This Is Bioenergy!

FACT SHEET: 2/98 • Wood fuels

SVEBIO

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The Swedish Bioenergy Association, SVEBIO, was formed in 1980. Its members consist of private persons, companies, authorities and organisations. The Association works for an increased use of bioenergy in an environmentally considerate and optimal manner.

STEFAN ERITSLAND/NATURFOTO

Vast amounts of energy are waiting to be collected in the forest, most of which consist of branches and tops from felling operations.

Forest fuels
– green gold in the forest

■■ Wood fuel is not something that is going to happen sometime in the future, it is here already. Today more than 100 municipalities obtain considerable amounts of their heat from forest fuels.

Since the mid-1980s wood fuel obtained directly from the forest has steadily increased its share of the energy supply. This has contributed to strong reductions in the imports of oil. Today, wood fuels produce 43 TWh, largely in the form of heat. This exactly corresponds to the amount of electricity used for heating. Forest fuel, also including the black liquors from the pulp industry, today produce more than 15 per cent of Sweden's energy supply.

Wood fuel is conveniently packaged solar energy. This is a renewable source of energy that does not damage the environment. The threat scenario that has been proposed - that the forest will be vacuum-cleaned of its contents if felling residues are removed - does not hold. Moreover, wood fuel is an inexpensive alternative with good developmental opportunities. SVEBIO estimates that by year 2020 wood fuels will be capable of producing almost three times as much energy as today.

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Swedish National Energy Administration

Sustainable source of energy

By correct use of wood fuel we can reduce emissions of carbon dioxide to the atmosphere and the nitrogen load on the forest. We will slow down the greenhouse effect and acidification. We will extract energy in a manner that has long-term sustainability and can be both ecologically and economically justified.

● Carbon dioxide in balance

Many researchers consider that the greenhouse effect is the greatest environmental threat today. The effect is the result of our emissions of gases that prevent the heat from the sun from leaving the atmosphere, with resulting global heating. The most important gas that forms this blanket enveloping the world is carbon dioxide formed during combustion.

When we use fossil fuels such as oil, coal and natural gas we increase the concentrations of carbon dioxide in the atmosphere. Today, Sweden cannot achieve its goal to reduce the emissions of carbon dioxide. However, by using wood fuel we will not be releasing more carbon dioxide than what will be bound in the trees during their growth.

● Less nitrogen

Removal of wood fuel also has other environmental advantages. It counteracts the excessive saturation of forest land with nitrogen, that leads to leaching and acidification. Nitrogen is an important plant nutrient that is found bound in the soil. But today large areas of forest land receive more nitrogen through atmospheric deposition than they can retain. This overdose contributes to the forest growing faster in the short-term perspective. In a longer perspective the nutrient imbalance leads to the ground becoming acidified. The soil will then start to leach out nutrients which will lead to water courses being eutrophicated and changes in the flora.

When tops and branches are removed from the felling site the nitrogen bound in the

Availability of wood fuel

■■ More than half of Sweden's land area is covered by forest. During the last century the standing volumes of wood in Swedish forests have doubled. How much fuel can we extract during the early part of the next century? We are all in agreement about the actual amount of wood fuel, the gross volume, but how much is actually available? This mainly concerns economic assessments and if the ashes are returned to the forests or not.

SIMS

The Department of Forest-Industry-Market Studies (SIMS) at the Swedish University of Agricultural Sciences has conducted the most detailed calculation at the request of the Energy Commission. The demand for forest products and wood fuel, the requirements for industrial round-wood, felling calculations and ordinary felling, felling residues, forest growth and ecological consideration are some of the many factors that affect the availability of fuel.

When bearing in mind the Forest Act and the Board of Forestry's recommendations on ecological consideration, the total amount of available wood fuel is about 130 TWh/year. The condition is that the nutrients removed with the fuel are recycled to the forest in the form of ashes together with compensation fertilisation.

SWEDISH FEDERATION OF FOREST-OWNERS

At least 30 TWh in addition to today's use of wood fuel up to year 2020 provided that the ashes are recycled - that is the assessment of the private forest-owners. The Federation estimates that the production of wood fuel directly from the forest could probably be increased by about 2 TWh per year during a 10-year period.

The forest-owners have based their prognosis on the calculations made by SIMS (discussed above) but the figures have been modified on the basis of what is considered to be economically reasonable. In contrast to SIMS, no volumes of industrial by-products or recycled wood have been taken into account.

SWEDISH FOREST INDUSTRIES ASSOCIATION

Swedish Forest Industries Association has used the Board of Forestry's recommendations to harvest only once per rotation (during the life of the tree) if the ashes are not recycled. They do not consider that there is any future in the

SOFIE SAMUELSSON, FOTOGRAFTEN BRUKSPROJ

How much can be burnt? The availability of raw material is unquestionable but there are different opinions about how much wood fuel that can be utilised.

This is wood fuel

■■ Wood fuel, isn't that the same as firewood? Of course firewood is a wood fuel, but firewood makes up only a fairly small part of the total use of wood fuel.

Wood fuel is defined as a biofuel consisting of raw wood that has not been subjected to any chemical process. The common factor for all our wood fuels is that they come from the forests. They consist of felling residues, i.e., branches and tops that remain when the stems are removed in clear-fellings. There is also the slash resulting from cleaning and thinning. And there is bark and firewood.

Wood fuel also includes secondary products from the forest- and furniture industry such as bark, shavings and recycled wood.

Wood powder, pellets and briquettes are processed wood fuels.

use of thinning waste for wood fuel.
The Association bases its calculations on what is today economically available in the forest: 70 per cent of the felling residues on clearcuts suitable for wood fuel can be removed and of these clearcuts 70 per cent are considered suitable.
If 90 million cubic metres are felled annually this would give 17 TWh. With recycling of the ashes and compensation fertilisation, the Federation's calculations suggest that 15-20 TWh felling residues can be removed from the forest during the early years of the 21st century

SWEDISH ENVIRONMENTAL PROTECTION AGENCY

Having made an assessment together with the National Board for Industrial and Technical Development and the Board of Forestry that a total of 140-160 TWh could be extracted from Swedish forests, the Swedish EPA revised their opinions a couple of times. Finally, the forestry Report from the EPA's "Sweden 2021" project arrived at a figure of 20-25 TWh. The Forestry Report is based on needles and leaves being left on the clearcuts before the residues are removed and does not calculate with recycling of the ashes (which would increase the volumes). The Forestry study considered that it was too difficult to assess the wood fuel potential from cleaning and thinning, and thus did not attempt to make any estimates. On the other hand, the Swedish EPA makes more optimistic assessments than SIMS with regard to industrial by-products, recycling of wood and firewood.

NATIONAL BOARD OF FORESTRY

Most of the theoretical potential for removal of wood fuel in the form of branches and tops can be utilised. This conclusion has been reached by a group of researchers commissioned by the Board of Forestry to conduct an environmental impact analysis (EIA) of the removal of forest fuel, recycling of ashes and other nutrient compensation. However, the removal must be compensated with nutrients, foremost ashes. The EIA identifies the gaps in knowledge and the research needs in this sector. The Board of Forestry is presently preparing new regulations for removal of forest fuel.

SVEBIO

SVEBIO uses the SIMS report in its energy scenario, but with a certain degree of caution. SVEBIO estimates that 120 TWh of wood fuel can be taken from the Swedish forests.

Estimated availability of felling residues in excess of those used in 1995:

SWEDISH FOREST INDUSTRIES ASSOCIATION	+ 6-11 TWh
SWEDISH ENVIRONMENTAL PROTECTION AGENCY	+ 11-16 TWh
FEDERATION OF SWEDISH FOREST-OWNERS	+ >30 TWh
SIMS	+ 56-72 TWh

No threat to biodiversity

■■ Removal of tops and branches after felling does not affect biodiversity. There seems to be agreement on this among experts from different camps. Birds, plants, fungi, lichens and micro-organisms are thus only marginally disturbed. The ecological systems in the forests are not affected by large removals of wood fuel.
Fellings in the forest will not increase as a result of Sweden using more wood fuels. Instead, the removal of wood fuel is a way of utilising the resources left by traditional forestry.
Swedish forests have become poorer in species and less varied. Features of deciduous species and the presence of dying or dead trees are examples of this deficiency. Birds, butterflies and other insects are particularly dependent on this, as well as fungi, mosses and lichens.
During recent years, however, there have been dramatic changes in forestry; today there are high levels of nature conservation ambitions, as well as demands by the authorities.
Therefore, removal of wood fuel requires, as is also the case in forestry, that valuable environments are not disturbed. Such environments, so-called key habitats, comprise wet forests, ancient deciduous stands, cliffs, and ravines. They are environments that are often extremely rich in species and are the home of many species under threat.
In places where forestry is recommended to save border zones along watercourses and forest edges, to leave copses of deciduous trees and old, large-dimension and dead trees on the clearcuts, the same rules also apply for removal of wood fuel.
This places severe demands on those who are to perform the work. Education of machine operators is of vital importance. Considerable knowledge and awareness is needed if damage to the ground is to be avoided, if dead trees and windthrows are not to be destroyed, or stands of special value and species are to be saved.
In the environmental impact analysis recently conducted at the request of the Board of Forestry, it was proposed that the needles should always be left on the site - just to be on the safe side. Even though we know quite a lot after 25 years of research, our knowledge of what happens below the surface of the soil is limited. As to the long-term effects of repeated removals of wood fuel, our knowledge is very limited.

Only stems are harvested

Stems plus 75% of branch and needles are harveste

biomass is also removed. During combustion, most of the nitrogen is reduced to innocuous nitrogen gas which is not taken up by vegetation. The more wood fuel that is harvested, the more the forests can cope with atmospheric depositions of nitrogen.
In some places, particularly in northern Sweden, it may be necessary to provide compensation fertilisation with nitrogen when wood fuel is removed. However, it is in the southern parts of the country that most industrial round wood is harvested and thus where most wood fuel is extracted. It is there that the atmospheric deposition of nitrogen is highest and where acidification is most serious.

Large opportunities for development

■■ Wood fuel is not only considerate to the environment, it is also inexpensive. The price of wood fuel has remained unaltered for 10 years. Due to inflation this means that the price in real terms has almost halved. During the past 15 years the use of wood fuel has increased almost two-fold, despite the wood fuel branch sector not being particularly profitable.

Heat corresponding to one kilowatt-hour (kWh) produced using wood fuel costs half as much as heat produced using coal and less than half when using oil. This is because the fossil fuels have to pay taxes and environmental tariffs to compensate for their environmental loading. Wood fuel, in other words, is a cost-effective way of reducing emissions of carbon dioxide.

CONTINUED STABLE PRICES

With increasing pressure to supply customers in an expanding market, it is in the interests of the producers to keep costs on a low level. Larger volumes may make the activities more rational and thus more profitable.

The rationalisations, but also the availability, contribute to the prices remaining stable. There is hardly a shortage of wood fuel in a forest country such as Sweden, even if there is an increasing demand. At the same time, the general opinion is that the rate of increase of biofuels of 3-4 TWh per year, where wood fuel makes up the largest part, is what the branch can manage without growing pains. The system can be made more effective by integrating production of round wood and fuel. Logistics and technology can be developed. In pace with the activities increasingly becoming established, the transaction costs will decrease. So far we are only at the start of this development.

BETTER TECHNOLOGY

A new felling head designed to utilise forest fuel in thin stands has been described as a breakthrough and a revolution in cleaning work. The felling head, mounted on a small forest machine, can cut and collect 5-10 stems at a time. The cleaning cost, which normally is very high, can be reduced or converted into an income. Interest in the new cutter head has been large, both in Sweden and abroad.

Another example of method and technological development for making use of wood fuel is baling of felling residues, i.e., branches and tops. Whereas in agriculture bales are wrapped in plastic, in forestry the bundles are wrapped in a net to keep them together. In this way, a truck can carry up to three times as much fuel in comparison with unwrapped material. Using this method, the production costs will be reduced by 20 to 30 SEK per MWh compared with chipping in the forest.

TORE URDEN LILJA/TT

When clear cut residues are baled three times as much fuel can be transported in one lorry.

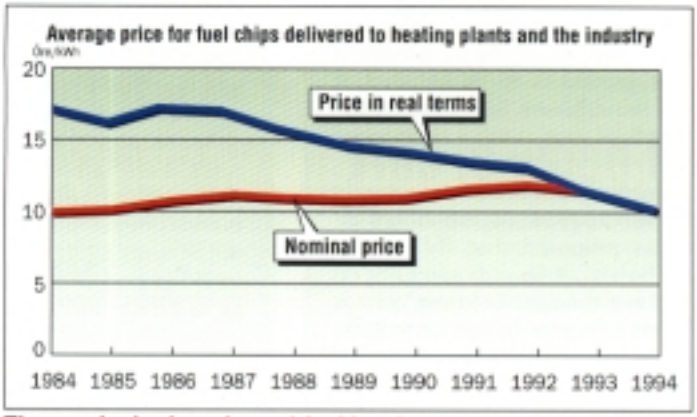
POLITICAL CONTROL

However it is not only rationalisation that affects the development of wood fuels. Political decisions on taxes and tariffs are of great importance. When tariffs were introduced on emissions of nitrogen oxides and sulphur dioxide the wood fuels were benefited, as well as when the decision was reached to impose a tax on emissions of carbon dioxide.

Conversely, taxation regulations for co-generation have a negative effect on wood fuels. Co-generation plants produce both heat and electricity, but the electricity production in these plants is exempt from carbon dioxide taxation, which has the result that biofuels, mainly those from the forest, have difficulty in becoming established.

EMPLOYMENT

Highly mechanised handling of wood fuel will generate 120 year-jobs for each additional TWh produced. With traditional mechanisation, each additional TWh produced using wood fuel will give 400 new jobs. More employment opportunities in one particular branch will simultaneously lead to new jobs being created in other branches. For that reason alone, the politicians should find reason to encourage a shift in the energy system to renewable sources of energy.



The nominal price of wood fuel has largely remained constant during the past decade. This means that the real price has decreased by 40 per cent. 10 öre/kWh= 100 SEK/MWh

● Recirculation of the ashes

The ashes contain all the nutrients, except nitrogen, that were removed when the biomass was taken from the forest. Sustainable use of wood fuel is based on the ashes being recycled so that the forest land does not become impoverished. If the nutrients in the forests decrease then the soil will become more acidic and the forest's vitality will deteriorate.

There are studies that demonstrate that the forest land has lost half of its available reserves of important nutrients during the last 50 years.

The ashes, being basic, counteract acidification. Ecological disruptions are avoided by hardening the ashes before they are spread - the ashes will then dissolve slowly.

Small and convenient forest vehicles can spray out the ashes in a simple, inexpensive and considerate manner. Return of the ashes will increase the price for the heat-producing customer by only a few per cent. The cost of treating and spreading the ashes can also be compared with what it would cost to dump them in landfills, not least when considering the planned landfill tariff of 250 SEK/tonne of ashes.

Other hindrances are that the ashes may contain environmentally hazardous substances and that it is not fully clear who is to be responsible for actually spreading or disposing of the ashes. These problems can be solved by quality declarations and agreements between producers of ashes and fuel suppliers.

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