Wood Pellets - tomorrow's fuel

Wood pellets are a clean, CO_2-neutral and convenient fuel, mostly produced from sawdust and wood shavings, compressed under high pressure using no glue or other additives. They are cylindrical in shape and usually 6-10 mm in diameter and 10-30 mm in length. As a highly standardised and compressed fuel, pellets allow cost-efficient transportation of fuel and automatic operation of plants for heat and electricity production, from one-family homes to large-scale power plants. With a rapidly growing share of the market, they are a key technology for increasing biomass utilisation in Europe and beyond. Pellets are also an excellent way of using local resources thus making a concrete contribution to environmental and climate change protection.

The European Union has set itself a number of policy objectives to increase the share of renewable energy sources in electricity and heat production and it is widely recognised that biomass has a strategic role to play in achieving these targets.

Pellets are a key technology in making this happen, with several particular advantages. As a condensed fuel, transportation is cheaper and less cumbersome than for other biomass fuels. The high degree of standardisation allows for extremely low-emission combustion, even in very small appliances. And wood pellets are a highly convenient fuel for end users: delivery by tank truck or in bags and automatic feeding systems make them as user-friendly and time-efficient as a gas or an oil heating system.

This article will look at market development issues in different parts of Europe, with a focus on small-scale heating systems.

Pellets market development in Europe

We have seen an encouraging rate of development in the wood pellet industry in the last decade, but the market growth in different EU member states varies greatly. Large-scale wood pellet installations (CHP and district heating) are predominant in Nordic countries whereas small-scale central heating installations, mainly in the residential sector, are common in Austria and Germany, and the market share of wood pellet stoves is very high in Italy. The development in selected European countries is presented below, starting with the North:

Sweden has a long tradition of using biofuels for heating. The interest in pellets grew as a result of the oil crisis in the seventies, and by the first half of the eighties the pellets industry had already achieved a first "peak" with pellet production reaching 50,000 tonnes a year. Pellet production technologies for the manufacture of agricultural feedstuff were already well established when the development of the combustion technology began around twenty years ago.

The introduction of large-scale pellet in boilers with up to 100 MW brought a major step forward and the district heating sector still plays an important role. In the early nineties Sweden introduced a new tax on fossil fuel carbon dioxide emissions, and this paved the way for a quick expansion of pellets market. Between 1992 and 2001, Swedish pellets consumption increased from 5,000 to 667,000 tonnes per year making Sweden the largest pellet user and producer in Europe with about 30 larger production plants. The pellet distribution network is well established, with bulk transport common for shorter distances, and shipping proving economical for longer distances.

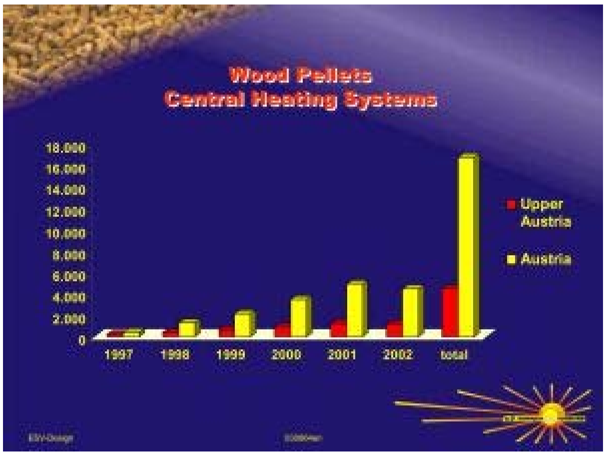
The raw material used includes sawdust, shavings, chippings and a wide range of other forestry by-products, depending on the quality requirements for the different fields of application. A full utilisation of all sawmill by-products (including bark, dry chips etc.) could result in a production of 6.9 million tonnes of pellets annually.

The fast expansion of the large-scale market - including such large plant as the one at Hasselby - has also paved the way for an expansion of the midsize and one-family home market. A common system is the use of pellet burners in existing boilers.

Three factors appear to have contributed to the favourable market development in Sweden: a good availability of wood raw material, a tax regime that discriminates against the use of fossil fuels and extensive district heating schemes.

Another important Nordic pellets market is Denmark. When Denmark first started to use pellets in the late 1980s, they were mainly used in district heating to replace coal firing. From 1993 onwards, annual pellet use in district heating was about 110,000 tonnes. The increase in pellet consumption in the last few years is due to an increased consumption in both public buildings (25,000 tonnes/annum) and the residential sector (160,000 tonnes/annum), with total wood pellet consumption amounting to 400,000 tonnes in 2001. At present pellets are primarily used for heat production only, but a new CHP plant partly fuelled by pellets (Avedøre II) started operation in 2003 and will raise the total Danish pellets consumption to up to more than 600,000 tonnes. Denmark's own pellet production only amounted to 190,000 tonnes in 2001, but a very large new plant for wood and straw pellets is currently under construction.

In Austria, a "pellets boom" started in 1997 when the first systems were introduced into the market, and by the end of 2002 a total of 17,000 pellet central heating installations were in operation. Right from the beginning, the Austrian market development was driven by consumer interest, supported by most of the regional governments and the R&D efforts of the boiler producers to improve the technical performance of installations.



Most of the pellet systems installed are fully automatic central heating systems for one family homes in the power range below 25 kW. Pellet stoves are used for new homes with very low heat demands (low energy and passive houses). About 30 Austrian companies are manufacturing pellet boilers.

Austrian legislation enforces stringent emission standards for boilers and a pellet certification system ensures high fuel standards. About 12 companies are producing pellets, three of them with a production capacity of more than 30,000 tonnes per year. The total production capacity at present amounts to about 200,000 tonnes/annum with is expected to increase in the coming years.

Consumers have responded very well to the advanced design of Austrian pellet boilers. Apart from efficiency, emissions and user-friendliness, Austrian boiler producers have put a significant effort in the "look" of their installations, one of them even offering a choice of colours!

An efficient distribution network has been established, with pellets usually delivered loose by a special pellet truck. In the early stages of market development, some boiler manufacturers guaranteed a pellets supply at a fixed price which helped to overcome initial doubts about the security of supply.

Similar to the Austrian experience, the German wood pellet market has so far expanded primarily in the small-scale sector. By the end of 2003, an estimated 20,000 pellet installations (central heating and single stoves) will be in operation. Together with the growing wood pellet market, the interest in wood pellet production has increased rapidly in the last few years. At present there are 14 wood pellet production plants in operation and 7 more are planned. By the end of 2003, pellet production will amount to 90,000 tonnes and the maximum production capacity could even reach 140,000 tonnes. If all planned production facilities are realised, that amount could be doubled.

When analysing successful market development in different European countries and regions, it becomes clear that fuel quality standards, the establishment of well-functioning distribution networks, convenience, consumer information and awareness are critical factors which will make or break a new pellet heating market. Competitiveness with other fuels varies strongly throughout Europe as it depends strongly on national and local conditions, both for the equipment and for the fuel - but there are certainly many regions in Europe where pellet heating systems are able to compete economically with fossil fuels today.

Raw material & quality issues

Besides agri-pellets all types of woody biomass are in principle suitable raw materials for wood pellet production. In order to keep costs for drying and grinding low, dry sawdust and wood shavings are used predominantly. The production of pellets from bark, straw and crops is usually more appropriate for larger-scale systems. Research indicates that wood pellet production is in principle economically possible both in small-scale (production rates of some hundred tonnes a year) as well as in large scale-plants (some ten thousand tonnes a year) – with the risk of production being uneconomical higher in smaller plants.

The requirements for pellet fuel quality vary according to the different characteristics of the wood pellet markets in different European countries.

A Swedish pellet standard was established in 1999 (SS 18 71 20), which classifies pellets into three groups according to their quality standards. When the market expansion to the domestic sector took place, it became necessary also to guarantee operational safety and low emissions. The P-marking testing procedure was developed to ensure that the minimum requirements of pellet burners, stoves and boilers were met.

The Austrian standard "ÖNORM M 7135" ensures a high quality of the densified biomass fuels and the exclusive use of natural raw materials. The main criteria are:

Property	**Pellets class HP1 (wood pellets)**
Diameter	Min. 4 max. 10 mm
Length	Max. 5 x d
Density	Max. 1.12 kg/dm³

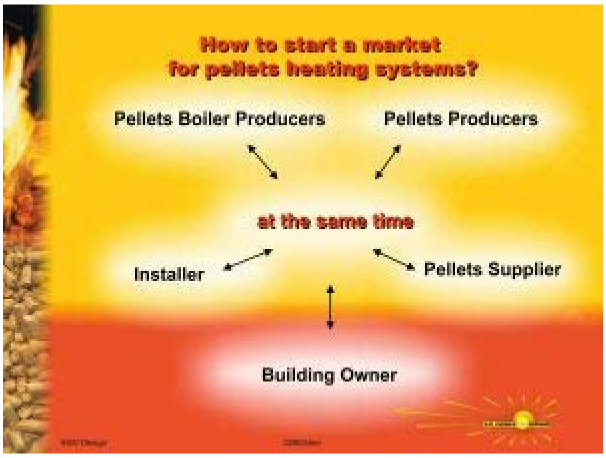
Water content	Max. 10 %
Abrasion	2.3 %
Ash	Max. 0.5 %
Caloric value	Min. 18 MJ/kg
Sulphur	Max. 0.04 %
Nitrogen	Max. 0.3 %
Chlorine	Max. 0.02 %
Additives	Max. 2 %

In addition, the industrial standard "ÖNORM M 7136" aims to ensure quality control during transport, storage and distribution. Another standard ("ÖNORM M 7137") lists quality criteria for wood pellet storage rooms at the customer's premises and deals with the requirements of different wood pellet storage options in single-family houses or apartment blocks.

The German standard "DIN 51731" regulates similar parameters to the Austrian ÖNORM M 7135, and since spring 2002 a new regulation "DIN plus" has been in force.

European efforts to find a common quality standard are ongoing. The CEN committee is preparing Europe-wide regulations concerning quality criteria for biomass fuels.

Building up a pellets heating market



Efforts to establish a new regional market for pellet heating systems should target both the "supply side" (pellets & equipment) and the "demand side" (building owners). The challenge to be met is that for a successful market to get started several factors have to be established at the same time: the production or importation of good quality pellets and boilers, the local distribution network for pellets (by trucks or bags), installers willing and able to install and service the equipment and - last but not least - customers willing to buy and use pellet heating systems.

"Creating demand":

The first step towards an investment decision in favour of a new technology or product is to know that it exists ("what you do not know, you do not buy") and that it is in principle applicable in your home, commercial or public building - this may sound trivial but is anything but: it can safely be assumed that the large majority of potential pellet users in Europe are not yet aware of the pellets option. Market development can be significantly sped up by professional market communication to potential users: here regional and local energy agencies and advice centres have an important role to play, both in creating general awareness as well as by offering product-neutral energy advice to consumers when they are on the point of making a concrete investment decision.

"Supporting supply":

Cost-effective, reliable and efficient equipment is a pre-requisite for any successful market development – here R&D, market monitoring and co-operation have an important role to play. Plumbers and installers are another crucial element in an emerging heating market: they need to be convinced of the economic and technical viability of pellets heating systems (otherwise they might dissuade potential pellets users) and to receive specialised training to install and service pellets systems.

Consumers - be they domestic, commercial or public - need to have confidence that a pellet supply of consistent quality is ensured in the long term, and to know how to find a pellet distributor - otherwise they are very likely to choose a different fuel.

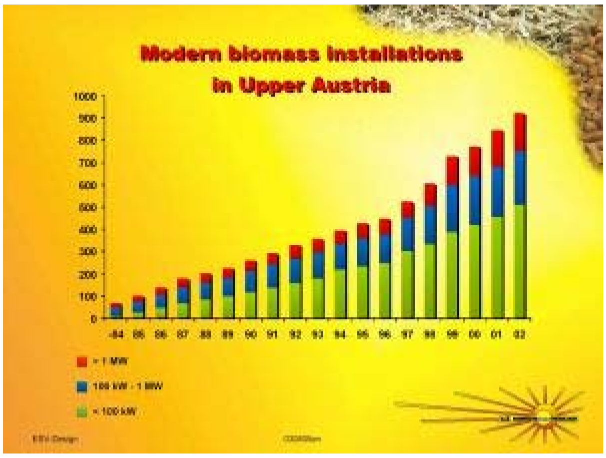
Both for the fuel and the boilers quality is essential - a few faulty installations (caused either by the fuel or the installation) can seriously damage emerging markets. Energy agencies, administrations on national, regional and local levels, research and testing institutes as well as standards bodies have an important role to play in ensuring long term quality control on all levels of the "pellets chain", including fuel standards, equipment performance and distribution networks.

The better these requirements are met right from the beginning, the quicker market development can take place.

The Upper Austrian example

In Upper Austria, a region with 1.4 million inhabitants located in the northern part of Austria, renewable energy sources provide 30 % of the primary energy consumption (of which 16 % is biomass). That high market penetration was achieved by a clear political commitment expressed in quantitative targets and the implementation of an energy action plan, dedicated to sustainable energy market development. O.Ö. Energiesparverband, the regional energy agency of Upper Austria, is responsible for the implementation of most of the measures of this action plan.

Biomass heating has seen a strong market development in the past decade in Upper Austria, both for biomass district heating systems (more than 200 are in operation) and for small-scale heating systems using logs, wood chips and wood pellets - in total more than 15,000. The fast growing pellets market in Upper Austria contributes to more than 30 % of biomass heating installations in new one family homes and increasing market shares in public and commercial buildings (at the same time, oil-heating systems for new homes decreased from over 40 % to 8 %).



A number of factors triggered this market growth, the most important being the "Upper Austrian wood pellets programme" including, among other:

- Information & awareness raising:
  A toll-free energy hotline is available for all questions concerning pellets use. Free energy advice (including on-site) is offered to private consumers, public bodies and SMEs when they are making a building-related energy investment - this ensures that the pellet option is at least considered when deciding about the future heating system. More than 10,000 such energy advice session

are held every year. Strong co-operation with the regional media as well as numerous other awareness raising activities are showing results: a recent representative survey showed that 85 % of the population know what wood pellets are.

- Subsidies:
  Financial support (usually around 20-25 %) is provided for the installation of a pellet heating system, with a special bonus when switching from fossil fuel and for removing old oil tanks.
- Training & education:
  In the late 90-ies, about one hundred installers participated in a short training course, explaining the principles of pellet heating systems and how to avoid the most frequent mistakes. Study tours and training courses for local government, energy advisers and other stakeholders aim at making the technology better known.
- R&D: a regional energy R & D programme also supports pellet-related R&D, e.g. the development of new combustion technologies, new product design and the integration of pellet heating and solar systems.

Upper Austria is also home to a number of leading pellet boiler producers, including companies such as Fröling, Guntamatic, ÖkoFEN, Kalkgruber, Hargassner, ETA and Gilles which have a significant share in the positive market development as policy drivers and in marketing pellet technologies to different user groups.

The Ökoenergie-Cluster (OEC), a network of green energy businesses, managed by O.Ö. Energiesparverband, was set up to trigger further business development Presently 131 companies and institutions are partners of the network, active in all renewable energy fields. These sustainable energy businesses have 2,000 employees, an annual turnover of about 215 M€ and an export share of more than 50 %.

The network aims to foster co-operation between the network partners by common training & information, research and export activities. One of the very successful activities within the network was a co-operation project to improve the quality of user manuals for domestic customers. As outlined above, the market approaches taken in Sweden and in Austria differ quite significantly: in order to profit from that know-how in both markets, the OEC started a co-operation programme in which both Austrian and Swedish companies are participating.

Detailed information on the network partners and activities can be found under www.oec.at

5 Conclusion & outlook

In some parts of Europe, significant pellet markets are already established, and there are a number of emerging markets in member states and accession countries. The future for further expansion of the pellets industry is very promising with an estimated annual market potential of 4-5 million tonnes and thousands of new installations.

The recently started ALTENER project "Pellets for Europe" aims to contribute to this positive market trend by providing technical and market information to pellet market actors across Europe. Further information is available under www.pelletcentre.info.

Connected to that project, the " European Pellets Conference", to be held on 3-4 March 2004 in Wels/Austria and organised by O.Ö. Energiesparverband, will provide a very timely opportunity to exchange knowledge and ideas, to find new partners and learn about successful projects: Which are the most promising innovations? Where are the most interesting markets? Which strategies for building up a new pellets market work best in practice? How can we find new customers? Which agricultural raw materials - apart from wood and straw - are suitable for pellets production?

This conference offers an interesting combination of events: it is held in parallel to the "Energiesparmesse" (4-7 March 2004), an exhibition and trade show dedicated to renewable energy sources and energy efficiency. More than 50 companies will present their pellets-related products and services. In addition, the annual World Sustainable Energy Days (3-5 March 2004) - which attracted more than 650 participants in 2003 - offers a number of other high-profile events including the European Green Electricity Forum and the conference "Tomorrow's Buildings".

Join the European Pellets community for the European Pellets Conference 2004!

References:

- *Egger Ch., Öhlinger Ch., Dell G.: "Strategies and Methods to Create a New Market", Stockholm 2002*
- *Proceedings of the First World Conference on Pellets, Sweden 2002*
- *INDEIF, ALTENER project "An integrated European market for densified biomass fuels", www.pellets2002.com/index.htm*
- *www.biomasse-info.net*
- *OPET Report "Refined Biomass", OPET Sweden, 2002*

Authors:

Christiane Egger, Christine Öhlinger, Gerhard Dell
Christiane Egger, Christine Öhlinger, Dr. Gerhard Dell work for O.Ö. Energiesparverband, the regional energy agency of Upper Austria (O.Ö. Energiesparverband, A-4020 Linz, Landstraße 45, T: +43-732-7720-14380, E: office@esv.or.at, I: www.esv.or.at)

This article was published in Renewable Energy World, September-October 2003