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April 7, 2009

Burning Issues: An Update on the Wood Pellet Market

Burning wood pellets for heat and power has become common across central and northern Europe and yields considerable environmental, and economic, benefits.

by Christiane Egger and Christine Oehlinger

London, UK [Renewable Energy World Magazine]

Wood pellets are a clean, CO₂-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 standardized and high-density fuel, pellets allow cost-efficient transportation and automatic operation for heat and power, from private homes to large-scale plants.

With a rapidly growing share of the market, they are a key technology for increasing biomass utilization in Europe and beyond, especially in the heating sector. Pellets are also an excellent way of using local resources, a concrete contribution to CO₂ reduction.

Developments in the European pellet market are once again very positive. Growth of about 25%–30% is expected in countries such as in Germany and Austria during 2009.

The European Policy Context

The policy framework in the European Union is supportive to the market development of biomass, both in the heating and electricity sector, as it contributes to climate and environment objectives, reduces import dependency and supports local economies.

The 27 Member States of the European Union have set themselves ambitious policy objectives to increase the share of renewable energy sources in electricity and heat production, with a target for 21% electricity and 20% heat from renewables in the total energy mix by 2020.

In December 2008, a new European Directive on the promotion of renewable energy was adopted by the European Parliament. The commitment is to achieve at least a 20% share from renewables in the EU's gross final energy consumption in 2020. This Directive also specifies targets for each Member State – varying between 10%

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and 49%.

Other important policy initiatives are the European Biomass Action Plan – COM(2005) 628 final – and the planned recast of the Directive on the energy performance of buildings.

Biomass has a strategic role to play in achieving EU renewables targets, and wood pellets are key to making this happen.

European Wood Pellet Use and Qualities

A number of different systems are suitable for using wood pellets these include:

Pellet stoves: These are often modern appliances in an attractive design where bagged pellets are normally used. They are ideal for milder climates or as a heating source additional to an electric, gas or oil heating system. The largest market for these in Europe is Italy.

Pellet boilers: These are fully automatic central heating systems for residential heating with bulk delivery of pellets. In parts of Europe, pellets are usually delivered by a special tanker truck and blown into storage systems. The pellet boilers are connected to the pellet storage by an auger or Archimedes screw (mechanical fuel feeding system) or a suction system (pneumatic system) from which the pellets are transported automatically into the boiler. No manual work is necessary for the fuel supply, making such systems as user-friendly as a gas or oil-fired heating system – the heat distribution system within the building is typically water-based.

Well developed markets for pellet central heating systems are found in Austria, Germany, Sweden and France. While the investment costs for such systems are about 30% higher than for an oil-fired heating system, fuel costs are considerably lower and there is a good return on investment.

Utility-scale boilers: In northern European countries, such as Sweden or Denmark, pellets are also used to fire biomass district heating or combined heat and power (CHP) plants. A growing market is also co-firing, whereby pellets are used to partially substitute coal in large power plants – for example in Belgium, the Netherlands and the UK.

Modern pellet stoves and pellet boilers require pellets of a high quality. Austria was the first country to adopt a pellet standard (the Austrian ÖNORM M 7135) which helped the market development tremendously; from the offset, only pellets of a clearly defined quality were available, allowing boiler manufacturers to develop very low-emission appliances.

Several other European countries followed by introducing quality standards for wood pellets (such as the German DIN plus standard). And, currently, a European standard is under development, with its adoption anticipated for 2009. In addition, with an increase of global trade, a world-wide certification for the sustainable production of pellets will become increasingly important.

Production and Consumption of Wood Pellets

In the last few years, pellet production facilities have boomed all over the world, especially in Europe and North America. Important pellet exporters are Canada and Russia, while large pellet importers are Denmark, Italy, Belgium and the Netherlands.

The production capacity in all EU 27 states is estimated at about 9 million tonnes (2007). Globally it might be as much as 12–14 million tonnes capacity.

Leading pellet producing countries in the EU are Sweden (1.7 million tonnes), Germany (900,000 tonnes) and Austria (800,000 tonnes). Both Sweden and Austria have been leading pellet countries since the earliest days of market development in Europe, in the 1990s. Growing production capacities can also be found, for example, in France, Spain, Latvia, Estonia and Poland. Meanwhile, Russia has significantly increased its production capacities – from 50,000 tonnes in 2005 to 550,000 tonnes in 2007 – nearly all of it for export. Canada's plants produced about 1.3 million tonnes in 2008.

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In terms of pellet consumption, Sweden, Germany and Austria lead the way in Europe, closely followed by France, where rapid market development has taken place in recent years. Italy has become one of the most important pellet consumers due to the increasing number of installed pellet stoves (about 800,000 stoves to date). Total annual pellet consumption in Europe presently amounts to about 6 million tonnes. On the North American market, about 2.3 million tonnes of pellets were consumed in 2008, with about 2 million tonnes of this in the USA.

Pellet Raw Materials

The issue of pellet raw materials and the pricing will be crucial for future market development. At present, the main raw material for pellets is sawdust. However, there is increasing competition for the current sawdust resources. One solution would be importing sawdust from China, Russia or South America. However, concerns about sustainable forestry and long transport routes might lead to a loss of consumer trust and support from public policies.

Another option is to use other raw materials.

Agricultural products and

TABLE 2. THE TECHNICAL FUEL REQUIREMENTS FOR PELLETS ACCORDING TO ÖNORM M 7135

Quality characteristics	Requirements
Diameter	5–6 mm
Length	max. 25 mm
Density	at least 1.12 kg/dm ³
Water content	at most 10%
Amount of ash	at most 0.5%
Heating value	at least 18 MJ/kg
Dust	at most 2.3%
Additives	at most 2%
For comparison	
2 kg pellets	~ 1 litre oil
1 m ³ pellets	~ 320 litre oil
1000 kg pellets	~ 1.5 m ³

residues such as straw, hay, miscanthus or other energy crops – forming so-called ‘agri-pellets’ – have been at the centre of attention of the pellet community in past years. Unfortunately, all of these products are harder to burn cleanly than wood. Therefore, due to existing emissions legislation, significant product development is required before mass use of agri-pellets will be possible.

Another promising option is other forest residues, such as woodchips, log wood or short rotation crop (SRC) forests.

Conflicts of Use

Raw material for wood pellets is not infinitely available, at least not at relatively low costs. Fluctuations in sawdust availability and price are caused by the construction industry – if this sector requires less material, this leads to lower activity in the woodworking industry, which results in lower quantities of sawdust being produced and available for pellet production.

Therefore, there is a debate in the pellet community as to where wood pellets should be best used in the future: in small installations to heat homes, schools and shops; or in large power stations where they can substitute significant quantities of coal.

There are those who argue that wood pellet heating is one of the few options available for the 100% CO₂-neutral heating of buildings. User-friendliness, low fuel costs, and the fact that it is an environmentally friendly solution, have already convinced tens of thousands of consumers in Europe to make the investment in a pellet stove or boiler.

Others state that pellets, when co-fired in power stations, allow for a rapid substitution of fossil fuels at very low investment costs.

One answer that could potentially resolve this issue would be a strong increase in global trade. Wood pellets that are shipped half way around the globe have lost some of their environmental advantages, and will be a lot less attractive to homeowners and to the public programmes that financially support the investment. However, the environmental balance looks much better for large power stations in the vicinity of seaports.



The Pricing Challenge

The price of pellets is another decisive factor affecting further market opportunities, both in the heating of buildings and in electricity production. As it is young market and still comparatively volatile, the pellet market has less ability to balance the impact of market turbulences than larger and more mature markets.

One example is the price crisis that hit a number of European markets in 2006. After several years with stable pellet prices – which had not followed the price fluctuations of heating oil and natural gas – a pellet price peak shocked consumers and excited potential pellet producers.

The rapidly growing demand, a very cold winter, and the lack of stored stock contributed to a very high pellet price, which peaked at twice the price of the previous heating season. In the following winter – which was unusually warm – pellet stove and furnace sales declined dramatically in a number of European countries. This created a very difficult situation for all those businesses that had invested in new production facilities for pellets or pellet appliances.

The situation calmed and pellet prices came back down to previous levels; however, consumer confidence in the fuel suffered.

Developments in the European pellet market are once again very positive. Growth of about 25%–30% is expected in countries such as in Germany and Austria during 2009.

Future solutions will have to take a number of different contributing factors on the pellet market into account:

- suppliers of pellet raw material are interested in high prices for the sawdust
- producers of pellets are interested in high fuel prices
- producers of pellet boilers want stable pellet prices and competitive heat costs
- public bodies, which provide investment subsidies for pellet installations in many European countries, have an interest in a stable market price situation.

Competitive and Clean

Wood pellets have a number of advantages compared with other wood biomass fuels, for example, as a condensed fuel, transportation is cheaper and less cumbersome. Due to the high degree of standardization, they allow for a very low-emission combustion, even in very small appliances (comparable to the emission of modern gas or oil heating appliances), but of course, without emitting CO₂. Already today, pellets are a very competitive fuel in the heat market and have become a mainstream fuel in a number of European countries. If the price and the raw material challenges can be mastered, wood pellets will be one of the key technologies in achieving climate policy objectives. More information is available at: www.wsed.at

Christiane Egger is Deputy Manager of O.Ö. Energiesparverband (Upper Austrian Energy Agency), based in Linz, Austria. **Christine Öhlinger** is Head of Sector at O.Ö.Energiesparverband.

The European Pellet Conference

With more than 600 participants every year, the [European Pellet Conference held in Wels, Austria](#), has become the largest annual pellet event in the world. The international pellet community gathers to discuss technological innovation, market trends and new co-operation projects with experts from all over the world. It also provides an insight into the current developments on the leading European and international pellet markets.

The European Pellet Conference is held in parallel to the 'Energiesparmesse' – a trade show dedicated to renewable energy sources and energy efficiency, with nearly 100,000 visitors each year and more than 100 exhibitors showing pellet-related products.

The European Pellet Conference forms part of the 'World Sustainable Energy Days', which is one of the largest annual conferences in the field of energy efficiency and



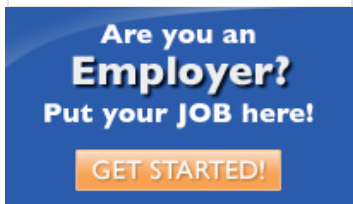
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renewable energy sources in Europe. The World Sustainable Energy Days includes different conferences which present the latest technology trends, outstanding examples and European strategies. In 2008, the conference attracted more than 950 participants from 61 countries. [Read coverage of this year's event here!](#)

Pellet Central Heating Systems

A pellet central heating system can directly replace oil or gas boilers. Fully automated, such systems not only light automatically and feed fuel from pellet storage at the rate of the heat demand, but the boiler also cleans itself every day ensuring continued efficiency. Automatic wood pellet heating systems are available in a range of sizes to suit anything from a small, energy-efficient house to a large office or business.

A typical residential wood pellet boiler normally requires a boiler room of 2m². A typical pellet store requires a similar amount of space and can be installed in a separate room within the building, or in a garage, shed or special container.

Automatic wood pellet heating systems are designed for bulk fuel supply. This method of delivery is common in mature pellet markets, providing cheaper bulk purchase prices, dust-free filling and is time-efficient for the home owners. A tank truck blows the fuel into the storage room, from where it is carried by an auger to the boiler. In most situations the pellet store requires refuelling only once or twice a year.

Upper Austria: A Wood Heartland

In Upper Austria, a region in the north of Austria with about 1.4 million inhabitants, renewable energy sources provide around 30% of the primary energy consumption, of which 14% comes from biomass. The share of renewable energy sources in the heating sector is over 40%. The region has made a commitment that by 2030 all space heating and electricity will come from renewables and biomass – and especially wood pellets – have an important role in achieving the ambitious target.

Presently, more than 16,000 wood pellet central heating installations are in operation – most of them are in homes, but increasingly also in larger commercial and public buildings. Pellet stoves are also very popular in thousands of low-energy homes.

Pellet market development is supported by comprehensive programmes well adapted to the changing needs of the market – ranging from training of installers to campaigns or consumer advice. Financial incentives are available to home owners and businesses willing to install a pellet boiler.

Leading European boiler producers have their headquarters in the Austrian region and based on the successful home market they are exporting pellet technology all over Europe. They are set to export to the US also. A network of companies active in the field of energy efficiency and renewable energy sources (the Oekoenergie-Cluster which is managed by the O.Oe. Energiesparverband - the regional energy agency) supports companies in their business development. There are 148 partner companies in the network, achieving a turn-over of €1.6 billion and having 4500 employees.

Image Gallery (3)



District	2007	2008
Upper Austria	1.1	1.1
Lower Austria	0.8	0.8
Styria	0.7	0.7
Carinthia	0.6	0.6
Salzburg	0.5	0.5
Tyrol	0.4	0.4
Vienna	0.3	0.3
Burgenland	0.2	0.2
Source: Oekoenergie-Cluster		

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Source: Oekoenergie-Cluster		

Reader Comments (11)

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<p>Author: James Thurber Date Posted: March 11, 2009</p>	<p>Interesting article. Where can I learn more about the problems associated with burning agri-pellets cleanly? Also, are there any figures available on the EROEI and cost for commercial electricity generation from burning pellets?</p> <p style="text-align: right;">Comment 1 of 11</p>
<p>Author: Thomas Tait Date Posted: March 19, 2009</p>	<p>You will need to check calorific content of material being used and then you should get between 25 to 35% recovery as electricity depending on size of plant and its efficiency but that is rough guide.</p> <p style="text-align: right;">Comment 2 of 11</p>
<p>Author: John Groweg Date Posted: April 7, 2009</p>	<p>I have always thought that there should be more emphasis on pellet fuel than cellulosic ethanol from wood byproducts and stover. Why expend the energy to make ethanol when the byproducts can simply be pelletized?</p> <p style="text-align: right;">Comment 3 of 11</p>
<p>Author: Clint LeRoy Date Posted: April 7, 2009</p>	<p>Pellet fueled stoves are inherently more fuel wasteful. They have to run all the time as it takes human intervention to start the pellets burning. So in the long run they can not work from an ignition point like Natural Gas or Heating Oil.</p> <p>Ethanol from Corn leftovers after the sugars have been removed is a plausible and more energy productive arrangement. The problem you derive though is that you take away some food quality from the animals that are fed the leftovers. But, then again more transportation is needed to haul the corn to the ethanol plant and then haul the leftovers to the animals. The Nutritional quality of the leftovers is less for the animals. I personally feel using the leftovers as a fuel to power the ethanol plant is a better way to go. But most business models do not show it that way.</p> <p>Pelletizing Corn leftovers or silage is something that is being done in the Lewisburg PA area by a friend of mine. He is actually using over one year old silage and corn stover. Mixed through a press to make pellets and with a 6% ash content. He is trying to convince Pellet Stove Manufacturers to use his product. He is a Dairy Farmer of a large herd.</p> <p style="text-align: right;">Comment 4 of 11</p>
<p>Author: Carlos Date Posted: April 8, 2009</p>	<p>I have a pellet stove - been using it for 3 winters.</p> <p>A 20kg bag of pellets typically lasts us 4 days to a week - for \$9 (Australian).</p> <p>There is no waste, we set the feed rate to match conditions and turn it off when going to bed. The feed rate can be very slow without the "fire" going out.</p> <p>The down side: you can't get instant heat - at breakfast time, don't bother, you'd be on the train to work before the room warmed up - have coffee instead.</p> <p>There are not enough pellets in the world for everybody. Shhh, keep pellet stoves our secret. Sustainable heating for the masses will have to come from solar/wind/geothermal and better house design. When there's not enough sun close to the poles, it might test</p>

the limits of HVDC cables. e.g. from the Sahara to Norway.

Pelletable material might compete with the biochar market. A better use for pellets might be to pyrolise and bury them - nature's carbon sequestration.

It also disturbs me that my carbon neutral fuel arrives by diesel truck. Can't wait till those Smith electric trucks are commonplace and charged by the wind.

Comment 5 of 11

Author:
[Martin Sherring](#)
 Date Posted:
[April 8, 2009](#)

Re James Thurber's question about agri-pellets, the most comprehensive source I found was a European research project which published in 2003. The report is downloadable at <http://www.pelletcentre.info/resources/1093.pdf>.

Comment 6 of 11

Author:
[David Doty](#)
 Date Posted:
[April 8, 2009](#)

Thanks, Christiane Egger, for this well researched and long over-due article (a rarity at REW) on a very important subject. And thanks Martin Sherring for the super reference. There was also a complementary article in the 13 Mar issue of Science. This is a critical subject because of its importance to what officialdom has seen as our planet's best future fuel – cellulosic ethanol. However, the energy in the cellulosic ethanol is not likely to approach 50% of the input wood energy for at least another 6 years. Wood burning can exceed 90% efficiency.

Bulk wood in large quantities (thousands of tons) is currently about \$130 per metric ton (MT), or about \$7.2/GJ. Wood pellets in quantities of a few tons (in favorable regions) are about 40% more expensive.

The cost of wood seems likely to soar again within a few years. A severe pine-beetle blight began in North America in 1999, and today vast expanses (several gigatons, over 500,000 km²) of the forests in the U.S. are dead. These forests will be largely destroyed by wildfires over the next 6 years. Wood pellets briefly sold for over \$350/MT in many places in early 2008. Demand for wood pellets is projected to grow by another order of magnitude over the next decade, while at the same time several GT of dead pine forests will be consumed by forest fires. It's hard to image wood pellets being under \$400/MT (\$22/GJ) by 2013. At that price, cellulosic ethanol from wood will be over \$5.50/gal. More useful and relevant information is available at the Doty Energy website, under biofuels.

And there is a better solution for future transportation fuels than cellulosic ethanol – efficiently recycling CO₂ into ethanol, gasoline, and jet fuel using off-peak wind energy. Read more about it at the WindFuels website.

Comment 7 of 11

Author:
[Martin Buckley](#)
 Date Posted:
[April 8, 2009](#)

Very good article. I like your simplicity of explanation and it really is informative to those who read it. Too bad a lot of other authors can't explain issues so well. Thank you.

Comment 8 of 11

Author:

No free lunch. Soot is second leading cause of global

[Russ Finley](#) warming behind CO2:
 Date Posted: [April 8, 2009](#)
<http://www.independent.co.uk/environment/climate-change/soot-reduction-could-help-to-stop-global-warming-1224481.html>
http://news.mongabay.com/2009/0405-hance_blackcarbon.html

A pellet stove may be worse than a gas appliance when it comes to global warming. Gas also burns a lot cleaner and may even be cheaper in some cases.

Comment 9 of 11

Author: [Russ Finley](#)
 Date Posted: [April 8, 2009](#)

On the other hand, displacing coal with biomass in a powerplant will help with global warming, assuming natural carbon sinks are not destroyed to get the biomass. Coal is also still used for heating homes in China. Displacing that with wood pellets would certainly help with global warming, with the same carbon sink caveat.

Comment 10 of 11

Author: [Ross Anderson](#)
 Date Posted: [April 8, 2009](#)

In Minnesota where I live we have more wood lying around downed in our urban forests than anyone could possibly use. Even if everyone one of us burned pellets made from it. The vast majority of the resource rots and goes to waste. The reason? Natural Gas, and the inherent laziness that this inspires in people. The fact is that massive amounts of free natural resources within 100yards of the consumer go to waste because of the huge subsidies that have created a super efficient fuel delivery system. The only thing that will change this human behavior is a long and protracted recession that forces people to turn to free local resources over the cost of efficient, but not free delivered fuels. Hey, that's what is going on here in America, a long and protracted recession. Almost makes you think it is by design, by the designers of our new eco-friendly economy... I expect the Urban forest floors to get cleaned out in the next couple of years.

Comment 11 of 11

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