FOCUS BIOENERGY
NO 7 2004 SMALL-SCALE USE OF BIOFUELS
www.svebio.se

The Swedish Bioenergy Association (SVEBIO) was founded in 1980 and is a non-profit association consisting of businesses, authorities, organizations and private members working for the promotion of an increased use of bioenergy in an environmentally sound and economically optimal manner.

Biofuels – heating for the future

» Biofuels for heating of homes and properties is rapidly making headway. Environmentally friendly, comfortable and priceworthy small-scale heating with biofuels is done using pellets or briquettes. Changing an oil burner for a pellets burner or replacing electric heating with a pellet-burning stove is often very profitable. It demands less effort than wood firing but somewhat more work than using an oil boiler. Wood firing can also be a good alternative in an efficient wood boiler or fireplace that fulfils environmental demands. Wood logs, pellets and briquettes do not contribute to the green house effect. These are also domestic fuels, which means shorter transports as compared to fossil fuels. Moreover, the biofuels stimulate economic life and rural areas.

SVEBIO
Torsgatan 12
SE-111 23 Stockholm
Tel: +46 8 441 70 80
Fax: +46 8 441 70 89
www.svebio.se
info@svebio.se

SVEBIO

Wood firing

Wood firing is a popular form of heating. The use of firewood in Sweden equals about 10 TWh annually. Wood firing will probably continue to play an important role in the heating of houses. In a sustainable energy system it must however be conducted in the appropriate way so that smoke and soot from bad wood firing will not create problems. New boilers with good combustion, yielding low emissions, have been at the market for about 10 years but the replacement of old boilers is moving slowly. Wood burning stoves and tiled stoves are two traditional alternatives, and today they come in modern efficient models.

Chose a wood boiler with accumulator tank, quality guaranteed and tested according to current building regulations. The accumulator tank raises efficiency and reduces emissions. It allows you to fire the boiler with a high and even load, which optimizes combustion. It is more comfortable, more environmentally considerate, in the same time as less fuel is consumed.

In Sweden you have to make a building report to install a wood boiler or wood stove. Also contact your chimney sweep, as there is an increased risk for fire. A chimney built for oil combustion does not work automatically with wood. The flue gas temperature at wood firing is much higher and the flow of flue gases is larger. With new boilers, the same problems with flue gases do not occur.

Wood firing requires large amounts of air for the combustible gases released when the wood is heated to be appropriately combusted. Therefore, do not restrict the air inflow. Wood firing also requires high temperatures. At a low temperature, tar and emissions of other environmentally disturbing hydrocarbons are formed. Moist wood leads to a less efficient combustion with more environmentally harmful emissions and a higher fuel consumption than dry wood does. Therefore, always use dry wood.

Alternative for home owners

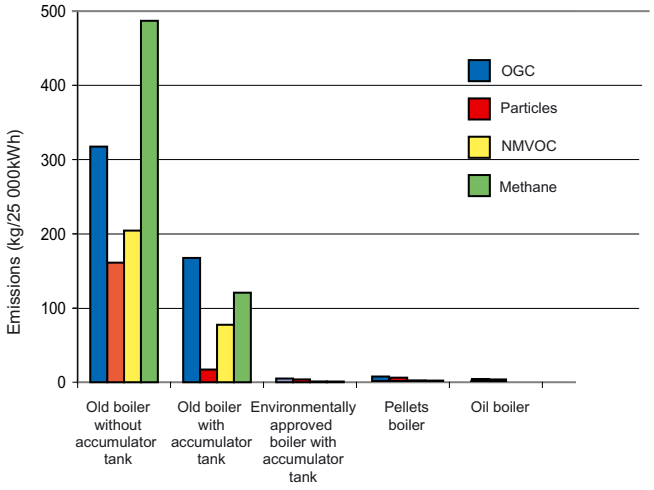
The most suitable solution for those who want to start heating with pellets is determined by the existing heating system.

Pellets burner

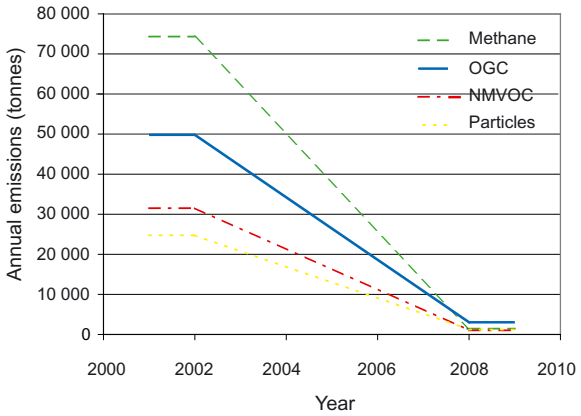
If your oil boiler is in good condition, just change the oil burner for a pellets burner and replace the oil tank with a storeroom for pellets. This is the cheapest way of conversion. If the existing boiler is old, you can buy an integrated pellets boiler. The best prerequisites for storerooms are found in houses with traditional boiler rooms. Sometimes it is possible to re-arrange a garage or another storeroom.

Besides sweeping the chimney and removing the ash a few times a year the equipment is completely automatic. Swedish producers hold the lead in the field, and the development during the latest years has been very rapid. The effectiveness of modern pellets burners is at the level of modern oil burners. Emissions are extremely low. A good pellets burner, fulfilling demands corresponding to those of national and international eco-labellings, yields emissions far below the Swedish building regulations. The labelling is voluntary in Sweden and is often developed by producer companies in co-operation with authorities. The Swedish P-labelling, for example, means that the product has been tested with regard to environmentally disturbing emissions, safety, efficiency, sound levels and instructions. In Sweden, there are now 6-year insurances for pellets heating systems. At machine damage the insurance covers excess and depreciation up to SEK 30 000 for all equipment having been installed at the same time.

Estimated annual emissions of organically bound carbon (OGC), particles, volatile organic substances excl. methane (NMVOC) and methane from a typical one-family-house.



Future scenario for emissions of methane, organically bound carbon (OGC), volatile organic substances excl. methane (NMVOC), and particles if gradually up to 2008, 90% of the "non environmentally approved" boilers without an accumulator tank are exchanged for "environmentally approved" boilers with an accumulator tank, while 10% are exchanged for pellets burners.



Source: Swedish Energy Agency (2003).

Pellets fired stove

Electricity is becoming a more and more expensive form of heating. For houses heated with electricity, a pellets fired stove is the best alternative. A pellets stove can heat a normally sized Swedish one-family house. If the stove is placed in the centre of the house it can replace up to 90 percent of the heating electricity. In principle, the pellets stove is a hot air boiler consisting of an air-cooled hearth and an attached fuel supply, lasting for about 24 hours during wintertime. The hearth is fitted with a burner. Heat is blown into the room and the pellets stove thus does not get burning hot on the outside. Water-jacketed pellets stoves can also supply the water heater with hot water, but in most cases water is heated separately. It can be good economics to install a pellets stove even in a house using waterborne electrical heating, since the stove provides most of the heat requirement. When converting an electrically heated house to heating with pellets a chimney must be installed, which is an additional cost.

Remember:

- In Sweden, building a chimney or making other modifications on the house requires a building report.
- Contact your chimney sweep before making any pellets firing installations.
- Always chose quality guaranteed and environmentally approved products fulfilling requirements corresponding to the various eco-labellings.

Refined biofuels

» Refined biofuels are dry little pieces of fuel with a high energy content, a homogenous composition and good qualities for transports and storage.

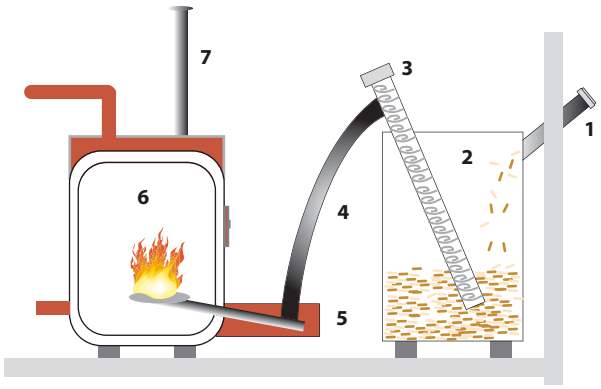
Pellets are cylindrical pieces of compressed biomass with a width or diameter less than 25 mm. Briquettes are larger pieces of compressed biomass with a width or diameter equal to or larger than 25 mm. Briquettes are produced with a technique less complicated than the one for pellets. They are mostly used in middle sized heating plants.

Saw dust, cutter shavings, dry wood chips and bark make up the raw material, but also lignin, peat or energy grass can be used as raw material. In the production of pellets the raw material is ground and dried. The intermediate product is a fine powder that is pressed under high pressure through a perforated matrix, whereby the lignin in the wood raw material is heated from the friction and softens. During the following cooling down the lignin becomes stiff and binds the material so that the pellets shape is preserved. Techniques for energy pellets using different mixtures of raw materials will also become interesting in the future.

The energy content in pellets and briquettes is around 4,8 MWh/tonne, at a moisture content of 10 percent. The volume weight is about 600-700 kilos/m³. To replace 1 m³ of oil, it takes approximately 3 m³ of pellets. Pellets are manufactured in factories all over Sweden. There are different forms of distribution: small sacks of 16 kilos on a pallet, large sacks of 500-800 kilos, or in bulk in the same way as oil. You can also chose to collect the fuel yourself from a factory or local storage depot.

Pellets, wood powder and briquettes are refined biofuels. Wood powder is used in large-scale plants, whereas pellets and briquettes are suitable for small-scale use.

Explanatory sketch for a pellet burning system



1. Filling inlet to pellets storage
2. Pellets storage
3. Feeding screw
4. Chute to burner
5. Burner
6. Boiler
7. Chimney

A municipality going in for bioheat

» In Kristianstad in southern Sweden, 43 municipal heating plants in schools and homes for the elderly have been converted from oil to pellets. The plants are situated in areas not covered by the district heating system. In doing so, 1000 m³ of oil have been replaced with 2100 tonnes of pellets, whereby the emissions of carbon dioxide from the municipality have been reduced by 3000 tonnes per year. A major motive for the conversion has been the improved economy afforded the municipality by the changeover.

The converted plants have an effect of 50-350 kW and pellets are delivered in bulk. In schools the deliveries are not made during daytime. To handle installations and operations the municipality has chosen to educate its own staff, instead of hiring entrepreneurs. Conversion to pellets in the schools serves as a good example for inspiring home owners and others.

The ash from the plants is handled by an employee of the municipality who drives around to the different facilities with a special vacuum cleaner. While there, this person can also check operations. The vehicle used is run on biogas, which also contributes to showing schoolchildren and others how it is possible to act in an environmentally friendly way.

Cost examples

The cost of installing a pellets firing system varies. The equipment you chose, whether the current boiler and chimney can be used and what type of storage you will construct all affect the costs. The running costs, in turn, depend on how you buy the fuel. Here are, as a guideline, some Swedish examples with prices (including value-added tax) from 2003:

Pellets burner for an existing oil boiler costs SEK15 000-20 000. Additional costs for feeding screw, storage and installation of about SEK 20 000 will be incurred.

New boiler with pellets burner and feeding screw costs about SEK 50 000. In this case, additional costs for storage and installation of some SEK 25 000 will be incurred.

Integrated pellets boiler with a built in storage costs about SEK 50 000, and the additional installation about SEK 5 000.

Pellets stoves cost SEK 25 000–30 000 each. Installation cost will be about SEK 5 000, and cost for chimney, in case this does not already exist, will be about SEK 20 000.

Pellets are sold per tonne with a guaranteed heat value. The price varies between 38-52 öre/kWh, depending on the distribution form (delivery at the house or collection in small sack, big sack or in bulk).

Of vital importance is how much time you are willing to spend, how much you want to invest and how much space that is available. For a handy person, costs can always be reduced. The price of oil is today 70-75 öre/kWh, and the price of electricity is 75-100 öre/kWh (including fees).

A general calculation on conversion of home heating from oil or electricity to pellets shows that the home owner can save between SEK 5 000–7 000 annually in running costs, by changing over to pellets firing.

Comfort without any bother

Pellets firing for heat production in homes and local district heating plants increases very rapidly. Deliveries to the Swedish home market alone three folded during the years 2000-2002. Now doors open for new customer categories, as new comfortable systems for installation and service are introduced. These, in combination with better techniques, reduce the users work input in pellets firing.

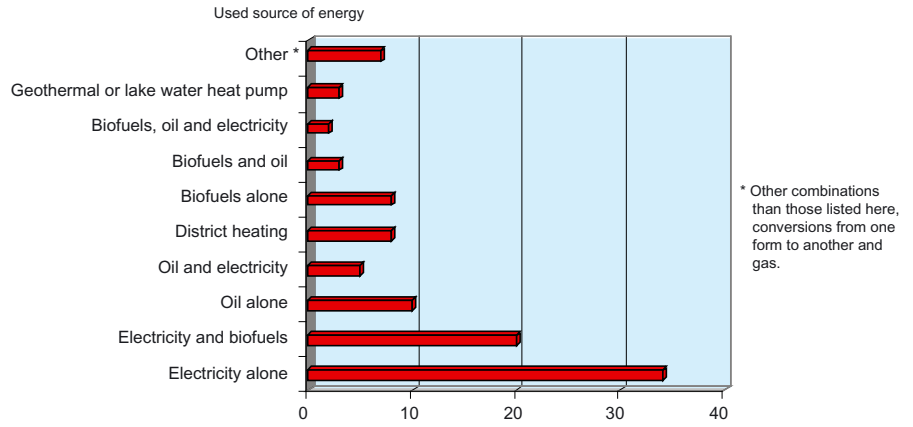
Service contracts

Applying service contracts, the supplier installs a pellets firing equipment with the medium-sized customer, builds a storeroom and stands for service and management. With automatic pellets feeding and removal of ashes the equipment normally does not need attendance. The customer only pays the monthly bill, based on consumed fuel, and contacts the supplier if mechanical problems arise. The conditions are thus favourable, and it is still cheaper than heat from electricity or oil. Several companies already sell heat from biofuels with service contracts, i.e. to municipal buildings, blocks of flats and other larger estates. Service contracts for home owners – including contacts with authorities, installations, maintenance and pellets deliveries – have now also been introduced. These types of system solutions will probably increase the rate of conversion to pellets firing from now onwards, as the comfort provided is comparable to that of electrical heating or oil heating. The only difference is that a more environmentally considerate and cheaper energy provision has been chosen.

Comfortable pellets firing

Moreover, a technique with automatic alarms from the home customer's boiler to the supplier's computers is being tested. The supplier then automatically receives direct signals when the equipment needs to be surveyed or the pellets store needs to be filled up. Thereby, the customer does not need to bother at all about the maintenance of the equipment, and the equipment reliability also increases so that the boiler can be left unattended for a month or more.

Heating of houses and farm properties in Sweden: total of 1 755 000 properties (2003).



Share of houses employing the source, including farm properties (%).

Source: Statistics Sweden (2003).

Production of pellets

Today there are some 50 pellets factories in Sweden. In later years several smaller production plants have been established. Between year 2000 and 2002 the Swedish production of pellets increased by 40 percent. The major part goes to large and medium-sized boilers in district heating plants (in total 69 percent of the production in year 2003). On the home side (31 percent of the production) and among medium-sized boiler plants is where the largest growth and potential for continued growth can be found. The use of domestically produced pellets in year 2002 reached 650 000 tonnes, equal to 3,1 TWh. There was also a certain import (about 170 000 tonnes) as well as export (about 36 000 tonnes) of pellets. The production of briquettes is about 350 000 tonnes per year.

Sweden is the second largest pellets producer in the world, after the USA. In 2002, 37 000 Swedish houses were heated with pellets in waterborne systems and another 8 000 households had installed pellets stoves. In the USA, more than 400 000 pellets stoves in homes have been installed. It is a promising branch for the future, and the market is expanding and integrating internationally. Lately, large oil companies, such as Shell and Statoil, have seriously engaged in the branch. Exports and imports of pellets are expected to increase. Swedish companies face great export possibilities. Within the EU pellets markets are growing rapidly in Denmark, Germany, Austria, Italy and France. Also in Japan and in New Zealand markets are on the upswing. Some 20 pellets factories also exist in countries neighbouring Sweden. A list of Swedish pellets producers can be found on Svebio's web site www.svebio.se.

Tax reduction

Anyone building a new house in Sweden during 2004-2006 can apply for a tax reduction for the installation of a biofuel system as the house's primary source of heating, e.g a pellets boiler but not a pellets fired stove. The maximum amount of such a tax reduction is SEK 15 000. More information about the conditions for the reduction is available from your local municipal energy consultant or from the tax board.

More information

www.energiinfo.nu
www.energikalkylen.
konsumentverket.se
(Swedish Consumer Agency)
www.energycentre.info
www.novator.se
www.pelletsindustrin.org
www.skatteverket.se
(Swedish Tax Board)
www.sp.se
(Swedish National Testing and Research)
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www.stem.se

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