes/day of wood. Next to this, gas turbine technology capable of utilizing pyrolysis oil is being developed. Utilization of pyrolysis oil in gas turbines would allow for high efficient electricity production.

In the pyrolysis process prepared feedstock (<10% moisture and 1–2 mm particle size) is fed into the bubbling fluid-bed reactor, which is heated to 450–500 °C in the absence of oxygen. This is lower than conventional pyrolysis systems and, therefore, has the benefit of higher overall energy conversion efficiency. The feedstock flashes and vaporizes like throwing droplets of water onto a hot frying pan. The resulting gases pass into a cyclone where solid particles, char, are extracted. The gases enter a quench tower where they are quickly cooled using BioOil already made in the process. The BioOil condenses and falls into the product tank, while non-condensable gases are returned to the reactor to maintain process heating. The entire reaction from injection to quenching takes only two seconds.

100% of the feedstock is utilized in the process to produce BioOil and char. As the non-condensable gases are used as energy to run the process, nothing is wasted and no waste is produced. The uncondensed, flammable gases are re-circulated to fuel approximately 75% of the energy needed by the pyrolysis process.

Three products are produced: BioOil (60–75% by weight), char (15–20% wt.) and non-condensable gases (10–20% wt.). Yields vary depending on the feedstock composition. BioOil and char are commercial products and non-condensable gases are recycled and supply a major part of the energy required by the process.

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