Telling the story in Austria
Sustainable wood energy supply

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INTRODUCTION

The use of forest biomass for heat generation has a long tradition in Austria. As a natural raw material, wood has been used to produce local and district heat since the early 1980s. With a forest coverage of 46%, Austria is one of the most densely forested countries in Europe. The increasing level of energy consumption, the finite nature of fossil fuels, the current supply uncertainties and the limited ability of the environment to absorb emissions have, in the truest sense of the word, stoked demand for biogenic fuels such as wood chips, split logs and pellets.

In Austria, biomass combustion technology has achieved an exceptionally high level of sophistication. In the last few decades, the market has developed enormously and offers a broad range of efficient and environmentally-friendly heating systems. Modern wood heating appliances offer the same comfort and convenience to consumers as heating systems designed for fossil fuels, meaning that what was once a persuasive argument against their use is no longer so important. In recent years, fuel wood has started to be used to a significant extent to supply heat in agricultural and timber processing companies as well as to fuel micro and local heating networks. In addition, fuel wood increasingly finds its way into our living rooms in the form of tiled and wood burning stoves.

Farmers and forest managers are by far the most important providers of biomass, and at the same time the key players in fostering the increased use of renewable energy sources. Securing a sustainable energy supply will be this century’s greatest challenge. Since the solutions to this energy challenge will be as much regional as national or international, it is necessary to formulate and determine regional approaches to meeting it. Fulfilling regional energy supply requirements from renewable energy sources closes not only the ecological loop but also economic
cycles. Prices for split logs, wood chips and pellets are developing in a relatively stable manner and largely independent of the sharply fluctuating world market prices for oil and gas. Fuel production is opening up new areas of activity for the agricultural and forestry sector, as well as for the timber processing industry. Wood is therefore not only a crisis-proof and cheap source of energy, but also a home-grown raw material that adds local value by creating and securing jobs and income within the region.

**The Energy Situation in Austria**

For the economy and society of a country to function, access to secure, sustainable and affordable energy resources over the long term is essential. At present, Austria still meets 73% of its gross domestic energy needs by imports from abroad. Over the next few years it is intended that this proportion be significantly reduced in favour of renewable energies. At 27%, the very high proportion of renewable energies in Austria’s gross domestic consumption is of particular significance for the country’s energy supply.

![Diagram showing the structure of gross domestic consumption in 2007](image)

*Fig. 1 Structure of gross domestic consumption in 2007 (Source: Statistic Austria)*
The share of renewables in Austria’s final energy output is largely supported by two key elements: the use of solid biomass for energy generation and the use of hydropower. These also make a significant contribution to the fact that in 2008 it was possible to meet 72% of domestic electricity consumption from renewable energy sources. However, the provision of energy for the industrial and transport sectors continues to be an issue. In 2008, the share of renewable energies in the transport sector (biodiesel, bioethanol and plant oils) only amounted to 5.3%.

Fig. 2 Renewable final energy in Austria in 2008 - Share of energy sources (Data source: Renewable Energy Sources Act calculations | www.energiestrategie.at)
Forest Biomass: An Energy Source with a Future

With a forest coverage of 46%, Austria is one of the most densely forested countries in the European Union. In arithmetic terms, for every Austrian citizen there are 0.5 hectares of wood. Of these 3.9 million hectares of wood, around 85% are cultivated. Due to its mountainous topography, Austria has a relatively high share of protective forest, the majority of which is non-productive, and which, for economic reasons, is not cultivated.

Austria applies the principles of sustainable forestry, which are anchored in numerous laws. The Austrian Forestry Act is one of the strictest in the world and enshrines the basic principle that forest must remain forest. Since 1961, compliance with this basic principle has been ensured by means of the Austrian Forest Survey, which is conducted by the Federal Forestry Department and the Research Centre for Forests. Its role is to continuously monitor the condition of the forest, with special regard to any structural changes.

The Austrian forest is characterised by a variety of forest communities and species of trees. Approximately 70% are coniferous trees (spruces, firs, larches, stone pines and black pines) and 24% are broadleaf trees (beech, oak); the rest are shrubs. The undisputed dominant tree species is the spruce, at 55%. However, in recent years the proportion of spruces has fallen back relatively rapidly in favour of deciduous and other coniferous trees. The forestry industry has reacted by selecting and promoting tree species that are suited to changing climatic conditions (rising temperatures).

In Austria, the resource “forest” is primarily in private ownership, i.e. owned by a large number of small foresters. A third of the overall area is owned by larger forestry
operations, with only around 15% being under the ownership of the state. The economic exploitation of wood as a raw material provides forest farmers with an income and thus helps to secure their livelihoods. There is no risk of damage to the forest, as it is exploited sustainably, i.e. no more wood is used than is replaced by new growth.

**THE FOREST AS A RESOURCE POOL**

Austria possesses enormous raw material potential, which until now has been left to slumber in its forests. Since 1975, the area covered by forest has increased by 7% and this trend continues on an upward path. And not only the forested area, but also the stock of wood is continually increasing. Across the country, a total of 31.3 million solid cubic metres of wood grow each year. Of this amount, only 18.8 million solid cubic metres, or 60%, are used. In addition, at 62.7 million solid cubic metres, residues from thinning in the context of forest management are extremely large. The greatest potential lies in forest areas on agricultural land, where only 46% of the annual growth is currently exploited.

Due to the topography of the terrain, the exploitation of forest resources is relatively difficult. On the one hand, special techniques are required for logging in alpine areas, and on the other hand there are higher harvesting costs. Only 46% of the existing resource potential can be harvested with cost-effective, low-intensity technologies such as harvesters and forwarders.

![Fig. 3 Harvesting methods in Austria](image-url)
In view of the growing concern about climate change and the impending shortage of fossil fuels, it is essential to forge ahead with the continued expansion of biomass usage. However, enthusiasm for doing so must be combined with a determination to ensure that in future the forests continue to be cultivated in a sustainable manner. Ripping out rootstocks and clearing out limbs and branches wholesale with large machinery is not the way that Austria should go. A look at current practice shows that for cost reasons forest residues are only harvested where the branches are already close to the logging roads following the use of cable cranes. Moreover, the heating value of this material is up to 25% less than that of forest wood chips. As a general rule, the use of forest residues for energy generation must be thought through very carefully and tailored to the local conditions. The routine harvesting of wood for energy supply purposes takes place within the context of a sustainable cultivation of the forest areas. This, however, requires highly trained and qualified personnel. Austria caters to this demand with numerous secondary schools and colleges that specialise in all aspects of forestry.

**Quality Requirements Placed on Wood as a Raw Material**

The construction of increasing numbers of heat and power generation plants has led to a strong upswing in demand for biogenic fuels over the recent years. Quality requirements are essential for ensuring that wood as an energy resource is used as efficiently as possible. Not all wood is the same when it comes to energy content.
Particular attention should be paid to the consumer’s specific quality requirements when marketing energy wood. For the typical use of biogenic fuels in single and multiple occupancy homes, the water content of split logs is limited to a maximum of 20%, while that of wood chips may not exceed 25%, as a high water content reduces the heating value of fuels. In order to supply the required amount of heat, much higher quantities of biomass need to be transported, stored and burnt. However, in larger district heating plants and industrial incineration plants, for economic reasons the use of very wet wood chips is both expedient and customary. Low-emission and efficient burning is ensured by these plants’ technical facilities (e.g. flue gas treatment and flue gas condensation).

The composition of high-quality fuels is subject to the requirements of numerous standards (e.g. wood pellets: Austrian Standard (ÖNORM) M 1735, wood chips: M 7133, etc.). Standards set out specific limit values for a variety of parameters such as water content, bulk density and ash content. As a result, efficient combustion of the raw material is guaranteed on the one hand, and on the other the customer is able to trust the fuel. Quality assurance is pursued throughout the entire value-added chain, from exploitation to utilisation.

**Convenient wood chip supply**

An essential condition to gain small, private homeowners as wood chip customers is a delivery system that is as customer-friendly as possible. That means dry, storable wood chips, a continuous supply and a convenient delivery method. Until now, the biggest obstacle to the installation of a wood chip heating system in a private single-family residence has been the supply system for wood chips. Most private homes are not accessible to the tipping of the wood chips from the trailer directly into the storage room because it is not possible to drive closely to the storage room with the tractor and the trailer. For such customers, a Styrian company
developed a new wood chip trailer called “Holzpumpe” (wood pump). This trailer is equipped with a material transport blower, a filter element and two pipes 20 metres in length. The two pipes are connected to the storage room with standardised couplings. Through one pipe, the wood chips are blown into the storage room, and the second pipe sucks air and dust out of the storage room and blows it through the filter element, where the dust is collected. The wood chip capacity of the trailer is about 40 cubic metres. With the new wood chip trailer systems, wood chip supply becomes easier and more convenient, which in turn makes wood chip heating systems more attractive for private homeowners.

**Traditional Market with Potential for Innovation**

Austria is a pioneer in the field of biomass use for energy generation purposes. As opposed to many European countries where the focus is placed on large-scale industrial plants, small and medium sized biomass incineration plants have a considerable market volume in Austria. While in urban areas the use of biogenic fuels has been largely replaced by fossil fuels such as natural gas and heating oil, biomass still plays a significant role in rural areas. More than two-thirds of the biomass exploited for energy purposes is used in low-temperature applications, either by small-scale consumers through burning wood, wood chips or pellets in individual stoves or central heating boilers, or in biomass-fuelled local heating plants that fire biogenic fuels such as bark, sawmill by-products and chips. Placing the emphasis on small and medium-sized plants makes it possible to take ecological aspects into consideration in the use of biogenic energy sources and to create an additional source of income for Austria’s small-structured agriculture and forestry sector.
In view of its large volume of domestic biomass resources, the use of solid biomass for energy production is a traditional form of renewable energy exploitation in Austria. In this respect, the current development of the market is building upon a broad base of pre-existing plants.
Just under half a million primary residences are currently heated with biomass-fuelled individual stoves and central home heating systems. A large proportion of these systems is equipped with modern combustion technology. New systems entering the market must comply with a strict approval procedure conducted by state-certified testing authorities. Due to the highly demanding requirements, significant progress has been made in the technological optimisation of firewood stoves for small incineration systems in terms of combustion and control technology since the 1980s, which has had a positive effect on the use and sales figures of these incineration systems. As a result, the emissions of organically bound carbon and carbon monoxide have been reduced to between a tenth and a hundredth of previous levels for both manually operated incinerators and automatically fed systems, while the level of efficiency has increased from an average of 60% to between 80% and 90% over the recent years. The design quality of the systems and their ease of use have also improved significantly. To make biomass-fuelled heating systems even more convenient for household users, increased efforts to stimulate the pellets market have been made in recent years.

Wood pellets are the most recent and most innovative type of wood fuel, and have undergone a rapid proliferation since 1997. Pellets are made from by-products of forestry management and the timber industry. During the pelleting process, pure, untreated wood is pressed into pellets without the addition of synthetic binding agents. Austria has the world’s sixth largest wood pellet production capacity. In 2009, domestic pellet factories attained a production capacity of 1.1 million tons. While previously only sawdust was used to produce pellets, nowadays wood from thinning and all kinds of wood residues are also being processed into pellets.

Wood burning stoves are also back in demand. In low- or zero-energy homes, demand for individual stoves has increased, as, with their low level of output, they can be optimally adjusted to the heating requirements of the home. Equipped with a viewing window, these stoves radiate a cosy atmosphere. They are also popular in older buildings as additional heating source in order to reduce oil and gas bills in the transitional periods in late autumn and early spring.
**BIOMASS DISTRICT HEATING PLANTS**

In the mid-1980s, local biomass heating networks began to be developed and constructed in rural areas of Austria. Since then, this market has experienced a considerable upturn. Biomass district heating plants provide communal buildings, multi-storey residential buildings, local and district heating networks and commercial and industrial operations with heat. In 2005, 1,002 biomass heating plants with a total output of 1,132 MW were in operation. As the customary biomass district heating networks only operate in winter, a few years ago moves were made to combine them with centralised solar powered hot water supply systems. It has thus become possible to provide the households connected to the grid with year-round heat and hot water generated from renewable energy sources.

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**Fig. 6 Biomass-heating plants and biomass CHP-plants in Austria (Source: Austrian Energy Agency)**
**Organisational and legal aspects**

A farmer-operator group unites to form a civil-law association or, in the case of bigger plants, a private limited liability cooperative. The heat supply cooperative sells the heat and is responsible for monitoring, service, repair and reinvestment of the system, as well as for chimney-sweeping. This means that the heating system does not involve any work for the customer purchasing the heat. Heat consumption is measured by a calibrated heat meter owned by the heat supply cooperative. The connection charge is based on the usual district heating rates.

**Project activities**

![Schedule of activities](Fig. 7 Schedule of activities (Source: www.agriforenergy.com).)
**Wood Energy Contracting**

In larger buildings and multiple occupancy homes, the trend towards wood energy contracting is increasing. This involves ever more fossil fuel heating systems being replaced by biomass technologies which predominantly consist of wood pellet and wood chip systems. The innovative nature of this model consists in the processing of the biomass by the operator—it is not the raw material, i.e. forest wood chips, that is sold, but rather heat as a service. Farmers acting as wood energy contractors rent the customer’s cellar and usually build a storage room outside of the house for the wood chips. Heat distribution equipment (heating pipes, regulation, pumps, radiators, etc.) is the property of the heat customer—just like with a district heating connection. A separate rental agreement is concluded for use of the heating and fuel storage room.

The heat customer does not have any organisational tasks in connection with the heating system. Thus it provides practically the same convenience offered by district heating, with the only difference being that the heat generator resides in the customer’s building. This system represents one of the most comfortable methods of heat supply. Typical customers are schools, municipal offices, nurseries, museums, residential buildings, etc. In the context of such projects, high-quality forest wood chips collected in the course of the management and thinning of forest areas on agricultural land can be used for the production of energy, thus resulting in an overall higher added value. Although at present the consumers involved in such projects are predominantly public institutions (local authorities, kindergartens and primary schools) or private residential buildings, multi-storey residential buildings constitute another key target market. The initial scepticism on the part of housing associations has already been largely overcome.
**Example - Wood Energy Contracting Project in Oberaich (2005)**

Properties supplied: primary school, 4 single occupancy homes  
Plant data: connected load 170 kW  
Annual heat requirement: 210 MWh  
Fuel storage area: 60 m³  
Annual wood chip consumption: 330 loose cubic metres  
System operator: 7 farming operations

**Cost structure** (Prices excluding VAT)

- Investment costs: € 56,000.00  
- Technical equipment: € 33,000.00  
- Electrical and heating installations: € 5,000.00  
- Structural measures: € 3,000.00  
- Heat supply pipeline 140 m: € 15,000.00

Income side:

- Connection charge per kW installed: € 150.00  
- Service charge per kW/year: € 20.70  
- Energy charge per MWh: € 59.00  
- Meter charge per month:
  - Primary school: € 9.75  
  - Residential buildings: € 7.50
**Electricity from Biomass—A New Challenge**

The use of split logs for heating purposes has long been state of the art. Small-scale plants for generating heat and electricity are an additional area of application for energy-independent households. In Austria, intensive research efforts into the development of combined heat and power plants have been conducted for a number of years. While in the industrial sector, combined heat and power plants (1 MW) have already reached market maturity, smaller CHP plants (50–400 kW electric) are still in the development stage.

**Energy Policy Subsidies**

Developing and promoting the use of renewable energy sources is a key aspect of Austria’s energy policy. In the context of the European Union’s policy package on climate and energy, Austria has committed itself to achieving an increase of 34% in its share of renewable energy sources by 2020. The increased use of forest biomass for heat and electricity production will make an important contribution to reaching this goal. With the exception of hydropower, heat and electricity generation from renewable energy sources is currently more expensive than with fossil fuel methods. To promote the market entry of renewable technologies—solar, photovoltaic, biomass, biofuels, combined heat and power, etc.—in spite of this fact, these technologies are supported financially by both the individual federal states and the Austrian government through a variety of funding methods. In addition to renewable energy technologies, energy efficiency measures aimed at reducing energy consumption are also supported. The specific subsidy rate for biomass plants ranges between 20% and 30% of the net investment costs. In Austria, the focus of energy policy subsidies is on technologies rather than raw materials.

Biomass district heating plants are subsidised at a standard rate of 25% of the environmentally relevant investment costs. If at least 80% of the forest wood chips used in the heating plants are produced in the region, a premium (sustainability premium) of 5% will be granted in addition to the standard subsidy rate. By stimulating the use of regional biomass, the subsidy guidelines serve as a financial steering instrument aimed at preventing purchases of raw materials (forest wood chips, sawdust and bark) from abroad. The transport of biomass over long distances
is not compatible with the concept of sustainability and calls the use of renewable energies into question. Furthermore, by purchasing raw materials from outside the region, the opportunity to create added value for local products is reduced.

A further focal point of the subsidy programme is to promote the acquisition of machinery that harvests the wood with as little ecological impact as possible, as well as subsidies for the provision, transport, storage and drying of biomass products.

**CONCLUSION**

The use of domestically supplied energy sources, especially wood, has a very long tradition in Austria and promotes the regional economy. More than 65 Austrian producers of biomass-fired furnace and boiler systems have established themselves on the international market with their quality products and comprehensive range of know-how and experience. The latest developments focus on the generation of electricity and heat in small and medium-sized plants. The ever-increasing prices and the lack of supply security for fossil fuels have contributed to a tremendous upsurge in the use of pellets, wood chips and other biomass fuels. At present, the forest as a resource is not yet fully exploited in Austria. The growing enthusiasm for biomass must be combined with a determination to ensure that in future the forests continue to be cultivated in a sustainable manner and that wood as a raw material is used efficiently. Standards and norms should continue to safeguard the quality standards of biogenic fuels both in Austria and on the European level. As, at the present time, renewable energies are unable to compete in the market with fossil energy systems, subsidising renewable technologies will continue to be a necessary and expedient approach. Using sustainable domestic resources secures jobs, creates added value to the regional economy, reduces dependency on fossil fuels and secures the world for our next generations.