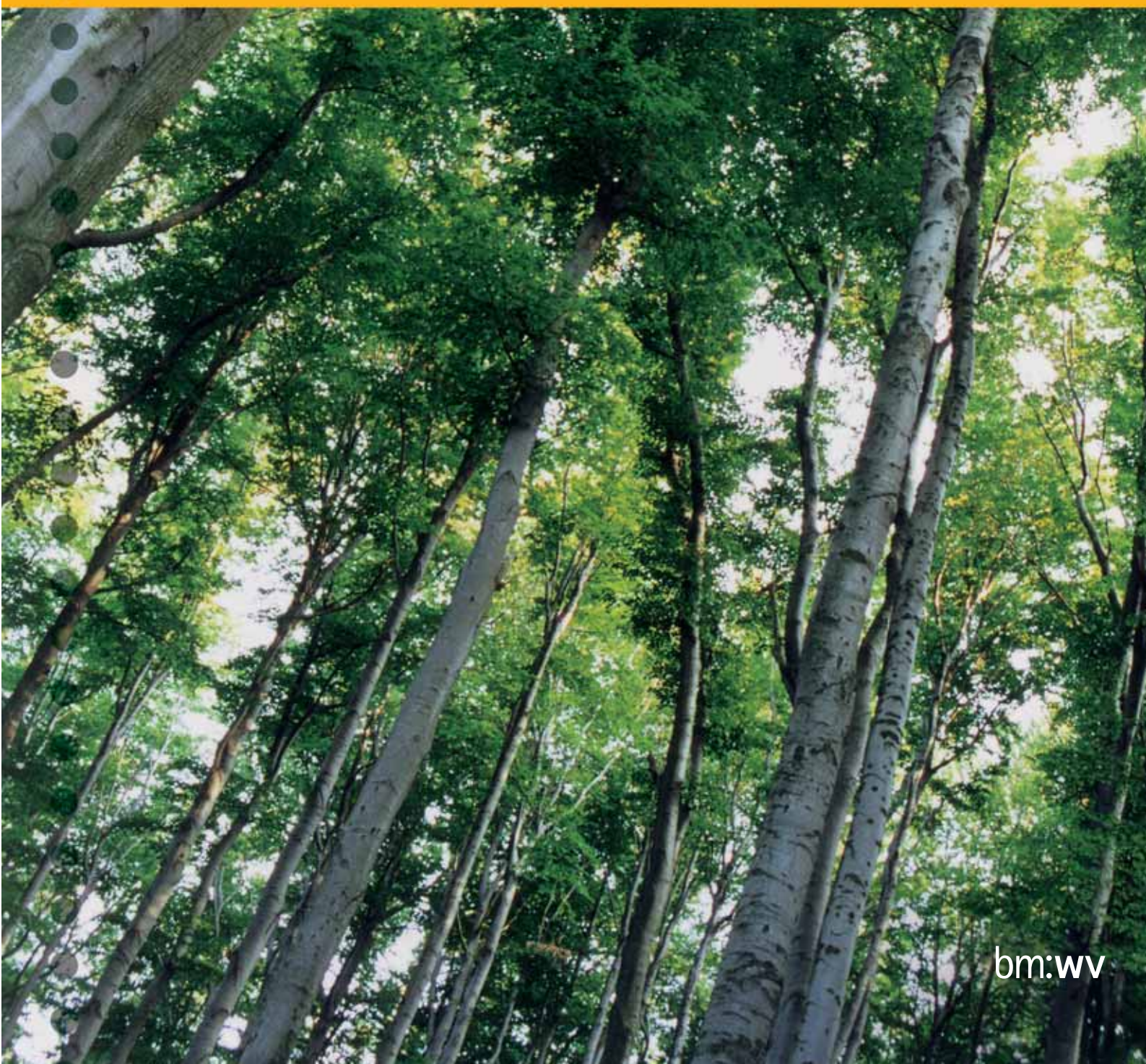
FORSCHUNGSFORUM
3/98
ENERGY

SPREADING OF SMALL-SCALE BIOMASS PLANTS IN AUSTRIA

NEW DEVELOPMENTS
FUEL SUPPLY WITH BIOMASS PELLETS



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P R O J E C T S

HEATING WITH BIOMASS IN AUSTRIA

Present Situation, Trends, New Perspectives

■ Austria is one of the leading European countries in making use of biomass in automatically stoked boilers. This includes development of plants as well as spreading of private small-scale plants and district heating projects in rural areas, which are fed with wood chips from the forest and waste wood from the wood-processing industry. Intensive research work over the last twenty years has led to a great leap of technology in the field of modern wood-fired heatings. Thus, substantial improvements could be achieved in reducing emissions, increasing efficiency rates, and making handling more convenient. Research initiatives not only concentrate on technological development, but also on implementation-oriented projects and the elaboration of appropriate diffusion strategies.

Wood is a domestic renewable energy source. It can play a major role in containing the greenhouse effect and is of great importance for the local economy. In 1996, 18.5 per cent of Austrian households used wood for heating. This relatively high percentage and Austria's leading role in Europe in the field of technological development, however, should not hide the fact that a considerable downward trend has been observed in recent years. 10 years ago as many as 21.5 per cent of Austrian households used wood for heating. Obsolete wood-burning heaters are likely to be replaced by gas- or oil-fired heatings.

This development can only be met by the introduction of modern wood-fired heatings - wood-chip- and pellet-fired heatings and heating boilers for logs. The use of small-scale wood chip plants up to 100kW has considerably increased. Only 0.6 per cent of the households, however, are heated by such facilities at present.

Wood chips from the forest are used as a fuel only in farming areas, where users own their own forest, and sufficient space is available. The goal is the spreading of biomass plants in heavily built-up urban areas, in housing estates and commercial properties, in tourism businesses, and as an alternative in replacing existing oil-fired heatings in detached family houses. Conventional fuels are not always appropriate to reach this goal.

This is where the utilization of pelleted biomass comes in. ***Biomass pellets*** offer decisive benefits and may represent another important alternative to fossil fuels in the future.

In recent years industry and the public have increasingly shown interest in this technology and, therefore, require more information.

Two recent studies, commissioned by the Federal Ministry of Science and Transport, deal with the topic "Spreading of small-scale biomass plants in Austria and the use of biomass pellets" and formulate the preconditions for further successful development.

Pellets

Wood chips

Corn-cockle

Briquettes

The Inter-University Research Center of Technology, Labor, and Culture (IFZ - Interuniversitäres Forschungszentrum für Technik, Arbeit und Kultur; Harald Rohracher, Jürgen Suschek-Berger, Günther Schwärzler) in Graz provides in its study "Verbreitung von Biomasse-Kleinanlagen" ("Spreading of Small-Scale Biomass Plants") recommendations on how to promote the spreading of modern wood-fired heatings.
The study is based on interviews with potential plant users in two Styrian municipalities and with experts in Styria and Lower Austria.

The study "Brennstoffversorgung mit Biomassepellets" ("Fuel Supply with Biomass Pellets") (Johannes Haas / Roger Hackstock) looks into preconditions for the use of the new raw material, summarizes all the experience at hand, and provides recommendations for participants and sponsoring institutions. About 30 interviews and visits were carried out along with surveys among energy experts. The study documents the results, structured according to individual fields of an infrastructure based on pellets.

Biomass Pellets

Pellets in this context are cylindrical sticks made of cut, pressed scraps of wood or ground raw materials of similar consistency. They are 5 - 40 mm thick and 10 - 80 mm long. They are produced by pressing the material through metal plates with appropriate drill-holes under high pressure. The machines employed are normally used in the feed industry and can press 0.5 - 5 tons per hour. Pellets have a moisture content of approx. 10 per cent and a bulk weight of 600 - 700 kg/m^3. They have a calorific value of 4.8 kWh per kg, which means that their energy density is about four times that of wood chips from the forest.

FUEL SUPPLY WITH BIOMASS PELLETS

"Pellets should definitely put the energy source wood on a quality level with liquid energy sources. In the long run, even all the logistics of fuel oil supply could be used."

Since 1996 several branches of industry and commerce have increasingly shown considerable interest in pellets.
The use of pellets could give an impetus to the partially stagnating development of biomass as a domestic renewable fuel on the market. Therefore, expectations placed in this new technology are high.

Biomass pellets offer decisive benefits. They comply with all the requirements to be used as an alternative to liquid, fossil fuels, even when a high degree of automation and combustion quality is required and/or available space is limited.

Furthermore, they facilitate the achievement of a singular standard of fuel quality for the whole of Austria and the use of logistics similar to those used in the distribution of fuel oil.
They can easily be transported, conveyed, and stored, and they burn well adjustably in conventional plants or in such especially built for pellets.
Moreover, several possible alternative raw materials can only be put on the market after pelleting.

GOALS AND EXPECTATIONS

In recent years more and more attempts have been made to implement the use of biomass pellets as fuel with all its theoretically undeniable benefits. The use of pellets is to facilitate replacement of fossil fuels by biomass, to increase the value of the production chain "wood", and to integrate many different participants in the field of heating with wood into a new structure.

Essential problems which obstruct a wider spreading of modern biomass wood-fired heatings can be solved by the use of pellets:

- Pellets have an energy density of 3,120 kWh per m^3 (approx. 650 kg per cubic meter of bulk wood and 4.8 kWh per kg), which is about four times that of wood chips of good quality.
Thus, the demand for storage decreases considerably.

- Owing to a uniform moisture content of 8 - 9 per cent there is no more microbial decomposition, no more formation of mildew and spores, and combustion can be perfectly adjusted, no matter which raw material is used.

- It is easier to handle feeding control and containment of harmful substances, therefore, heating facilities should become more economical (smaller facilities, use of cheaper materials.)

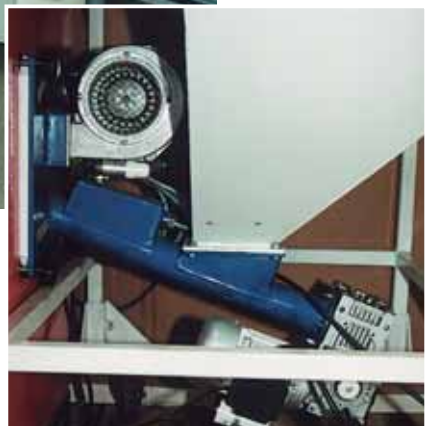
- Pellets can be sold in small quantities in supermarkets and can be distributed loose by tankers in urban areas.

- The same fuel is suitable for room heaters as well as for large plants; pellet burners can even be flange-mounted on existing oil boilers.

RECOMMENDATIONS

In spite of the positive aspects of biomass pellets the development of the market can not been foreseen yet. A fundamental problem here is that participants' point of view differs, depending on whether they are involved before or after pelleting. "Before" the goal is to achieve the highest possible increase in value through waste treatment. Energetic use is only of interest if it leads to higher proceeds. "After" pelleting a high-quality energy source has emerged, which is to help putting biomass heating on a comfort level with oil- and gas-fired heatings. In addition, fuel and plants should be as economical as possible.

Therefore, sponsoring which wants to support biomass pellets as a contribution to Austria's renewable energy supply has to focus on the energetic use of pellets and to leave all other steps in the process to the market. Otherwise, competitive utilization like cat litter, binders, or the export of pellets would also be sponsored. What should be supported is: local production and distribution, enhancement of heating plants, installation of pellet boilers, particularly to replace fossil fuels and electric heatings, and possibi-



Boiler testing stand BLT Wieselburg

lities of direct energetic use of pelleted industrial waste. Interviews resulted in varied approaches to perfection and further development on different levels.

Procurement and Quality

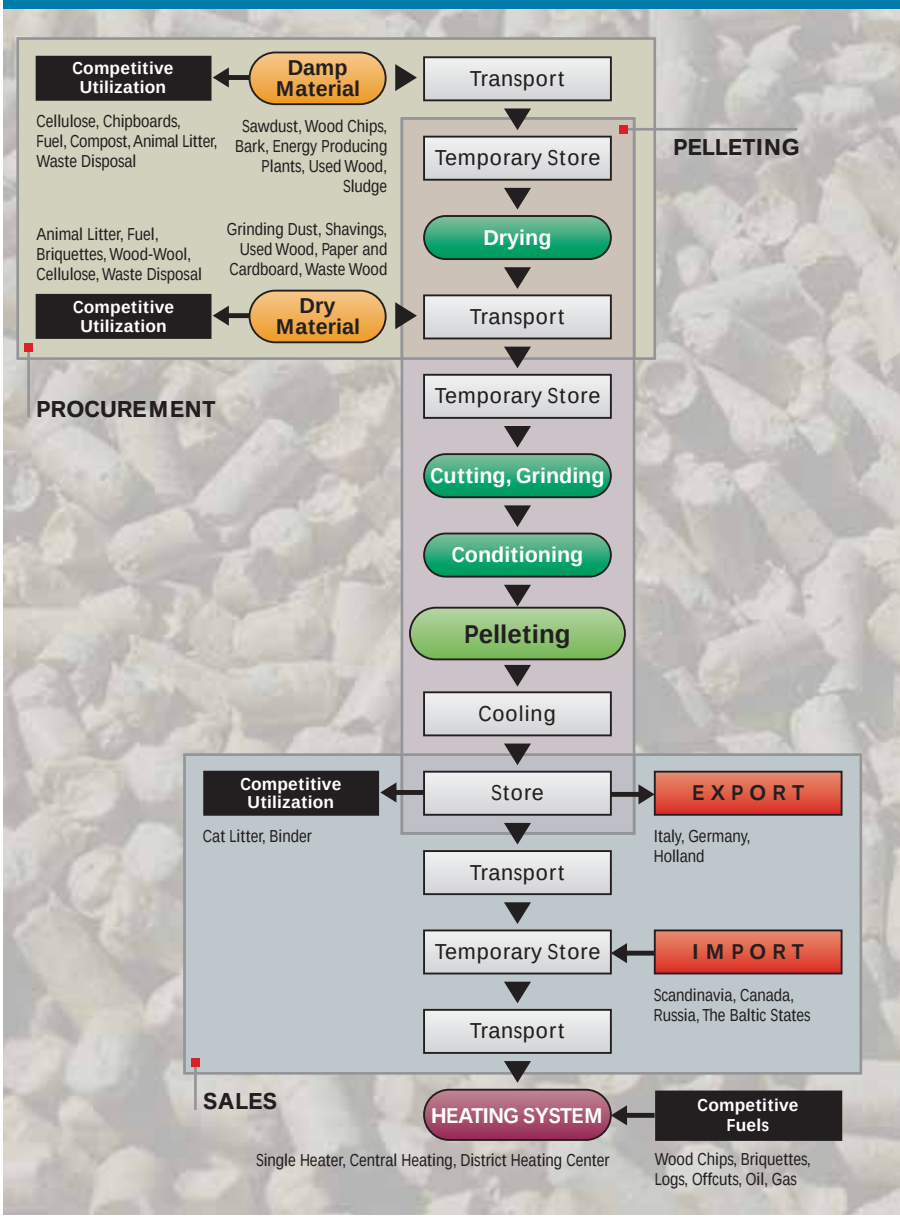
In 1996 approx. 15,000 tons of pellets and 100,000 tons of briquettes were produced of dry waste wood from wood treatment in Austria. The annual amount of dry material is about 300,000 tons. It is difficult, however, to estimate how much is really available. It would be an important approach to establish a system of cheap decentralized pelleting. A considerable increase of the potential, however, is only possible with damp waste-products from sawing, thinning material, agricultural biomasses, and suitable industrial waste. For further spreading it will be necessary to carry out extensive surveys on the potential of every available source, from agriculture and forestry to industry, and to draw up cost estimates for comparison to competitive utilization.

In principle, pelleting of waste material and mixing of different raw materials are also attractive logistic solutions. First of all, however, "ideal mixes" should be defined, and the use of fuels in suitable facilities only should be guaranteed. There is a call for standardized quality checks of all pellets on the market, since traders and users are not able to check the level of harmful substances.

Distribution Structures

Nearly all interviewed participants regarded perfection of distribution as an important driving force in market development. Improvements could be achieved, for example, by unloading small amounts from transport vehicles (e.g. augers instead of fans) or automatic distribution for central heating systems in multiple dwellings. It is, above all, important to pursue a uniform pricing policy - at present pellets are not cheaper than fuel oil - , to coordinate the market through uniform offers, to safeguard the quality of the products, and to intensify information and public relations work.

Scheme of Biomass Pellet Use



Source: Study "Brennstoffversorgung mit Biomassepellets" (Haas, Hackstock)

Heating Plants

In this field, reduction of purchase prices should result in a considerable increase of market shares. Low-energy houses or small-scale facilities with a maximum power of 10 kW for central heating systems should be developed. It could also be considered to combine the system with hotplates or tiled stoves. Economical small silos with feeder device and automatic ventilation during blowing in, which can be installed instead of oil tanks, are necessary too. Another prerequisite for sensible distribution of this technology is standardization of testing conditions for pellet boilers.

Supply with heating services, especially for commercial users, and intensified cooperation between manufacturers and heating engineers are major requirements in developing adequate background structures. The final goal should be to define the ideal quality of pellets for every use and then lay down binding standards. Public funding by the Federal Government and provincial governments - above all, for replacing electric, oil-fired, and gas-fired heatings by small-scale biomass plants - will be an essential factor in spreading the plants.

APPROACHES TO THE SPREADING OF MODERN WOOD-FIRED HEATINGS

Massive spreading of this technology in Austria is necessary not only with a view to increase the share of renewable energy sources. It is also a prerequisite to keep the utilization of wood at the present level and not to lose ground to fossil energy sources.

■ Since the beginning of the 80s it has been one of the goals of Austria's policy on energy and ecology to substitute the domestic renewable fuel wood for the imported fuels coal and oil. High energy efficiency rates and low emissions enable wood-fired heatings to keep pace with modern oil- and gas-fired heatings, provided the appropriate fuel is used. However, wood-fired heatings have constantly lost market shares. At the moment, about 580,000 households are heated with wood. Still, the annual decline amounts to 2,000 - 3,000 facilities.

The study "Verbreitung von Biomasse-Kleinanlagen" emphasizes the important role of heating engineers in connection with this. While owners of other heating systems were given advice from their local heating engineer, owners of wood chip plants had a great deal of troubles to convince their engineer. Heating engineers are not integrated very well into the project because the installation of wood-chip-fired heatings requires more technology and know-how, and, above all, because of the manufacturers' strategy to supply end-users directly instead of using the heating engineer as a middleman.

Further obstacles to the spreading of biomass plants are an insufficient level of information within large parts of the population, high-priced facilities, a confused and often not target-group-oriented range of facilities offered on the market, uncertain availability of the fuel, and their image of being less user-friendly.

A catalogue of ideas was worked out in the study "Verbreitung von Biomasse-Kleinanlagen" on the basis of interviews with participants and analysis of the results. The most important strategies to remove existing obstacles and to promote positive approaches are summarized below:

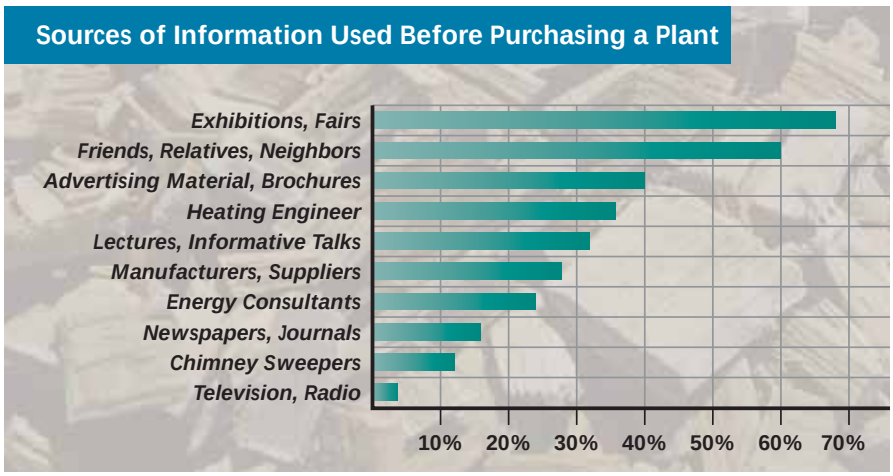
■ Integration of heating engineers into the project and their training play a major role in the spreading of biomass plants. Setting up a network of certified biomass partner engineers should help to establish a pool of qualified and locally available experts.

■ Cooperation between manufacturers should intensify immensely. Technology transfer from research to firms, as well as promotion of cooperation between manufacturers - for example, in the field of joint development and use of facility components - play a major role in further spreading. The concept of "innovation assistants" - "integration experts", partially financed with public money, who promote cooperation with research and between firms as consultants and agents - may be a strategy to achieve this goal.

■ On the suppliers' part a range of more attractive offers will have to be developed. Perfect infrastructure is a prerequisite of customers other than farmers and wood owners using biomass. Furthermore, a new range of service offers is being developed. Direct supply with heat seems to be a successful marketing strategy, particularly in the field of multistory residential buildings, public buildings, or small groups of houses. In Styria a contracting model is already in progress. Some associated farmers operate, maintain, and sometimes prefinance heating plants and then add their charges to the heat price.

■ Sponsoring is also essential in this field. Customers are not likely to invest in an expensive small-scale biomass plant because prices for oil and gas are low at the moment. The erection of a modern biomass plant should be directly sponsored in order to attract non-agricultural user-groups as well.

Sources of Information Used Before Purchasing a Plant



Interviews with 25 users of small-scale biomass plants in two Styrian municipalities
Source: Study "Verbreitung von Biomasse-Kleinanlagen" (IFZ)

ITF-PROJECT "STORAGE, TRANSPORT, AND LOGISTICS OF WOOD PELLETS"

Participants in a project of the Innovation and Technology Fund (ITF) are a pellet manufacturer and dealer (UMDASCH AG), a pellet boiler manufacturer (Fa. Sonnenkraft), the Austrian Institute of Wood Research (Österreichisches Holzforschungsinstitut), and UMBERA (Environment oriented Management Consulting). They aim to find solutions to existing problems at the interfaces raw material supplier - pellet manufacturer - supplier / carrier - boiler manufacturer - client / contractor - customers.

The goal of the project is to elaborate minimum standards in the following areas:

- quality of the raw material (shavings) - in order to guarantee problem-free production of pellets (permissible impurity, dampness, bulk density,...)
- quality of the pellets in terms of transport, storage and durability, feeding, and burning
- ways of (temporary) storage and transport (maximum turnover rate, ideal injection pressure, etc.)
- make of the customer's storeroom (volume, tightness, installations, dampness, protection devices against heavy impact during blowing in,...)

Furthermore, uniform guidelines regarding the connections between storeroom and pump wagon for automatic blowing in, and solutions to perfect feeding of the pellets to the burner are to be elaborated. Another goal is the coordination with existing standards (ÖNORM, DIN, current fire regulations and those in the process of being elaborated, instructions of the Austrian Council for Agricultural Engineering and Rural Development on pellets, etc.)

Logistics, which are to be developed, should aim at constructing a continuos reliable, on-schedule, and economical supply chain from the place where secondary raw materials occur, pellet production, fuel business and availability, erection and guaranteed maintenance of the heating plants to required general and market information.

Members of the Austrian Pellets Association (a merger of some fuel and boiler manufacturers, aiming at cooperation and common marketing) and all other pellet and pellet boiler manufacturers, heating engineers, dealers, planners, and, above all, (potential) customers will benefit from the results.

Results found in Austria should also contribute to the EU-sponsored THERMIE-B-project - Industrial network on woodpellets - From the production to the marketing of a comfortable biomass fuel, in which, aside from Austria (coordination: UMBERA), the European Biomass Association, and companies from Austria, Germany, Sweden, and Norway want to cooperate.

PROJECT SPONSORS

The study *"Verbreitung von Biomasse-Kleinanlagen"* was commissioned by the Federal Ministry of Science and Transport, the Department of Science and Research of the Province Styria, and the Styrian Energy Society of the IFZ - Inter-University Research Center of Technology, Labor, and Culture, Graz. March 1997.
Project Leader: Harald Rohracher, Jürgen Suschek-Berger
Cooperation: Günther Schwärzler

The study *"Brennstoffversorgung mit Biomassepellets"* was commissioned by the Federal Ministry of Science and Transport. March 1998.
Project Leader: Johannes Haas, Roger Hackstock

PUBLICATIONS

The studies ***"Verbreitung von Biomasse-Kleinanlagen"*** and ***"Brennstoffversorgung mit Biomassepellets"*** were published by the Federal Ministry of Science and Transport in the series "Berichte aus der Energie- und Umweltforschung".

Available at: *PROJEKTFABRIK, Nedergasse 23, A-1190 Wien.*

The complete list of the series "Berichte aus der Energie- und Umweltforschung" can be found on the Forschungsforum homepage:
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