# IEA BIOENERGY TASK 40

**"Sustainable International Bioenergy Trade: Securing supply and demand"**

# Country Report Austria 2009


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# 1 Introduction

Austria is a small country located in Central Europe with a population of 8.3 million. It borders both Germany and the Czech Republic to the north, Slovakia and Hungary to the east, Slovenia and Italy to the south, and Switzerland and Liechtenstein to the west. Austria's terrain is highly mountainous due to the presence of the Alps. Therefore the country is influenced by a temperate and alpine climate. The territory of Austria covers 84.000 km² (8,4 million ha). According to the Austrian forest inventory (1986/90) 3,9 million ha, nearly 50 percent of Austria, is forest. Forestry, sawmills and wood and pulp and paper industry therefore play a very important role in Austria. The overall utilised agricultural area is about 3,2 million ha. 1,375 million ha are crop land, 1,8 million ha are grass land (half of it are used extensively).

## 1.1 Greenhouse gas emissions and $CO_2$ reduction requirements

The Kyoto Protocol stipulates a reduction of greenhouse gases (GHGs) of the European Community by around 8% against the levels of 1990 over the commitment period 2008–2012. Austrias target is a reduction in GHG of 13% below base year levels by 2008-2012.

According to the 2009 Report on Climate Change Mitigation in Austria (Schneider, 2009) in 2007 greenhouse gas emissions in Austria amounted to 88 million tonnes of carbon dioxide equivalents ($CO_2$ equivalents), 11,3% above the levels of 1990. This means emissions in 2007 were 19,2 million tonnes of $CO_2$ equivalents above the annual mean value of the Kyoto target stipulated for 2008–2012. When considering emission trading as well as Joint Implementation and Clean Development Mechanism (JI/CDM) projects and the afforestation/deforestation balance, the deviation from the target is still around 8,1 million tonnes of $CO_2$ equivalents.

The main sources of GHG emissions in 2007 were the sectors industry (29,2%), transport (27,6%), energy supply (15,9%) and energy demand (residential and commercial) (12,6%). In the sectors industry and energy supply around 80% of the emissions are caused by plants participating in emission trading.

The post-Kyoto goal of the EU is to reduce greenhouse gas emissions by 20% until 2020. This is what the Member States agreed by adopting the climate and energy package in December 2008. This target value can be increased to 30% if other industrial nations including the USA commit themselves to similar reductions and newly industrialising countries such as China and India also make adequate contributions. Under the climate and energy package, Austria is expected to achieve a 16% reduction of its emissions by 2020 (excluding emission trading). The base year is 2005.

## 1.2 Energy Supply and Demand

In the following basic data about the development of the energy system in Austria will be presented. The data is referring to the energy balances of Statistics Austria[1]. For more detailed information on the status of the Austrian Energy System the report (BMWFJ, 2009) can be recommended. In table 1 data on the development of the overall energy balance for Austria is given. Because of the limited local sources of fossil fuels Austria is largely dependent on imports of oil and gas.

[1] www.statistik.at

Table 1 Overall energy balance for Austria for the period 2000-2007, in Petajoule ($10^{15}$ Joule); Source: Statistics Austria – Energy Balances for Austria, 2009

| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|---|
| Indigenious primary production | 412,5 | 416,1 | 428,3 | 430,4 | 433,8 | 420,1 | 440,1 | 458,9 |
| Imports | 925,7 | 982,1 | 1030,2 | 1127,1 | 1171,3 | 1238,5 | 1284,9 | 1246,1 |
| Stock changes | 9,0 | 38,5 | 0,3 | -7,5 | -6,6 | -9,2 | -28,9 | -15,6 |
| Exports | 125,3 | 145,1 | 142,6 | 158,8 | 189,6 | 202,9 | 232,2 | 268,4 |
| Net Imports | 800,4 | 837,0 | 887,5 | 968,4 | 981,7 | 1035,6 | 1052,7 | 977,7 |
| Gross inland consumption | 1221,9 | 1291,5 | 1316,1 | 1391,2 | 1408,9 | 1446,5 | 1463,9 | 1421,0 |
| Final energy use | 944,4 | 998,7 | 1016,8 | 1076,4 | 1081,3 | 1106,3 | 1118,2 | 1082,6 |

In the next figure (fig. 1), the development and the structure of the gross inland consumption of energy in Austria is presented. The gross inland consumption has increased from slightly above 1000PJ in the beginning of the 1990's to 1421PJ in 2007. The share of bioenergy has more than doubled in that period of time to 213PJ in 2007.

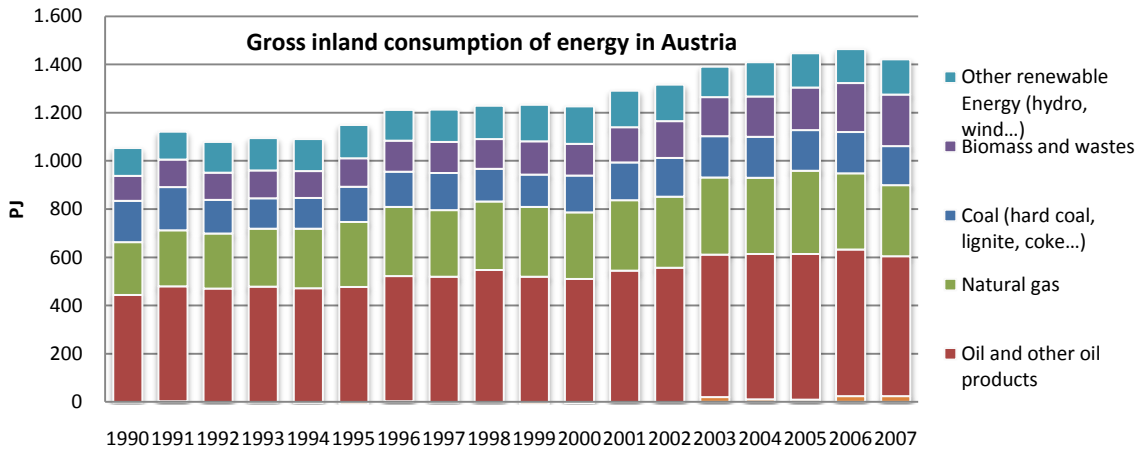



Fig 1 Development of the gross inland consumption of energy in Austria in Petajoule PJ ($10^{15}$ Joule); Source: Statistics Austria – Energy Balances for Austria, 2009

With regards to the production of energy in Austria the development has been characterized by a reduction in the share of coal (the production of lignite has been stopped in 2005) and an increase in the share of renewable energy in the past 15 to 20 years. In 2007 32,3% of the gross inland consumption of energy in Austria were covered by indigenous production (458.9PJ, see fig. 2).

Thanks to its favourable topographical position hydro power and bioenergy traditionally play an important role in the Austrian energy system. According to (BMWFJ, 2009) in 2007 the overall share of renewable energy in the local energy production was 76,4% (28,2% hydro power, 48,1% other renewable energy sources). The share of oil was 9% and the share of natural gas was 14,6%.

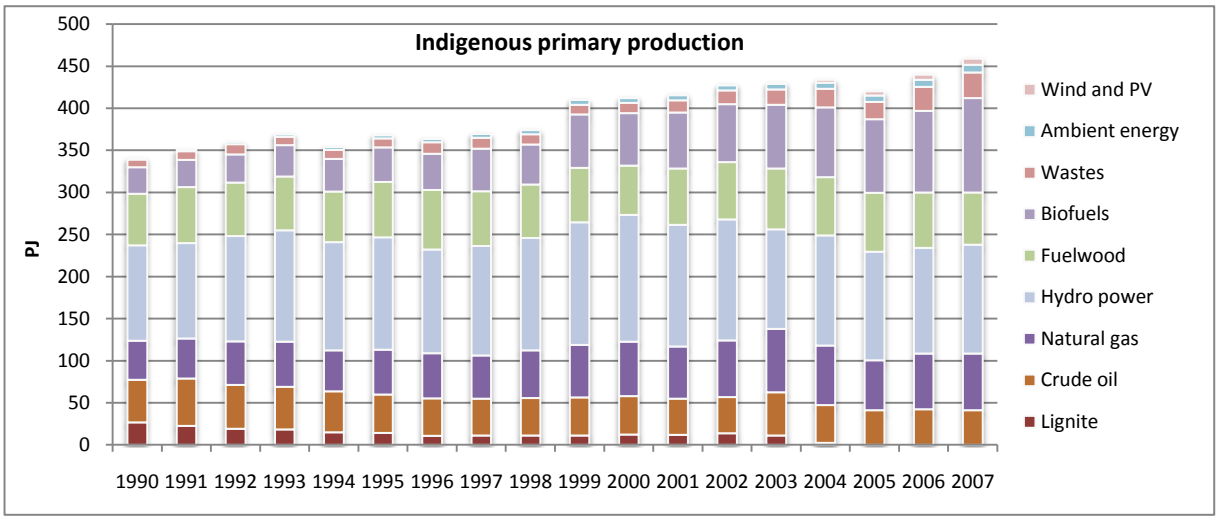



**Fig 2 Development of the indigenous primary production of energy in Austria in Petajoule PJ ($10^{15}$ Joule); Source: Statistics Austria – Energy Balances for Austria, 2009**

As shown in figure 3 the production of renewable energy has increased from 217PJ in 1990 to 350PJ in 2007. Energy from biomass and hydro power are the most important renewable energy sources in Austria. Depending on precipitation (snow and rain) and temperatures the annual production of hydro power is ranging between 113-150PJ, with an average of about 131PJ. In 2007 about 130PJ have been produced by hydro power. The overall share of bioenergy has increased strongly since 1990. This is primarily due to an increase in the production of biofuels (use of by-products of the saw-mill- and pulp and paper industry, biogas, liquid biofuels...).

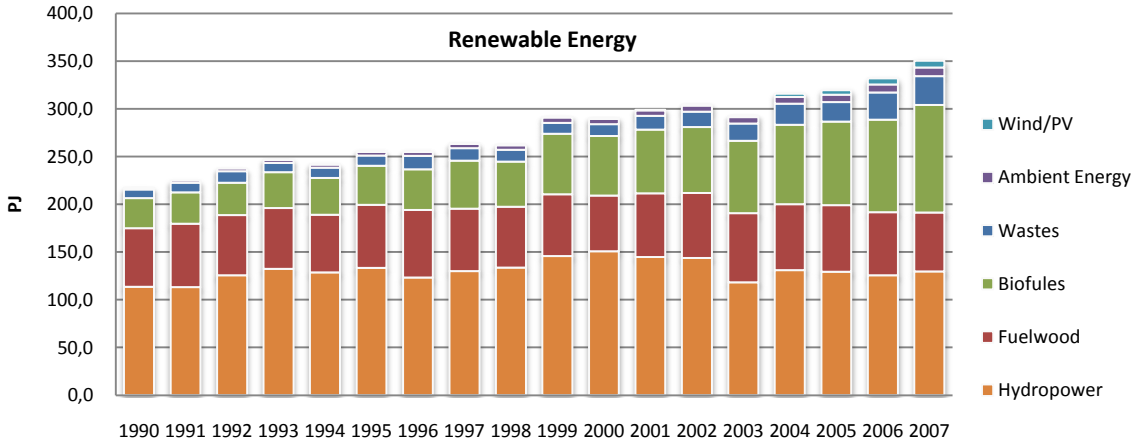



**Fig 3 Development of the indigenous production of renewable energy in Austria in Petajoule PJ ($10^{15}$ Joule); Source: Statistics Austria – Energy Balances for Austria, 2009**

Figure 4 shows the development of the distribution of the final energy use in the economic sectors. In 2007 the distribution was as follows: industries and construction: 29%, transport: 35%, commercial and public services: 9,4%, the residential sector: 24,3%, agriculture: 2,4%. Except for the agricultural sector and the residential sector there have been increases in the use of energy in all other sectors since 1990. The strongest increase, more than 80%, has been in the transport sector. This development in the transport sector on the one hand originates from a steady increase in the car occupancy rate and car travel in general and on the other hand is caused by increases in transportation of goods and in air traffic.

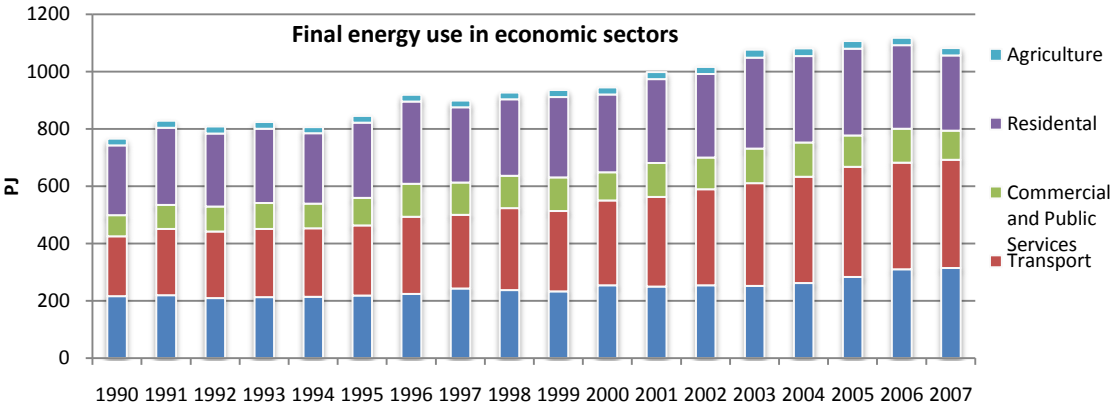



**Fig 4 Development of the final energy use in the economic sectors in Austria in Petajoule PJ ($10^{15}$ Joule); Source: Statistics Austria – Energy Balances for Austria, 2009**

# 2 Policy

## 2.1 National targets and measures to stimulate RES

Due to the RES directive, Austria is obliged to increase its share of renewables on the total gross final energy consumption until 2020 to 34% and at the same time decrease the GHG - emissions in those sectors which are not part of the ETS until 2020 by 16%. Moreover, of course the European target of 10% RES share in the transport sector also holds for Austria. The RES-E target to be achieved by Austria in 2010 (due to the RES-E directive from 2001) is 78% of gross electricity consumption.

To reach the 2020 targets in June 2009 the Austrian federal ministry of economy, family and youth and the ministry of agriculture, forestry, environment and water management initiated the policy process "Energy Strategy Austria". The aim of this process is the development of a sustainable energy system that guarantees the supply of energy services to private households and enterprises and at the same time is fulfilling the EU 2020 targets. Energy supply security, environmental compatibility, cost efficiency, energy efficiency, social compatibility and competitiveness are the framework conditions for the work within this process.

The process "Energy Strategy Austria" now is supposed to come up with concrete measures for fulfilling these targets. For this purpose, nine working groups have been established.

1) Renewable Energy
2) Hydro Power
3) Conventional energy generation
4) Grids (Transmission, distribution, storage)
5) Buildings
6) Households and service sector (without heating)
7) Energy intensive industry
8) Mobility
9) Incentives, Regulation, Financing, R&D

These working groups are cooperating until autumn 2009 and three official meetings are scheduled for each of them. After the results of these working groups are completed, a clearer picture about technology specific and in particular bioenergy specific targets might be available. Up to now, there is only a preliminary study for a bioenergy action plan (BMLFUW, 2006) which however has not been adopted formally. Latest in mid 2010 the national renewable action plan for Austria should be ready including sector and technology specific targets.

## 2.2 Research and development for renewables

With regard to energy R&D funding in Austria, there have been improvements and Austria has slightly increased its funding in recent years. In 2002 the goals of Austria's R&D policy were laid down in the "Austrian Energy Research and Energy Technology Concept" document. The main objectives of this document were to promote sustainable development, to boost existing strength, to engage in European energy R&D activities and to focus on results-oriented programmes. A strategy process called "e2050" was launched in 2005 with the aim to develop a long-term strategy for Austrian research on energy technologies. Based on this strategy the government has developed different programmes for the energy sector to support R&D in renewable energy and energy efficiency and for

market demonstration and deployment. The programme “Energy for the Future” was created in 2007 with a budget of 20 million Euros with the aim to support high-quality technology R&D projects.

In the report (Indinger, et al., 2009) there is a detailed overview about Austria’s public expenditures for energy related research and development. In the following there is given an excerpt of this report (the executive summary) with the most important data.

According to this report in 2007 Austria’s public expenditures for energy related research and development were 31.886.023 Euro. Compared to 2006 this means a decrease of 24,8 %. About two thirds of this amount (67,3 %) [2006: 72,9 %] was supplied by the government (state, federal) and funding organisations. However 32,7 % [2006: 27,1 %] of Austria’s expenditures were spent by universities, colleges of higher education and research institutions, which are (partly) publicly financed.

The expenditures of federal ministries amount 11.784.740 Euro, lead by the Federal Ministry of Transport, Innovation and Technology with 58,5 % [2006: 82,0 %], followed by the Federal Ministry of Agriculture, Forestry, Environment and Water Management with 20,8 % [2006: 7,4 %] and the Ministry of Economy and Labour 16,6 % [2006: 8,5 %].

Universities spent 6.615.374 Euro [2006: 7.144.127 Euro], lead by Vienna and Graz University of Technology.

Federal provinces (Länder) spent 4.429.318 Euro [2006: 2.980.568 Euro]. Vienna was the province with the highest expenditures 56,1 % [2006: 10,4 %], followed by the province of Upper Austria (23,3 %) [2006: 28,4 %]. Styria has been removed from its leading position with 7,0 % [2006: 36,5 %].

The most important fields were “renewable energy” with some 46,5 % [2006: 32,6 %] and “energy conservation” amounting up to 24,1 % [2006: 23,6 %].

About 60 % [2006: 56 %] of the budget was spent for applied research, the share of experimental development was 24 % [2006: 33 %]. 16 % [2006: 11 %] was spent for basic research. 578 energy-R&D projects in 2007 were identified and analysed [2006: 560].

## 2.3 Green electricity

The EU Directive 2001/77/EC establishes targets for increasing the proportion of electricity generated from renewable energy sources. The target for Austria is an increase in the share of renewable electricity from 70% to 78%.

The promotion of green electricity is regulated in the Green Electricity Act and the associated orders (BGBL I Nr 149/2002 idF. BGBL I Nr 44/2008) at a federal level in Austria. A feed-in tariff system (purchase obligation, guaranteed tariff height & length) is the main instrument to develop renewable electricity in Austria.

The following table gives an overview on the feed-in tariffs system in 2009.

| EINSPEISETARIFE FÜR ÖKOSTROMANLAGEN | | Tarif in Cent/kWh gemäß BGBl II Nr 53/2009 10 plus 2 (reduzierte) Jahre |
|---|---|---|
| | | 2009 |
| Windenergie | | 7,53 |
| Feste Biomasse (wie Wald-hackgut, Stroh) | bis 2 MW | 15,63 |
| | 2 bis 5 MW | 14,93 |
| | 5 bis 10 MW | 13,28 |
| | über 10 MW | 11,08 |
| Abfall mit hohem biogenen Anteil | SN 17, Tab. 2, Bsp. Rinde, Sägespäne | minus 25 % |
| | SN 17, Tab. 1, Bsp. Spanplattenabfälle | minus 40 % |
| | Andere 5-stellige SN in Tab. 1 und 2 ÖkoStrG | 4,89 |
| Mischfeuerungen | | anteilig |
| Zufeuerung in kalorischen Kraftwerken | Feste Biomasse (Waldhackgut, Stroh) | 6,28 |
| | SN 17, Tab. 2, Bsp. Rinde, Sägespäne | minus 25 % |
| | SN 17, Tab. 1, Bsp. Spanplattenabfälle | minus 40 % |
| | Andere 5-stellige SN in Tab. 1 und 2 ÖkoStrG | minus 50 % |
| Mischfeuerungen | | anteilig |
| Flüssige Biomasse | Pflanzenöle, kaltgepresste biogene Öle, RME bis 300 kW | 12,49 |
| | Pflanzenöle, kaltgepresste biogene Öle, RME über 300 kW | 9,49 |
| | andere flüssige biogene Brennstoffe | 5,99 |
| Biogas aus landwirtschaftl. Produkten (wie Mais, Gülle) | bis 100 kW | 16,93 |
| | 100 bis 250 kW | 15,13 |
| | 250 bis 500 kW | 13,98 |
| | 500 bis 1000 kW | 12,38 |
| | über 1000 kW | 11,28 |
| Biogas bei Kofermentation von Abfallstoffen | | minus 30 % |
| Deponie- und Klärgas | Klärgas | 5,93 |
| | Deponiegas | 4,03 |
| Geothermie | | 7,28 |
| Photovoltaik | bis 5 $kW_p$ | 45,98 |
| | 5 $kW_p$ bis 10 $kW_p$ | 39,98 |
| | über 10 $kW_p$ | 29,98 |
| Kleinwasserkraft *) | | |

*) Geförderte Tarife für bestehende Kleinwasserkraftanlagen ohne entsprechender Investitionen zur Revitalisierung oder Neuerrichtung sind gemäß Ökostromgesetz mit Jahresende 2008 ausgelaufen.

| | a) Errichtung nach 2007 Vertragsabschluss 2009 (15 Jahre) | b) Errichtung nach 2007 Vertragsabschluss 2009 (15 Jahre) |
|---|---|---|
| a) nach Investitionen mit mindestens 15 % Stromertragssteigerung<br>b) Neubau bzw. mindestens 50 % Stromertragssteigerung | | |
| erste 1.000.000 kWh | 5,94 | 6,23 |
| nächste 4.000.000 kWh | 4,56 | 4,99 |
| nächste 10.000.000 kWh | 3,79 | 4,15 |
| nächste 10.000.000 kWh | 3,42 | 3,92 |
| 25.000.000 kWh übersteigend | 3,29 | 3,76 |

[Einspeisetarif abgestuft nach jährlich eingespeisten Strommengen]

| |
|---|
| Kombinierte Strom-Wärmeförderung bei Biomasse-Altanlagen (genehmigt 2003-2004) |
| Wärme-Unterstützungstarif möglich (allerdings Maximalbegrenzung) |
| WT=ET/4,4-WP |
| wobei WP = 2,4 Cent/kWh(th) |

[Quelle: Energie-Control GmbH, Februar 2009]

**Tabelle 1: Einspeisetarife 2009**

More details on the promotion of green electricity can be found on the homepage of the Austrian energy regulator (www.e-control.at).

## 2.4 Promotion schemes for RES-Heat in Austria

Promotion of solar thermal, heat pumps and biomass heating systems for residential appliances is strongly based on investment subsidies. Since they mainly belong to the authority of the province governments, nine different schemes exist. National policies only exist for large scale plants (e.g. biomass district heating, commercial plants).

Within all provinces, traditionally quite substantial subsidisation schemes for residential building construction (and more recently also for renovation) exist. These schemes since the 1950's represented the main promotion system for supporting the construction of new residential dwellings. Originally, no energy specific standards were required for receiving these subsidies.

However, within the last years, several provinces transformed these systems in promotion schemes for higher thermal quality of building shells as well as for renewable systems (e.g. support is only granted in dwellings with solar thermal or biomass heating systems).

These subsidisation systems on the provincial level (i.e. investment subsidies for RES-H systems and subsidies for residential building construction) clearly represent the main promotion scheme for RES-H systems in Austria.

Besides financial incentives there is a number of awareness campaigns and training programmes from regional energy agencies as well as the federal government (e.g. the "holz:wärme" for biomass and "solar:wärme" for solar thermal within the frame of the programme "klima:aktiv").

### 2.4.1 Subsidies for biomass systems

Since the beginning of the 80's (after the second oil crisis) the Austrian government forced the use of bioenergy mainly to reduce the dependence of imports of coal and oil. There were a variety of measures to facilitate the marketing of renewable energy sources both at the federal and the provincial level, ranging from fiscal measures and subsidies to emission standards.

With respect to biomass heating systems, investment subsidies are granted in every province but their amounts and conditions are different. In Carinthia and Vorarlberg, fixed amounts are paid out, whereas in other provinces, such as Burgenland or Styria, the subsidies account for certain proportions of the total investment costs. In some provinces there are also additional requirements and restrictions and thus, a comparison between the different support schemes is not straightforward.

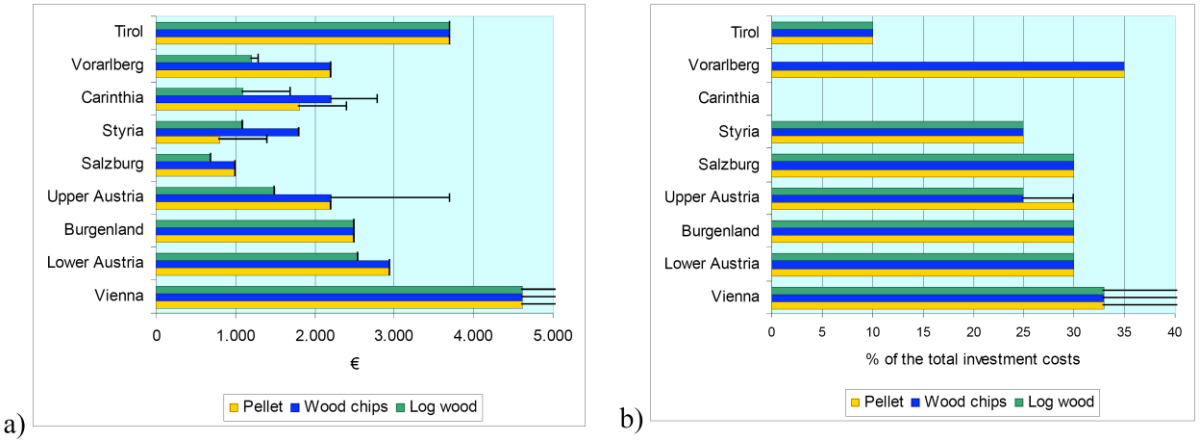



**Fig 5 Investment subsidies for domestic biomass heating systems in Austrian provinces in € (a)[2] and % of the total investment costs (b); Source: Haas, Havlickova, Kalt, Knapek, Kranzl, Weger 2005**

In some regions, municipalities also grant subsidies for domestic biomass-fired heating systems and there are also support schemes for the installation of small-scale district and local heating systems in some provinces (e.g. Styria, Upper Austria, Carinthia). Biomass-fired combined heat and power systems and heating systems for agricultural purposes are subsidised both at federal and provincial level.

[2] The investment subsidy in Vienna is between 33 and 51% of the total investment costs, depending on the emissions of the heating system. The maximum amount is 7,250€.

Austria has been very successful in recent years in developing sustainable energy technologies like solar water heating and biomass heating technologies. One reason for this is the promotion of the use of renewable energy with subsidies. The following figure illustrates the dynamic development of investment subsidies for domestic biomass heating systems in Austrian provinces in recent years. In 1998, investment subsidies were granted only in Burgenland, Upper Austria, Carinthia and Vorarlberg. There were no direct subsidies in the other provinces but the installation of new heating systems was supported by the granting of soft loans. In the following years, direct investment subsidies were introduced in all provinces and in most of them the amounts were raised significantly.

The impact of these measures was the acceleration of substitution of old and inefficient single stoves and boilers with modern low-emission systems. As a result world-class technologies have been developed in Austria that have turned into exporting industries. In 1998, about 1.900 wood chip and 1.300 pellet heating systems had been installed in Austria. According to (Furtner, et al., 2009) in 2008 the number had risen to 4.100 and 11.100 respectively.

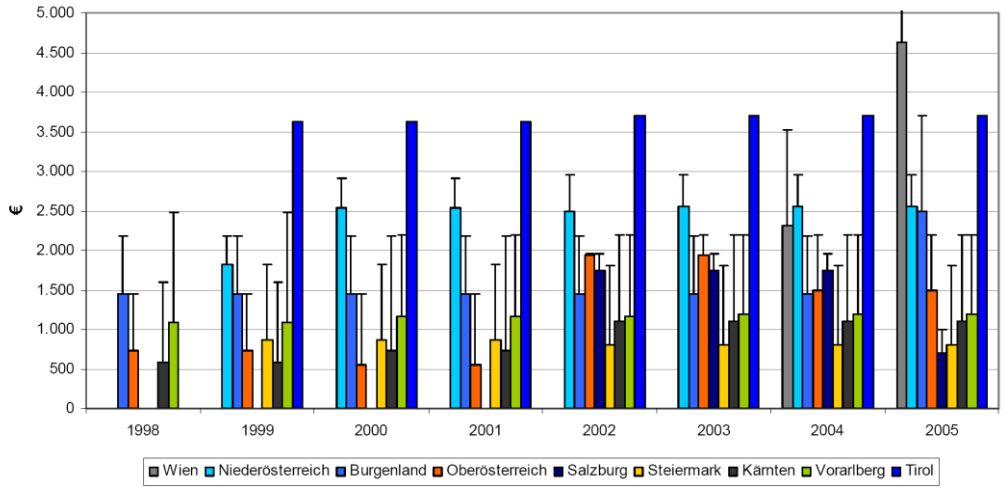



Fig 6 Development of investment grants for small-scale biomass boilers in the Austrian provinces; Source: EEG

### 2.4.2 Subsidies for solar thermal systems

In general, the provincial subsidies started during the 1980's and developed strongly during the 1990's. Roughly speaking, the level of investment subsidies vary for solar thermal systems in the range of 20%-40% of investment costs (depending on the size of the installation, the type of collector and type of system, e.g. between 600€ to 1.700€ for water heaters, 1.100€ to 3.500€ for combined solar systems).

### 2.4.3 Subsidies for heat pumps

For heat pumps investment subsidies are in the range of 10%-30% of investment costs (depending on the type heat source, coefficient of performance etc). Moreover, for heat pumps several electricity utilities provide additional incentives like investment subsidies or/and reduced electricity tariffs.

## 2.5 Biofuels

The following information about biofuels is taken from the report "Biofuels in the transport sector in Austria 2008" (Winter, 2008) that is published annually by the Austrian Federal Environmental Agency.

The Directive 2003/30/EC on the promotion of the use of biofuels or other renewable fuels for transport (the Biofuels Directive) was transposed into Austrian national law by an amendment to the Fuel Order (Kraftstoffverordnung) in November 2004. Since 1 October 2005, in accordance with Austrian legislation, those subject to the substitution requirement have had to ensure that biofuels replace 2,5% (energy content basis) of all petrol and diesel fuels placed on the market. This increased to 4,3% on 1 October 2007 and to 5,75% on 1 October 2008.

To promote the use of biofuels in the transport sector rates of duty are lower for fossil fuels that are blended with biofuels compared to fossil fuels without blending. By Decision of the National Council of 24 April 2007 the 1995 Mineral Oil Duty Act (Mineralölsteuergesetz) (BGBl. No 630/1994), as last amended by Federal Act BGBl. I No 180/2004), was amended by means of the 2007 Finance Act (Budgetbegleitgesetz, BBG 2007). The following rates of duty per 1.000 litres are currently valid:

**Table 2 Rates of duty for fossil fuels and biofuels in Austria; Source: (Winter, 2008)**

| Fuel type | Specification | rate of duty per 1 000 litres |
|---|---|---|
| **Petrol** | containing at least 44 l of biogenic substances and with a sulphur content of no more than 10 mg/kg | 442€ |
| | Other | 475€ |
| **Diesel** | containing at least 44 l of biogenic substances and with a sulphur content of no more than 10 mg/kg | 347€ |
| | other | 375€ |
| **Pure biofuels** | completely exempt from mineral oil duty | 0€ |

# 3 Domestic biomass resources

The basic requirement for the production of biomass is land. In Austria about 7,5mio ha (~90% of the area) are theoretically available for agriculture and forestry. In fact about 3,17mio ha were agricultural land and 3,34mio ha were used for forestry in 2008. 1,38mio ha of the agricultural land are arable land, the rest is grassland.

Assessments of biomass potentials are numerous and the results vary widely (see (Rettenmaier, et al., 2008) for example). Basically, there are different concepts of potentials (like theoretical, technical or environmentally compatible potentials). Usually potentials in literature are qualified according to these definitions. Yet methodological approaches, assumptions and constraints of potential assessments differ from study to study, and therefore results are often not directly comparable. According to (Kaltschmitt, et al., 2000) the theoretical annual potential of biomass in Austria is 3.300PJ.

Given that the theoretical biomass potential is subject to several restrictions we will refer to the realisable biomass potential (the part of the energy that can be exploited taking into account various barriers and diffusion restrictions) that can be implemented sustainably in the following paragraphs. We therefore correspond to (Haas, et al., 2008) which gives a very detailed and complete overview about the Austrian bioenergy potentials. Figure 7 gives an overview of the results of the dynamic biomass potential assessment of this study. The historic utilization (2005) is also depicted.

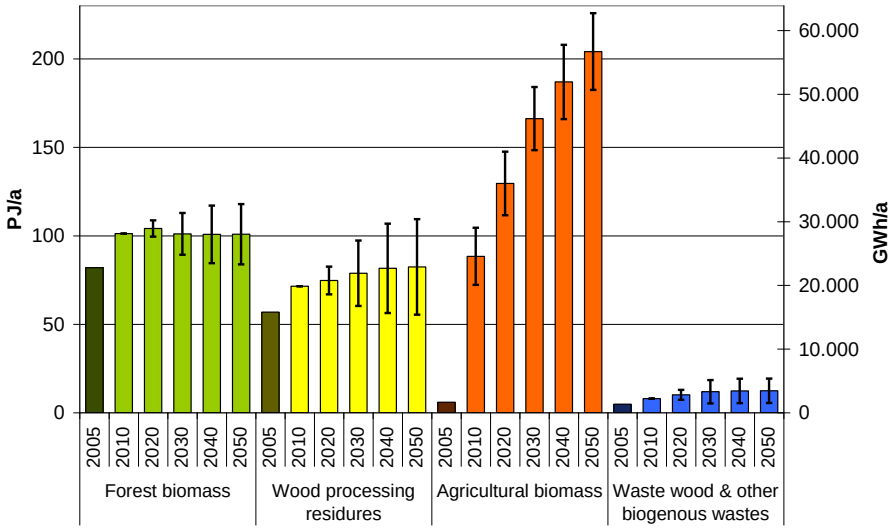



**Fig 7 Overview of the biomass resource potentials in Austria and the historic utilization in 2005; Source: (Haas, et al., 2008)**

It is clear to see, that the current use of biomass is primarily based on forest resources ("wood processing residues" include residues of the wood processing industries, such as wood chips, saw dust and waste liquor of the paper industry). In 2005 about 82PJ of forest biomass have been used for energy consumption. On the short term, a further increase in the use of forest biomass can be expected. However, according to (Haas, et al., 2008) the additionally available potential of forest biomass and wood residues is quite limited when it is presumed that the domestic raw material supply of the wood processing industries (especially the paper, pulp and board industry) should not

be put at risk. Therefore the annual potential for energy from forest biomass could be in the range of 84-118PJ up to 2050.

Agricultural biomass (including agricultural residues and wastes) has only been utilized scarcely in the past (about 6PJ in 2005) but represents a very big potential. Given that structural changes of the agricultural sector and a mobilization of the agricultural biomass resources are about to happen, agricultural biomass could even become the most important fraction. The Austrian annual potential for agricultural biomass is given in a range of 182-226PJ up to 2050.

For the dynamic potential assessment in (Haas, et al., 2008) a special focus was put on the different influencing factors for the availability of biomass resources, such as the future development of the wood processing industries or livestock breeding in Austria or the availability of arable land for bioenergy production. By assuming different developments for these influencing factors, probable ranges for the potentials have been assessed. These ranges are also included in Figure 7. For wood processing residues the estimated annual biomass potential ranges from 55-109PJ, depending strongly on the development of the wood processing industries and for waste wood and other biogenous wastes the range could be 5-19PJ up to 2050.

Alltogether, according to (Haas, et al., 2008) the annual biomass potential in Austria could be in a range of 330-470PJ in 2050.

# 4 Current and expected future energy use of biomass in Austria

With a share of more than 10 % in the total primary energy consumption, biomass currently plays an important role in the Austrian energy supply. Until the end of the 20th century, the energetic use of biomass was limited to heat generation. But in recent years it has also become increasingly important for power generation and in the transport sector.

In the electricity sector, the implementation of feed-in tariffs in the Austrian Renewable Energy Act of 2002 resulted in the enhanced use of biomass for combined heat and power generation. However, after an amendment to the Renewable Energy Act was passed in 2006, the deployment came to a halt.

In the transport sector, according to the European biofuel directive an obligatory quota for biofuels was introduced. However, according to the implementation of the directive in Austria, the target of 5,75 % of biofuels in the total transport fuel consumption has to be reached by the end of 2008. Hence, the Austrian regulation is clearly more ambitious than the EU directive (which specifies this target for the end of 2010).

The data and figures that are given in the following part of this chapter are taken of a study on strategies to develop and enhance the use of bioenergy in Austria up to 2050 (Haas, et al., 2008). This study was finished in 2008. The following figure 8 gives an overview on the development of bioenergy in Austria and a short-term outlook until 2010. It shows that the use of bioenergy has been increased from 95PJ in 1980 to more than 170PJ in 2007. The outlook to the year 2010 is based on recent trends as well as data on planned and approved bioenergy plants.

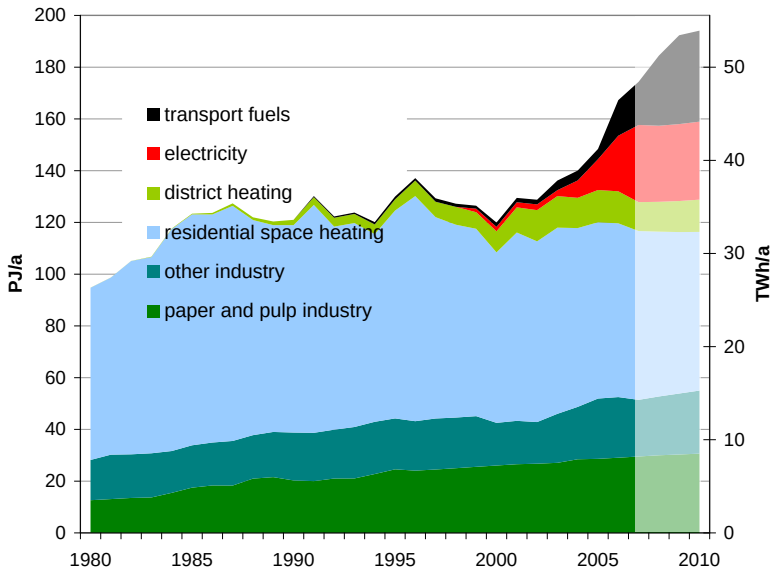



**Fig 8 Historic development of bioenergy in Austria and short-term outlook until 2010. Sources: E-Control 2008, Austropapier 2008, Haneder et al. 2008, Statistik Austria, Biotreibstoff-Institut, Primes 2006, EEG**

## 4.1 Forest biomass and industrial wood processing residues

Forest biomass (fuelwood and wood chips) is widely used for heating in Austria. Depending on the duration of the heating period the demand for fuel wood is ranging between 60-70PJ $y^{-1}$. Additionally

industrial biomass, e.g. sawmill by-products (wood shavings, wood chips, bark and other wastes) and residues of the pulp and paper industry (black liquor) are playing an important role in forest biomass energy consumption. In 2004 about 31PJ of sawmill by-products and 24PJ of black liquor have been used for energy purposes.

The amount of saw-mill by-products is to a great extent correlating with the demand for sawn wood. Moreover saw-mill by-products can either be used for the production of other products (e.g. paper, particle boards...) or energetically (e.g. pellets, briquettes). Because of this severe competition with regards to potentials of woody biomass it is necessary to have a closer look on the overall wood processing industry.

According to (Moser, 2008) the most important wood processor in Austria is the sawmill industry. Sawn wood is mainly exported and the demand for sawn wood in Italy, USA, Japan and Levant (countries of the East Mediterranean) is the „driving force" in the timber industry. It determines how much round timber is cut, and this quantity then determines how many sawmill residues (wood chips and shavings) are produced and thus available on the market. Sawmill residues are important raw materials for the paper industry and particle board industry. In the paper industry, the ratio between pulpwood (timber direct from the forest) and sawmill residues is 1:1. In the particle board industry it is 1:2,5.

Output figures in the sawmill industry, the particle board industry and the paper industry have shown a rising tendency till the beginning of the global financial crisis, as has the demand for the raw material timber and sawmill residues.

The demand for timber for energy recovery has also increased. Biomass firing installations have been established in the timber and wood processing industry as well as to provide heat and electricity for final consumption, a trend which has caused contention between material and energy recovery, especially over assortments of shavings from saw mills (wood pellet production) and wood chips.

Since 2008 as a consequence of the global financial crisis there has been a reduction in the demand for sawn wood and other wood products with higher value.

The following figure (fig. 9) shows biomass potentials for different scenarios of the Austrian wood processing industry (see Haas et al 2008).

In the "biomass max" scenario it is assumed that there is a steady growth in the saw mill industry whereas in the same time there is a drop in the production of pulp and paper and particle boards. This could happen under the following basic conditions: a stronger promotion of bioenergy and higher prices for energy. This scenario would be ideal for the development of bioenergy potentials because then a greater amount of sawmill by-products would be available for the production of bioenergy products. In this scenario the overall annual potential for forest biomass and industrial wood processing residues could reach 230PJ in Austria.

The "industry min" scenario describes a situation, where the whole wood processing industry has to face a decline of the market. To give an example this situation could occur due to a decline of the whole economy (the situation right now) or because of a stronger competition from eastern European countries. In this case the annual potential for forest biomass and industrial wood processing residues could increase to more than 190PJ in Austria.

In the “industry basis” scenario it is assumed that there is a slight increase in all the sectors of the wood processing industry. This would result in a slight increase (across all products) in the annual potential for forest biomass and industrial wood processing residues to about 175PJ.

With “industry max” a scenario is drawn with a considerable increase in all the sectors of the wood processing industry. Due to this assumption there would be a decrease in the available potential of fuel wood and wood chips. In the same time there would be an increase in the available potential of bark and black liquor. In this scenario the overall annual potential would be comparable to the one from the “industry basis” scenario.

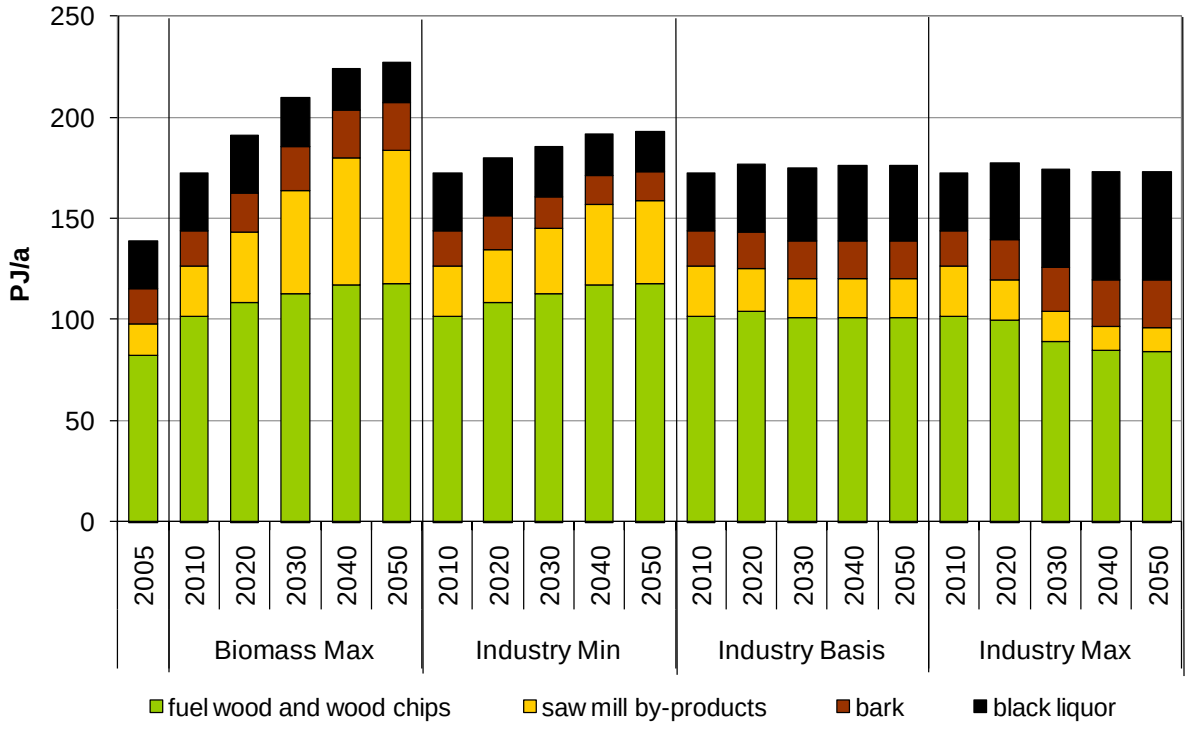



**Fig 9 Realisable biomass potentials in different scenarios for the Austrian wood processing industry; Source: (Haas, et al., 2008), EEG**

## 4.2 Agricultural biomass

According to (Haas, et al., 2008) the acreage for the production of energy crops was assumed to be 50.000ha in 2006. The biggest part of this area has been used to produce maize silage for the production of biogas and to produce oilseeds for the production of vegetable oil and biodiesel. Other agricultural bioenergy products like miscanthus, short rotaion coppice and straw are of no significance up to now. Nevertheless, this could change in the near future.

With the launching of the bioethanol plant in Pischelsdorf in 2007 (see chapter 6.2.2 and 7.2.5) the acreage for the production of energy crops more than doubled. For the production of 240.000m³ of ethanol an additional 65.000-70.000ha are required.

The following graph (fig. 10) shows three scenarios of (Haas, et al., 2008) that draw a picture of the possible development of realisable agricultural biomass potentials for energy in Austria with regards to different basic conditions. In this potential assessment the possible increase in yields, the

development of livestock, the use of by-products and other assumptions have been taken into account.

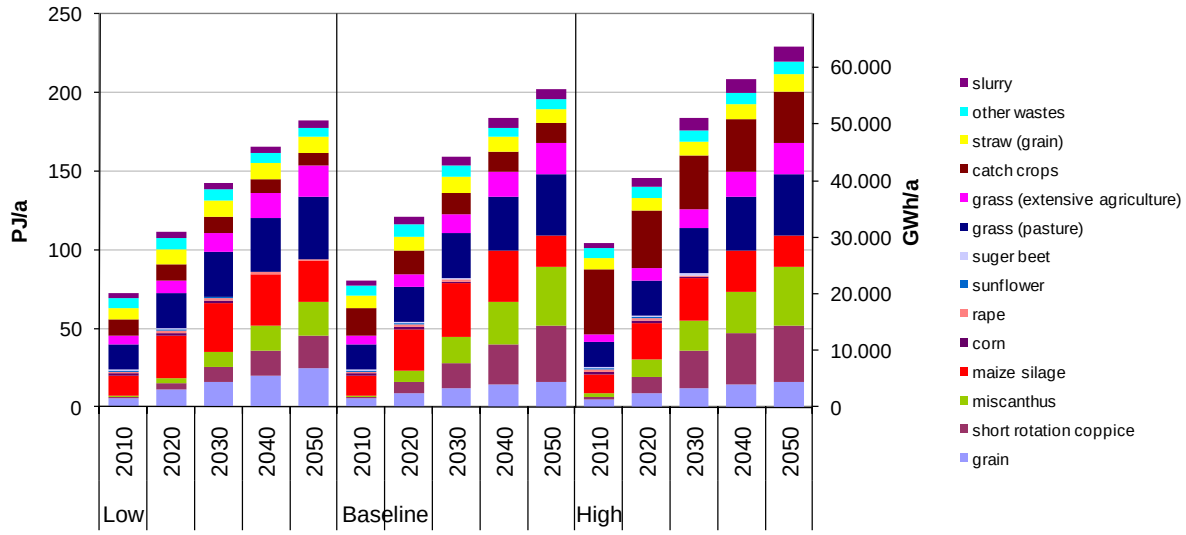



**Fig 10 Realisable agricultural biomass potentials in different scenarios for the Austrian agriculture; Source: (Haas, et al., 2008), EEG**

This potential assessment shows that on the short term in the best case the agricultural bioenergy potential could be expanded to 100PJ per year. Therefore it would be required, that about 10% of the acreage were used for the production of energy crops.

In these scenarios it is assumed that there is an average increase in the yields of energy crops of one percent per year from 2010 to 2030 and 0,5% from 2030 to 2050. Furthermore it is assumed that there is a transition from first generation biofuels like biodiesel and conventional ethanol to second generation biofuels.

Presuming that 30% of the overall acreage would be used for the production of energy crops, the long term annual potential of agricultural bioenergy products could be more than 200PJ in 2050. In the development of these scenarios, restrictions with regards to the nutrient cycle and crop rotation have been incorporated.

# 5 Current biomass users

In this chapter there will be given a qualitative and quantitative overview of the users of energy from biomass in Austria. Therefore data on heating with biomass, the production of electricity and the production of liquid biofuels will be presented.

The following graph shows the development of the primary energy consumption of biomass and the share of biomass on total gross energy consumption in Austria.

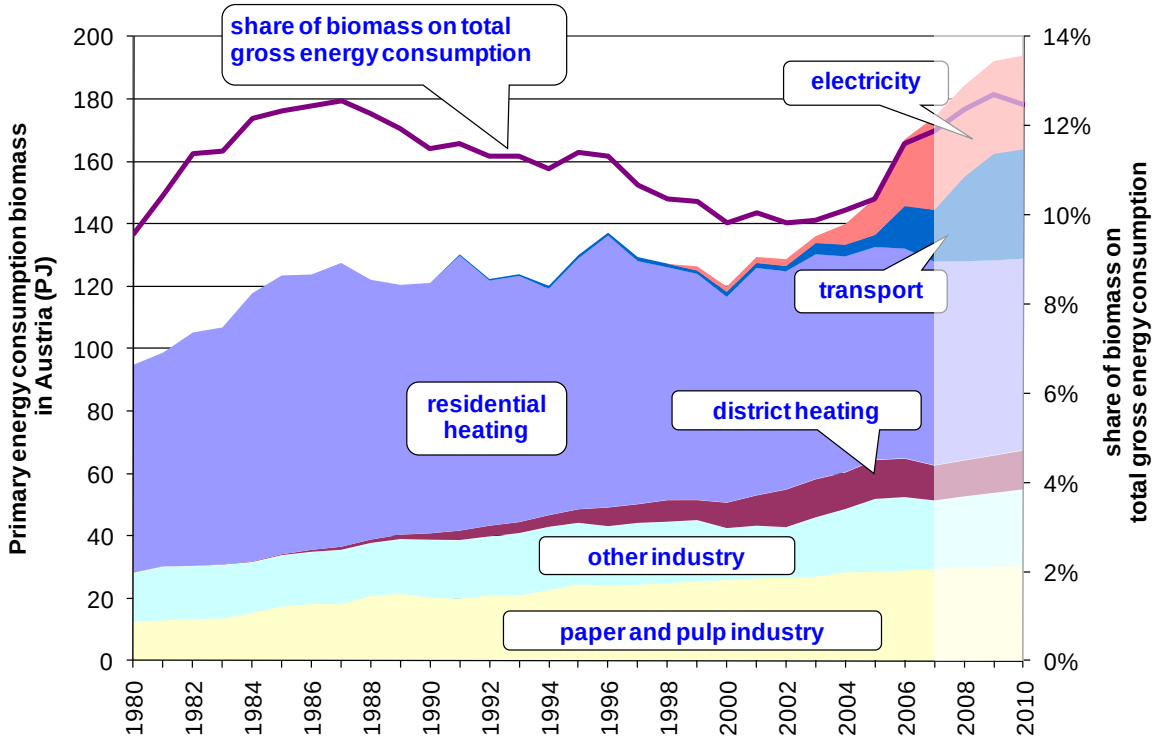



Fig 11 Development of primary energy consumption biomass and share of biomass on total gross energy consumption in Austria; Source: Statistik Austria, EEG

It shows that residential heating up to now is the most important consumer of biomass. At the moment Statistics Austria is revalidating the figures on the decrease in the residential heating sector. Probably, due to this process this data will be adjusted upwards in the next publication of the Austrian energy balance.

## 5.1 Heating with biomass

Most (56%) of commercially used forests are owned by small scale (<200ha) owners, most of them farmers. Because of this division in the property of forests there a lot of households that have access to fuel wood. Therefore, and because of the good availability of woody biomass, Austria has a long tradition in heating with biomass.

### 5.1.1 Domestic heating

Up to 1970 single stoves were dominating domestic heating in Austria. As shown in Fig 12, which shows the development of the number of dwellings with biomass heating in Austria, from 1970 onward single stoves were increasingly substituted with modern central heating systems. After a phase of a decrease in the overall number of dwellings with biomass heating from 1972 to 1978

there was a strong increase in the number of dwellings with central heating, especially after the second oil crisis in 1979/80. In 1988 about 21% of all dwellings were heated with biomass. Afterwards, when oil prices were falling again, the number of dwellings heated by biomass decreased significantly from the beginning of the 1990's. There was a trend to automated, easy-to-use and comfortable oil, gas and district heating.

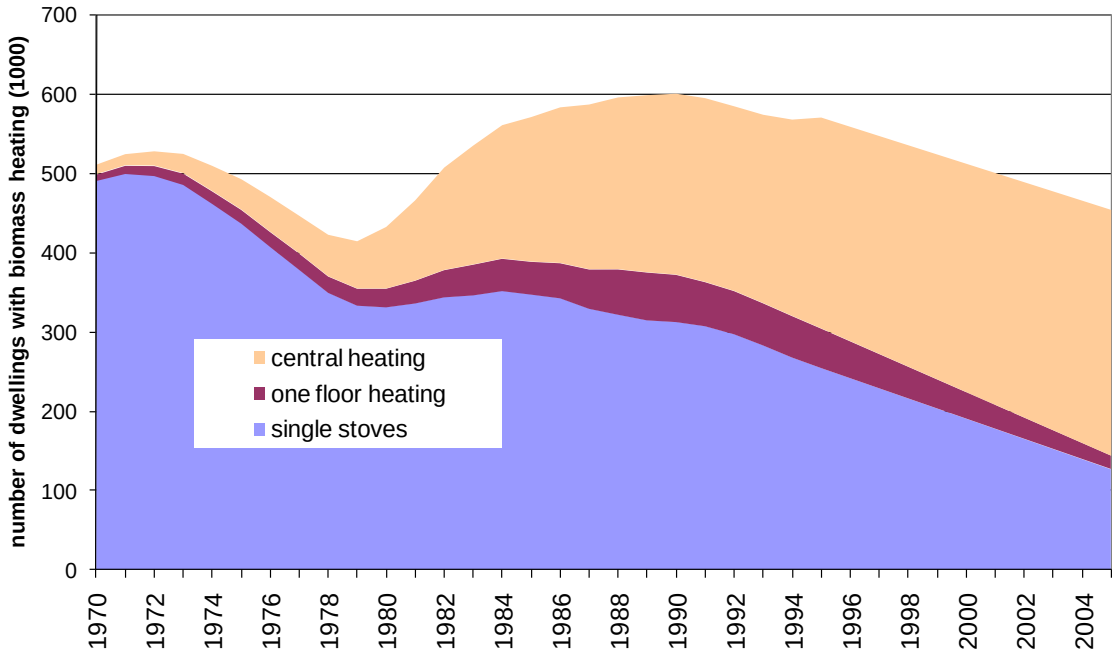



Fig 12 Development of the number of dwellings with biomass heating in Austria from 1970 to 2004; Source: Statistik Austria, EEG

While the number of sales of small-scale biomass boilers fired with log wood or wood chips remained static 1990-07, sales of pellet boilers rose considerably (see Fig. 13).

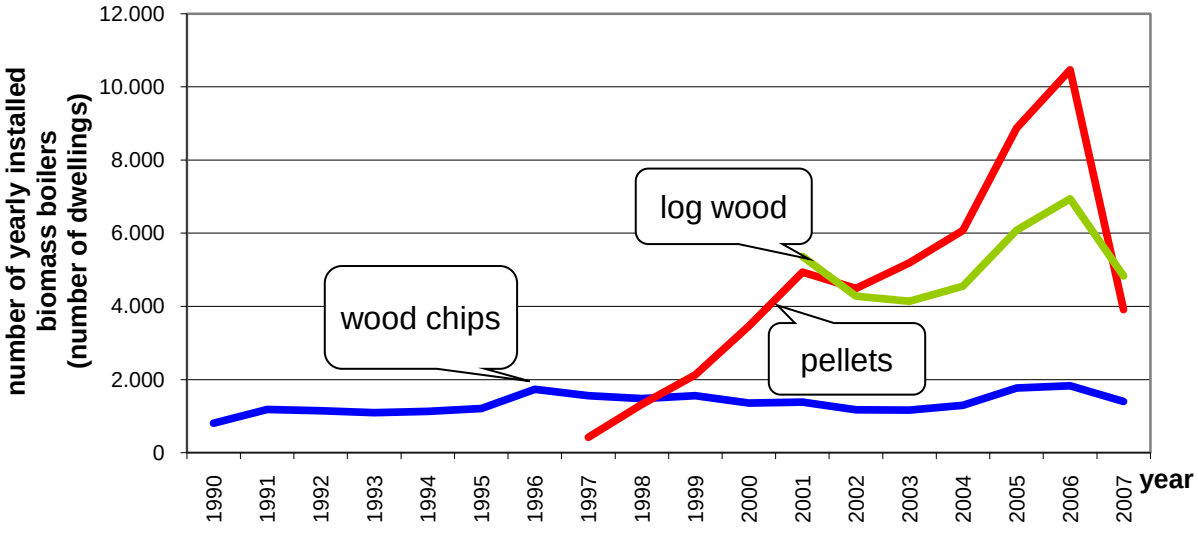



Fig 13 Development of the number of yearly installed biomass boilers in Austria; Source: NÖ LWK, EEG

After years of rapid growth the Austrian pellet boiler market peaked in 2006. In 2007 there was a collapse in pellet boiler sales, with 10.500 pellet boilers sold in 2006 compared to only 4.000 in 2007 (see Fig. 13). This drop in pellet boiler sales happened because of sky-rocketing pellet prices in winter 2005/06. The reasons for this development are described in detail in (Bradley, et al., 2009).

### 5.1.2 District heating

District heating had its breakthrough in the middle of the 1980's in Austria. Up to the beginning of the 1990's there have been high annual growth rates of more than 20%. This was mainly due to investment grants of the provinces and of the ministry of agriculture. In the last years the expansion of district heating was slowing down. Nevertheless, in 2007 the overall primary energy demand for district heating with biomass was slightly above 10PJ.

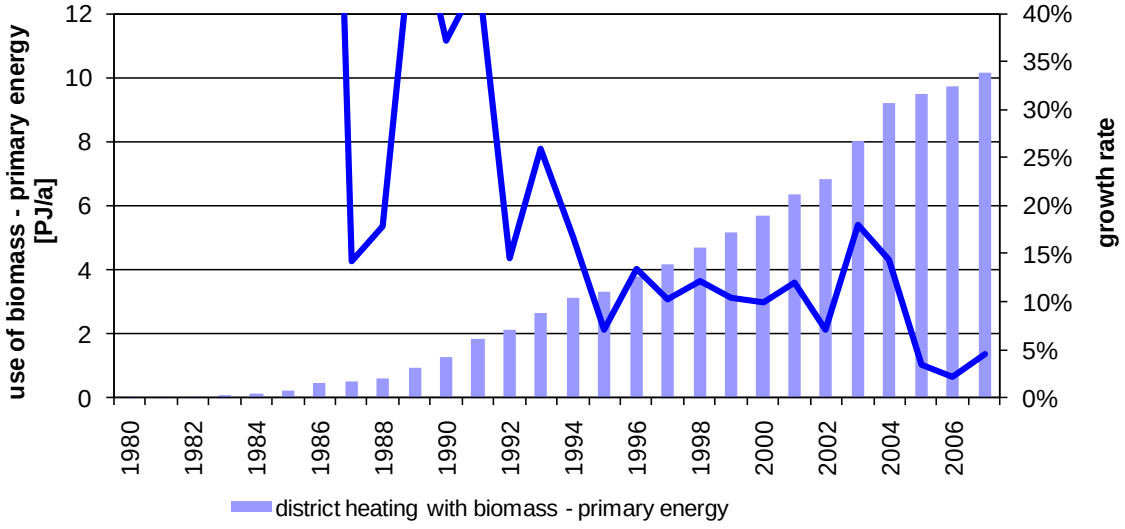



Fig 14 Development of district heating with biomass in Austria; Source: (Haneder, et al., 2008), EEG

### 5.1.3 Commerce and industry

In commerce and industry there are three relevant users of bioenergy: the sawmill industry, the pulp and paper industry and the particle board industry. In 2006 the overall primary energy input of biomass in these sectors has been more than 50PJ. More than 50% of the biomass used has been black liquor and sewage sludge, another big part has been wood chips and a minor part has been bark. The future development in these sectors will strongly depend on the demand and the competition for these feedstocks in the future.

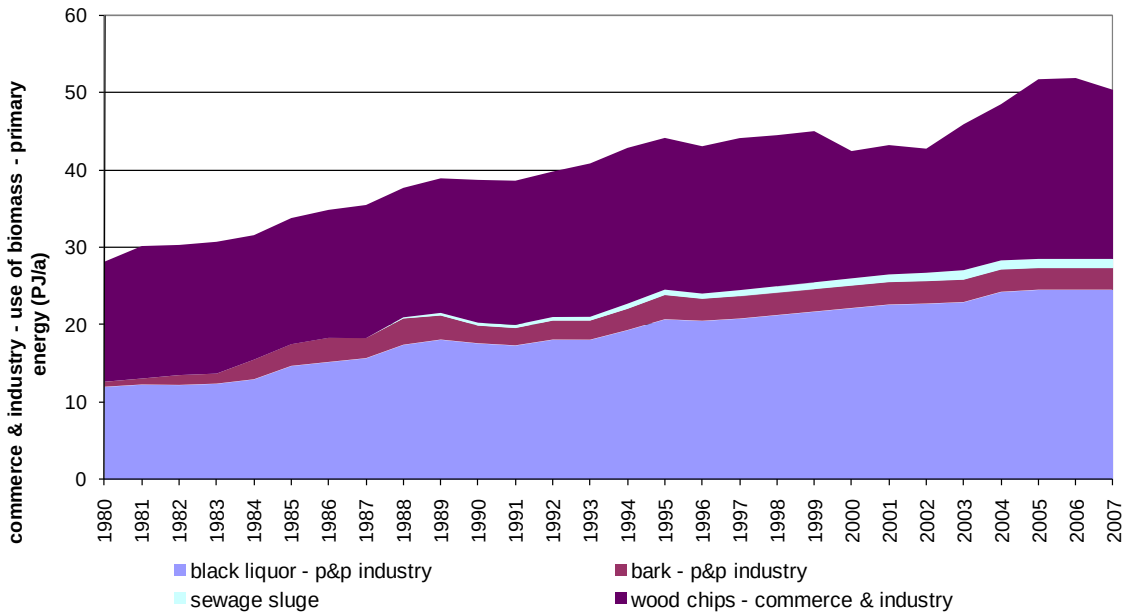



**Fig 15 Development of the demand for energy from biomass in commerce and industry; Source: (Haneder, et al., 2008), EEG**

## 5.2 Production of electricity with biomass

Since the implementation of feed-in tariffs in 2004 there has been a real boom in the production of electricity by using biomass. In 2007 altogether about 2,2TWh of electric energy have been produced by using all forms of liquid, gaseous and solid biofuels. The most important kinds of biofuels for the production of electricity are solid biofuels with 1,6TWh in 2007 and biogas with 0,44TWh.

According to ÖMAG in 2008 the overall installed power of biomass power plants was 423,6MW. In 2008 there have been 113 plants powered by solid biofuels, 338 biogas plants and 47 plants powered by liquid biofuels.

Figure 16 shows the development of public electricity generation from biomass and gives an outlook on the possible development until 2010. This assessment is based on an analysis of the bioenergy action plan (see chapter 2.1) and an evaluation of the Eco Electricity Act. Due to a cap on subsidies it is estimated that the growth will slow down in the near future. Nevertheless, at the moment the parliament is discussing a revision of the Eco Electricity Act and therefore the situation could change quickly.

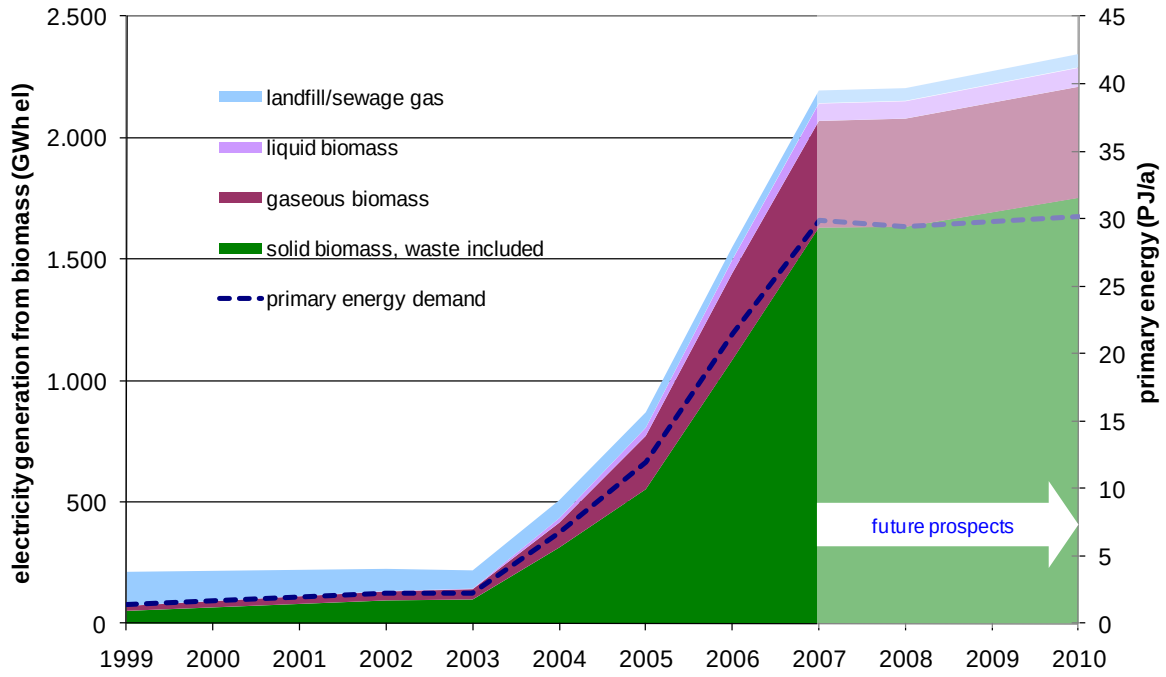



Fig 16 Development of public electricity generation from biomass; Source: E-Control 2008, BMLFUW, EEG/TU WIEN

## 5.3 Production of liquid biofuels

In Austria there are several biodiesel plants and one single bioethanol plant. The following information about the production of liquid biofuels in Austria can be found in the annual report "biofuels in the transport sector in Austria" (Winter, 2008) which is published by Austrian Federal Environmental Agency.

According to this report there were 14 biodiesel plants operating in Austria in 2007, with a total capacity of approximately 468.500 tonnes. Capacity was expected to increase to 676.500 tonnes in 2008 as one new plant will start production and four existing plants are set to increase their capacity.

According to information provided by the Austrian association of liquid-biofuel manufacturers' (ARGE Biokraft) members, 241.381 tonnes of biodiesel were produced in Austria in 2007 (by nine biodiesel producers). Of this amount, 161.467 tonnes were sold in Austria, 102.531 tonnes of which were supplied to the mineral oil industry for blending. Disregarding any variations in stocks, some 80.000 tonnes of biodiesel were exported in 2007. 59.000 tonnes were used in the Austrian transport sector either as pure biofuel or as diesel with a higher, non-standard proportion of biofuel.

In Austria there is only one single plant (Pischelsdorf, Lower Austria) for the production of ethanol. It was completed in autumn 2007. The plant, which according to information provided by the operator is to produce approximately 240.000m³ of ethanol per year (an annual output of about 190.000t), did not go into production immediately as planned, however, due to the high cost of raw materials. In the fourth quarter the plant was brought into service for test runs. According to the operator a total of 12.189 tonnes of bioethanol were produced in 2007, some 10.000 tonnes of which were supplied to the mineral oil industry for blending.

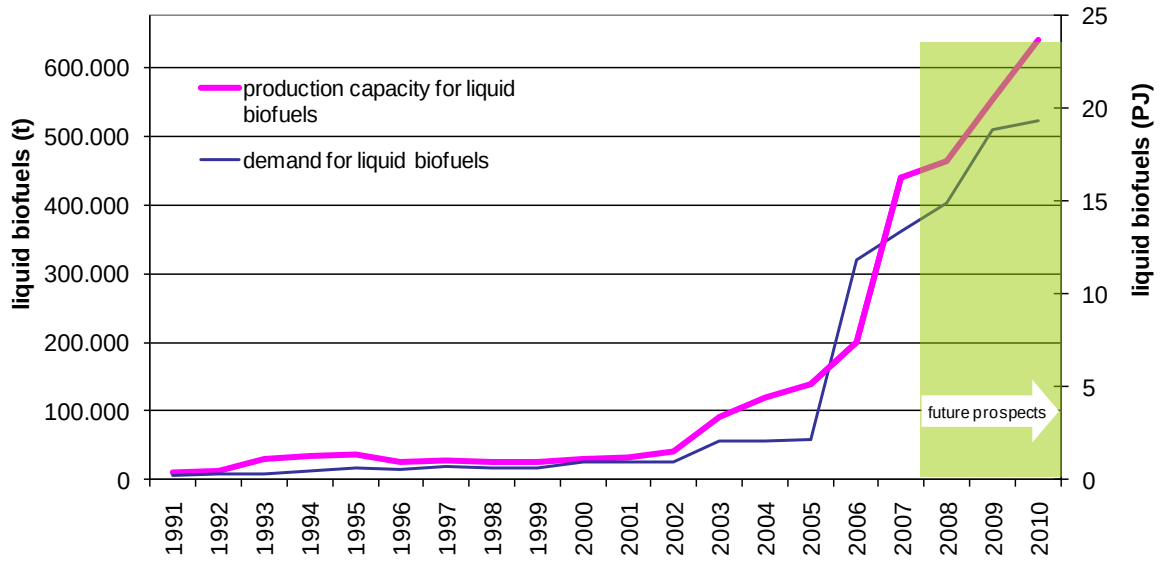



Fig 17 Development of the production of liquid biofules in Austria; Source: Biotreibstoffinstitut 2008, (Winter, 2008), EEG

# 6 Biomass prices

In the following chapter the development of the prices of several types of biomass feedstocks and bioenergy products in Austria from 2004 up to the latest data available are presented. The different types are divided into two broad classes of biomass: woody biomass and agricultural biomass.

## 6.1 Woody biomass

In the first part of this chapter the prices for the following woody biomass types and products are given: fuel wood (coniferous and non coniferous), wood chips, sawdust and pellets.

### 6.1.1 Fuel wood

In figure 18 the development of producer prices of fuel wood (coniferous and non coniferous) in Austria are shown. The prices are weighted bulk buyer and small consumer prices without VAT and transport. Up to 2004 the prices of fuel wood in Austria have been at a stable level (28€/m³ for coniferous wood and 43€/m³ for non coniferous wood from 2002-2004). From 2005 to 2009 there has been an increase of 25 percent for both coniferous and non coniferous fuel wood. In the first half of 2009 the average price for coniferous fuel wood was 36€/m³ and the price for non coniferous wood was 54€/m³.

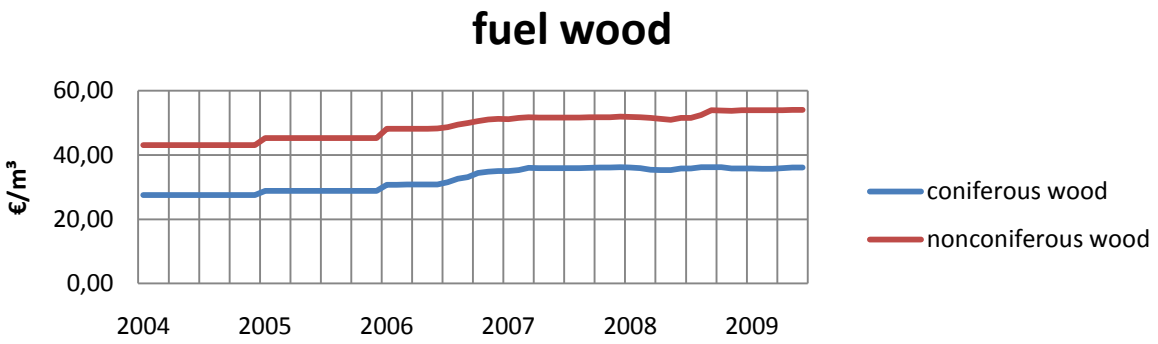



**Fig 18 Development of producer prices of fuel wood (coniferous and non coniferous) in Austria, prices are weighted bulk buyer and small consumer prices without VAT and transport; Source: Statistik Austria 2009**

### 6.1.2 Wood chips and sawdust

According to (Moser, 2008) the output figures in the sawmill industry, the particle board industry and the paper industry have shown a rising tendency in the last few years (and with it the demand for the raw material timber and sawmill residues). The demand for timber and saw mill residues for energy recovery has also increased. Biomass firing installations have been established in the timber and wood processing industry as well as to provide heat and electricity for final consumption, a trend which has caused contention between material and energy recovery, especially over assortments of shavings from saw mills (wood pellet production) and wood chips. Therefore prices for these assortments have shown a rising tendency over the last five years (see fig. 19). From 2001 to 2005 sawdust nearly doubled in price because of severe competition of pellet producers and the pulp and panel industries for the same raw material. After a peak in the prices for wood chips (60€/t) and sawdust (50€/t) in the beginning of 2007 the prices have stabilised at a lower level in 2008.

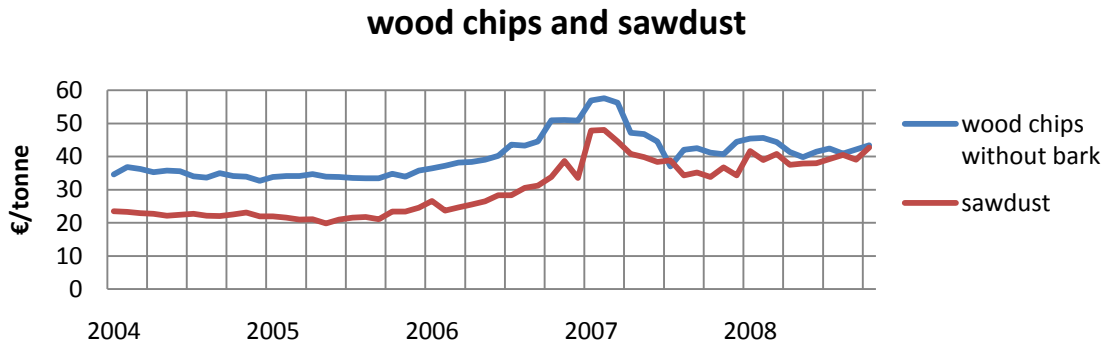



Fig 19 Price development of wood chips (without bark) and sawdust in Austria; Source: FHP – Kooperationsplattform Forst Holz Papier and Association of the Austrian Wood Industries, 2009.

Due to the economic crisis the situation of the Austrian wood processing industry has changed dramatically thus also influencing the prices of saw residues and other woody biomass fractions.

### 6.1.3 Pellets

From the beginning of pellets production in Austria in 2001 up to 2005 there was a continuous fall of pellet prices, due to technological learning and due to economies of scale. Whereas in 2001 the average price for pellets was 183€/t, in 2005 the average price was 163€/t. When there was a long and extremely snowy winter in 2005/2006 this situation suddenly started to change (see fig. 20). Because of a very long and snowy winter the heating period was long too and therefore there was a great ongoing demand for pellets. At the same time removals of round wood decreased by 20-30% because of the extreme amount of snow and so there was a shortage of round wood. Given this situation of supply and demand the price of pellets went up dramatically to 265€/t.

The windstorm Kyrill that affected Western Europe in January 2007 caused widespread forest damage through wind throw and as a result there was plenty of round wood. At this time, pellets prices fell to a lower level of 190€/t. Similarly, windstorms Paula and Emma in 2008 caused prices for pellets to go down again to approximately 174€/t. In the first half of 2009 the average price of pellets was slightly above 200€/t.

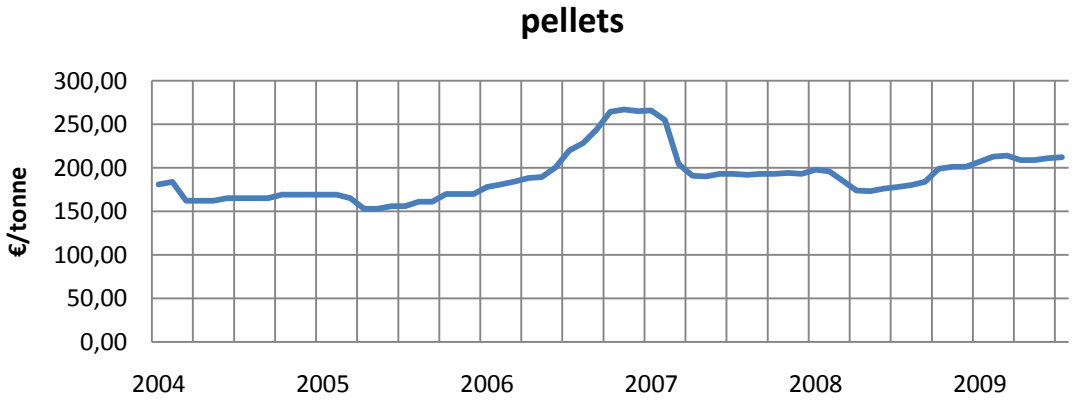



Fig 20 Price development of wood pellets in Austria. Weighted average price per tonne delivered as loose; purchase volume of about 5 tonnes; incl. transport of max 50 km; incl. VAT (10%); ÖNORM M 7135; Source: proPellets Austria.

## 6.2 Agricultural feedstocks for the production of biofuels

In this part the development of prices of agricultural feedstocks that are mainly used for the production of vegetable oil, biodiesel and ethanol in Austria are given.

### 6.2.1 Feedstocks for vegetable oil and biodiesel

The main feedstock for the production of biodiesel in Austria is rapeseed. The following graph (fig. 21) shows the development of the prices of the two most important types of oilseeds (rapeseed and sunflower seed) that are traded at the Vienna Agricultural Commodities Market Place. The given prices are monthly average wholesale prices in €/t, without VAT. It shows that the prices for oilseeds have been at an average level of 215€/t from 2004 to 2006. With the promotion of biofuels, the implementation of the EU Biofuel Directive and with the strong increase in the prices of fossil fuels from the beginning of 2007 to the middle of 2008 there has been a strong increase in the prices of oilseeds. In the first two quarters of 2008 the monthly average price of rapeseed has constantly been over 400€/t with a peak of 455€/t in March 2008. As shown in figure 21 the development of the average price of sunflower seed has been very similar to the development of the price of rapeseed. From the middle of 2008 to the beginning of 2009 there has been a decrease in the prices of oilseeds. The average price of rapeseed in the first two quarters of 2009 has been 265€/t with a slight upward trend.

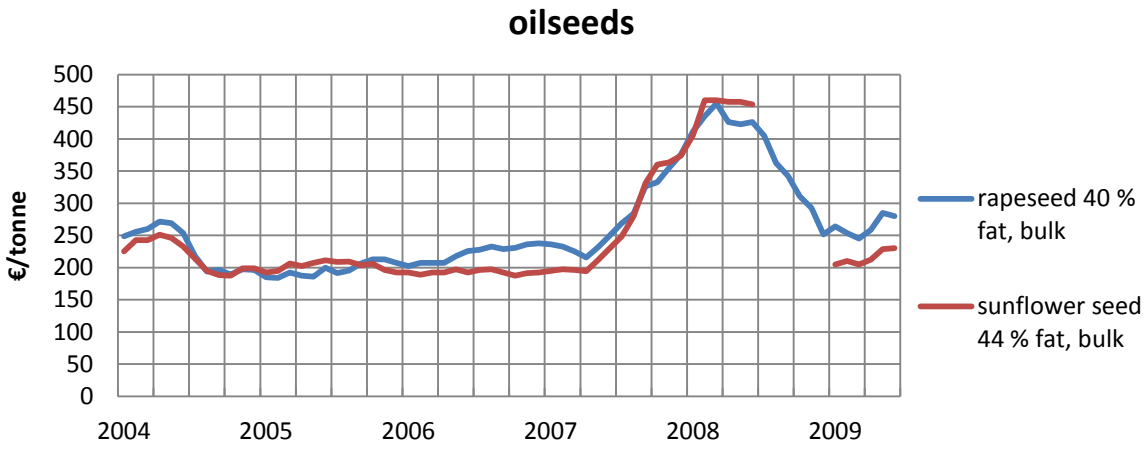



**Fig 21 Development of the prices of oilseeds at the Vienna Agricultural Commodities Market Place (Börse für landwirtschaftliche Produkte in Wien), monthly average wholesale prices in €/tonne, without VAT; Source: Daten & Fakten der AgrarMarkt Austria für den Bereich Getreide und Ölsaaten, 2009**

### 6.2.2 Feedstocks for ethanol

In Austria there is one single plant for the production of ethanol (Pischelsdorf) with an annual production capacity of up to 240.000m³. In this plant ethanol is produced from wheat, corn and sugar beet syrup. The most important feedstock is wheat. Generally, different types of wheat with different qualities are available. The type of wheat that is used for the production of ethanol in Pischelsdorf depends on the overall demand for and supply of wheat. In Pischelsdorf particularly three types of wheat are used for the production of ethanol: fodder wheat (Futterweizen), wheat for grinding (Mahlweizen) and quality wheat (Qualitätsweizen). The following illustration (fig. 22) shows the development of the prices of wheat and corn that are traded at two different market places (Vienna and Wels) in Austria. In the first quarter of 2004 the price for wheat and corn has ranged between 150-170€/t. Afterwards there has been a drop in prices and from the middle of 2004 to the middle of

2006 the prices for wheat and corn have ranged between 80-120€/t. From the beginning of 2006 there has been a slight increase in the prices of grain. From the middle of 2007 prices began to skyrocket, reaching almost 280€/t for soft wheat and 220€/t for corn. Since 2009 the prices for wheat and corn have decreased and are ranged between 100-120€/t for corn and 120-140€/t for wheat.

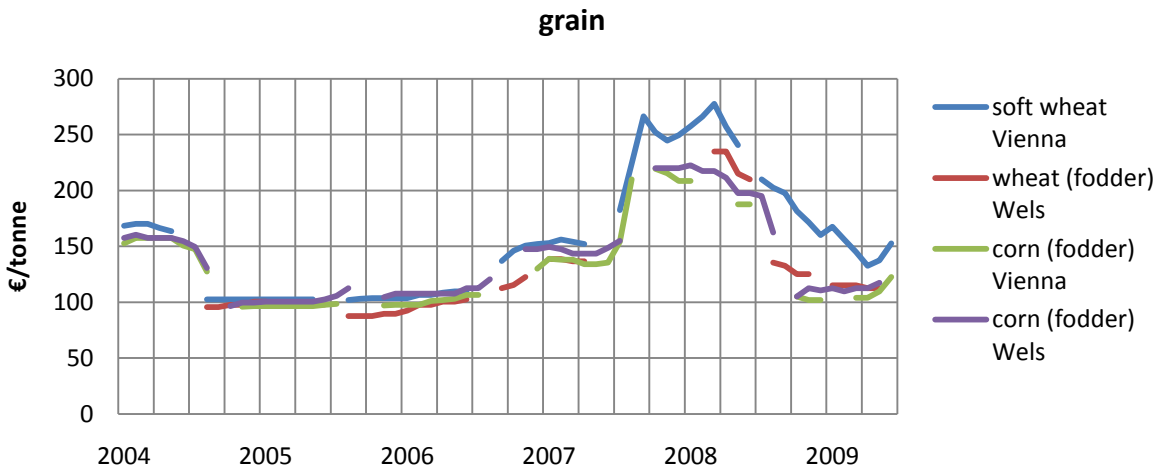



**Fig 22 Development of the prices of grain at the Vienna Agricultural Commodities Market Place (Börse für landwirtschaftliche Produkte in Wien), monthly average wholesale prices in €/tonne, without VAT; Source: Daten & Fakten der AgrarMarkt Austria für den Bereich Getreide und Ölsaaten, 2009**

# 7 International trade of Biomass for bioenergy in Austria

In this chapter there is a description of cross border trade with biomass for bioenergy in Austria. Therefore data about exports and imports for different biomass and bioenergy products (woody biomass, liquid biofuels and agricultural feedstocks for the production of biofuels) are presented.

To get an overview about trade flows of forestry and agricultural biomass products, table 1 gives an extraction of the Austrian foreign trade statistics for 2008. It shows that up to now foreign trade with cereals, oilseeds, cork, wood and animal and vegetable oils and fats in Austria is for the most part limited to European countries. Only in the field of imports of oil-seeds and oleaginous fruits the Americas and Asia play a minor role with a share of 5% and in the field of exports of cork and wood Asia plays a minor role with a share of 8,5%.

**Table 3 Foreign trade of several product groups in Austria in 2008; Source: Statistik Austria, Außenhandel: Tabellen zum Schnellbericht Dezember 2008 (endgültige Ergebnisse)**

| | | Total in 1000€ | | Europe (share in %) | | Africa (share in %) | | Americas (share in %) | | Asia (share in %) | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SITC classification | | Import (I) | Export (E) | I | E | I | E | I | E | I | E |
| 4 | Cereals and cereal preparations | 801.608 | 873.508 | 98,2% | 98,9% | 0,0% | 0,1% | 0,8% | 0,4% | 1,0% | 0,6% |
| 22 | Oil-seeds and oleaginous fruits | 235.939 | 154.314 | 89,4% | 99,5% | 0,2% | 0,0% | 5,4% | 0,1% | 5,0% | 0,4% |
| 24 | Cork and wood | 1.060.643 | 1.598.678 | 98,6% | 87,4% | 0,2% | 2,7% | 0,9% | 0,4% | 0,4% | 8,5% |
| 40 | Animal and vegetable oils, fats and waxes | 404.485 | 169.331 | 98,0% | 99,6% | 0,1% | 0,0% | 0,4% | 0,2% | 1,5% | 0,2% |

In the following the major trade flows for woody and agricultural biomass and bioenergy products will be described.

## 7.1 Woody biomass

Austria is a densely wooded country. According to the Austrian forest inventory (1986/90) 3,9 million ha, nearly 50 percent of Austria, is forest. Commercial forestry takes place in a high proportion of this area (86% or 3,3 million ha). As a result, the Austrian forest and wood industries is well developed. Due to the large role of the Austrian wood processing industry, Austria is a major importer of round wood and exporter of wood products. In the following the imports and exports and the major trade flows for fuel wood, wood chips, sawdust, wood waste or scrap and pellets will be described.

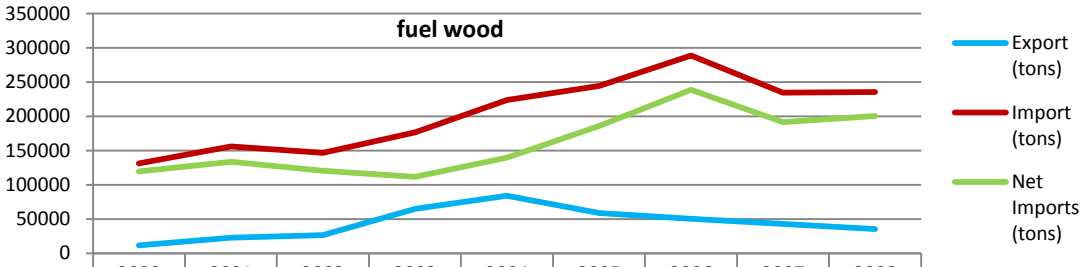
### 7.1.1 Fuel wood

In Austria fuel wood is used for covering about 20% of the heating demand. Therefore up to now fuel wood is the most important bioenergy product in Austria. It is estimated that the yearly demand for fuel wood in Austria is about 7.500.000m³. The biggest part of the demand for fuel wood is covered by domestic forests. Net imports only represent about 4% of the Austrian demand for fuel wood.

As shown in figure 23 Austria is a net importer of fuel wood. In the period from the year 2000 to 2008 the amount of imports of fuel wood has been increasing from 131.000t up to 235.000t, with a

peak of 289.000t in the year 2006 with a very long and snowy winter. In 2008 235.000t of fuel wood have been imported and 35.000t have been exported, so the net imports have been 200.000t. The main countries of importation of fuel wood are the Czech Republic, Slovakia, Hungary, Russia and Germany. Hardly all exports (95%) are going to Italy.

In relation to the overall consumption of fuel wood, the volume of international trade is very low (about 4% in 2008).




| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|
| Export (tons) | 11753 | 22613 | 26431 | 64853 | 83962 | 58691 | 50243 | 42969 | 35248 |
| Import (tons) | 131141 | 155880 | 146644 | 176324 | 223736 | 244380 | 288658 | 234350 | 235366 |
| Net Imports (tons) | 119388 | 133267 | 120213 | 111471 | 139774 | 185689 | 238415 | 191381 | 200118 |

Fig 23 Development of foreign trade of fuel wood in Austria in tonnes; Source: UN Comtrade Database, 2009

### 7.1.2 Wood chips

As presented above the particle board industry and the paper industry are very well developed in Austria. Additionally district heating stations and combined heat and power plants have shown a rising tendency in the last few years. As a result the demand for timber and saw mill residues for energy recovery has increased steadily. According to (Moser, 2008) the Austrian sawmill industry is producing about 4.550.000m³ of woodchips. In addition in 2007 and 2008 about 1 million m³ of coniferous (the biggest part) and non coniferous wood chips have been imported, mainly from Germany (80%) and the Czech Republic (12%). With a share of 85% Italy is the most important consumer of Austrian wood chips.


| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|
| Export (tons) | 305761 | 281576 | 294636 | 379890 | 272396 | 406821 | 339375 | 440110 | 313435 |
| Import (tons) | 432721 | 439528 | 417325 | 379713 | 226426 | 386613 | 789163 | 1017032 | 991657 |
| Net Imports (tons) | 126960 | 157952 | 122689 | -177 | -45970 | -20208 | 449788 | 576922 | 678222 |

Fig 24 Development of foreign trade of wood chips in Austria in tonnes; Source: UN Comtrade Database, 2009

It has to be noted that only part of these trade volumes are used for bioenergy.

### 7.1.3 Sawdust, wood waste or scrap, including wood pellets and briquettes

The following figure (fig. 25) shows the development of foreign trade of sawdust, wood waste or scrap in Austria. In this data the two products wood pellets and briquettes are included. As the development of the wood pellets market in Austria has been highly dynamic, more detailed information on the trade of wood pellets can be found in the next chapter.

In the last years there has been a strong increase in the demand for these products, mainly because of the strong increase of the pellets production and consumption in Austria. Whereas in the period of 1996-2000 the average amount of imports of this products group was about 167.000t there was an increase to 685.000t in 2008. In the same time the exports this products group increased from an average of 341.000t to 777.000t in 2008.

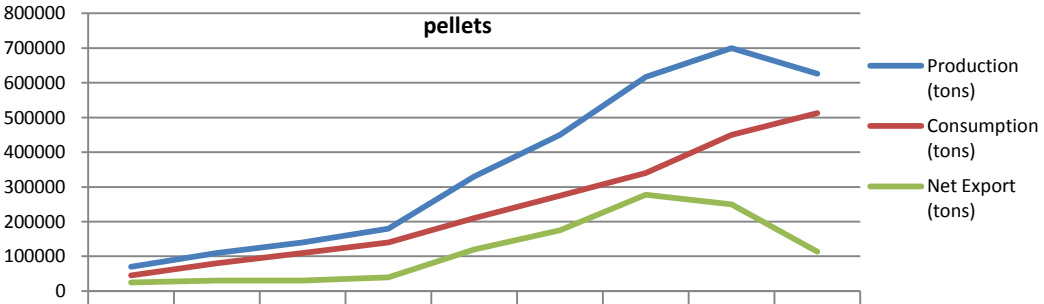

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|
| Export (tons) | 403101 | 486550 | 417997 | 634927 | 697757 | 800480 | 696650 | 771474 | 776769 |
| Import (tons) | 167998 | 249672 | 272695 | 258485 | 409574 | 425917 | 1003649 | 869743 | 685472 |
| Net Imports (tons) | -235103 | -236878 | -145302 | -376442 | -288183 | -374563 | 306999 | 98269 | -91297 |

**Fig 25 Development of foreign trade of sawdust, wood waste or scrap in Austria in tonnes; Source: UN Comtrade Database, 2009**

It has to be noted that only part of these trade volumes are used for bioenergy.

### 7.1.4 Pellets

With a production capacity of 978.000t and a production of 626.000t in 2008 Austria is one of Europe's major pellet exporters. According to (Steiner, et al., 2009) in 2008 a total amount of about 250.000 tonnes (in bags), nearly 100 % of the export potential was exported to Italy. The import of pellets in 2008 is estimated at 146.000 tonnes. The most important import countries are Germany (~ 70.000 tonnes) followed by Czech Republic (~ 43.000 tonnes) and Romania (~ 27.000 tonnes). In addition to that small amounts of pellets are imported from Slovakia and Slovenia (~ 3.000 tonnes each). The transport is done by trucks.




| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|
| Production (tons) | 70000 | 110000 | 140000 | 180000 | 330000 | 450000 | 617000 | 700060 | 625960 |
| Consumption (tons) | 45000 | 80000 | 110000 | 140000 | 210000 | 275000 | 340000 | 450000 | 513000 |
| Net Export (tons) | 25000 | 30000 | 30000 | 40000 | 120000 | 175000 | 277000 | 250060 | 112960 |

**Fig 26 Development of foreign trade of wood pellets in Austria in tonnes; Source: proPellets, Pellets@las Project, 2009**

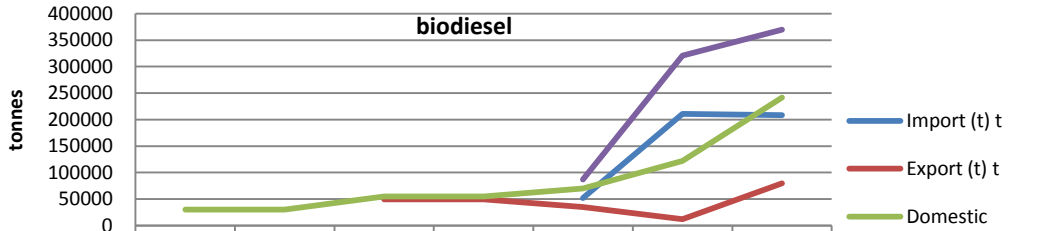
## 7.2 Liquid biofuels and agricultural feedstocks for the production of biofuels

With the introduction of the European Biofuel Directive and the implementation of an obligatory quota for biofuels the use of agricultural products for the production of energy has steadily gained in importance in the last years. On 4 November 2004, the Biofuel Directive was transposed into Austrian national law with an amendment to the Fuel Ordinance. This amendment stipulates that all companies that put fuels in circulation (e.g. OMV) must replace a certain amount of the total energy quantity put in circulation by biofuels. Since October 1st, 2005 in Austria 2,5% of fossil fuels have to be replaced by biofuels. On October 1st, 2007 this value has been increased to 4,3% and since October 1st, 2008 the value is 5,75%.

### 7.2.1 Biodiesel

The industrial production of biodiesel in Austria started in the middle of the 1990s. With the implementation of the Biofuels Directive in Austria in 2004 a real boom in the production of biodiesel was triggered and from 2005 to 2008 there was a sharp increase in the production capacity. In the middle of 2008 there were 18 biodiesel plants in Austria with an annual production capacity of about 560.000t.

Figure 27 shows the development of the Austrian biodiesel market. In 2007 the domestic demand for biodiesel in Austria was 370.000t. According to the report “Biofuels in the transport sector in Austria” that is published annually by the Austrian Federal Environment Agency (Umweltbundesamt), in 2007 300.000t have been used for the blending of fossil diesel and 70.000t have been used in pure form. With a domestic production of 241.000t and exports of 80.000t about 210.000t of biodiesel had to be imported. This means in 2007 Austria was a net importer of 130.000t of biodiesel.




| | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 |
|---|---|---|---|---|---|---|---|
| Import (t) t | | | | | 52000 | 211028 | 208579 |
| Export (t) t | | | 49500 | 49500 | 35000 | 11693 | 79914 |
| Domestic production (t) t | 30000 | 30000 | 55000 | 55000 | 70000 | 121665 | 241381 |
| Domestic demand (t) t | | | | | 87000 | 321000 | 370046 |

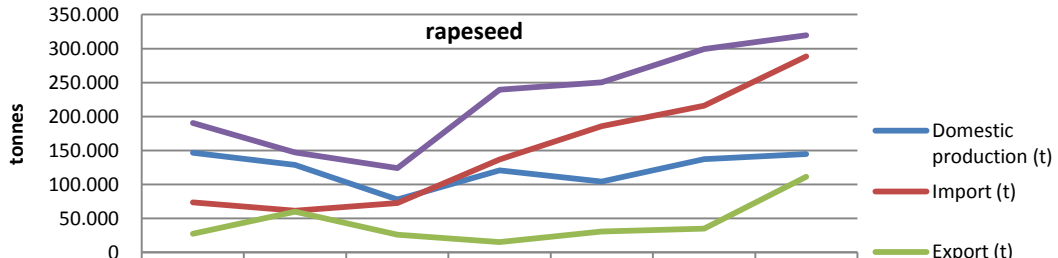
**Fig 27 Development of foreign trade of biodiesel in Austria in tonnes; Source: Austrian Federal Environment Agency (Umweltbundesamt), 2009**

There is a poor documentation of the trade flows of biodiesel and the trading partners in Austria. However, it can be estimated that Germany is the most important import country for Austria.

The main feedstock for the production of biodiesel in Austria is rapeseed oil. Rapeseed oil is ether imported from other countries or it is produced in Austrian oil mills. In the following data on foreign trade of the most important feedstocks for the production of biodiesel will be presented.

### 7.2.2 Rapeseed

According the supply balance sheets for oilseeds in Austria[3] the annual average demand for rapeseed before the implementation of the Biofuels Directive was relatively constant at a level of about 150.000t in the period of 2001-2004. With the implementation of the directive, there was a sharp increase in the demand for oilseeds up to 320.000t in 2007/08 (see fig. 28). This increase of 170.000t can be attributed to the production of biodiesel.




| | 2001/02 | 2002/03 | 2003/04 | 2004/05 | 2005/06 | 2006/07 | 2007/08 |
|---|---|---|---|---|---|---|---|
| Domestic production (t) | 146.525 | 128.647 | 77.720 | 120.815 | 104.303 | 137.303 | 144.706 |
| Import (t) | 73.465 | 61.414 | 72.637 | 136.992 | 185.666 | 216.035 | 288.455 |
| Export (t) | 27.634 | 60.072 | 26.336 | 15.312 | 30.790 | 34.964 | 111.527 |
| Domestic demand (t) | 190.356 | 146.989 | 124.021 | 239.495 | 250.179 | 299.374 | 319.634 |

**Fig 28 Development of foreign trade of rapeseed in Austria in tonnes; Source: Statistik Austria, supply balance sheets for oilseeds, 2009**

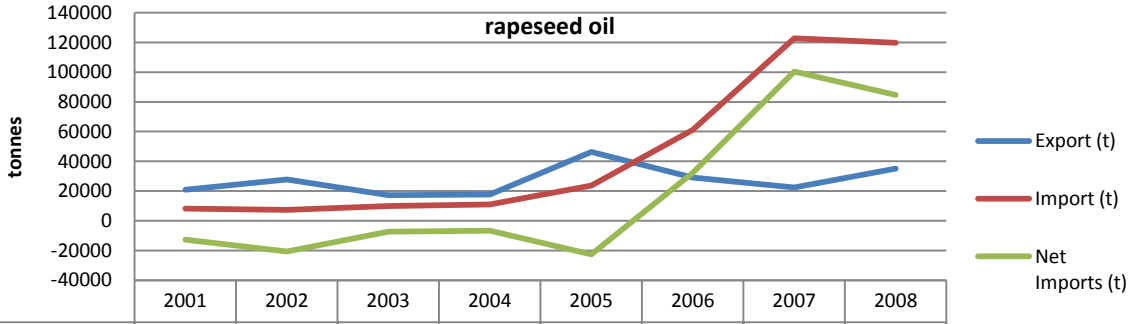
Because of the great domestic demand for rapeseed the degree of self sufficiency decreased from more than 80% in the period of 2001-2003 to 45% in 2007/08. As a result there was a strong increase in the imports of rapeseed in the last few years, mainly from Hungary (147.000t), Slovakia (66.000t)

[3] Statistik Austria

and the Czech Republic (42.000t). The biggest share of Austrian exports has been going to Germany (74.000t).

### 7.2.3 Rapeseed oil

Besides rapeseed oil that is extracted in oil mills in Austria imports of rapeseed oil from other countries are very important for the Austrian biodiesel industry. Up to the year 2005 Austria has been a net exporter of rapeseed oil. With the implementation of the Biofuel Directive Austria this has changed completely. In the period from 2005 to 2007 there has been a strong increase in the imports of rapeseed oil. In 2008 the net imports have reached a level of 85.000t. Compared to 2007 this is a reduction of 15%. The most important countries for imports of rapeseed oil to Austria are Germany with a share of more than 50%, Slovenia (8%), Serbia (7,5%), Romania (6%), the Czech Republic (5,5%) and Poland (5,5%). One third of the Austrian export goes to Germany, the rest to other neighbouring countries.

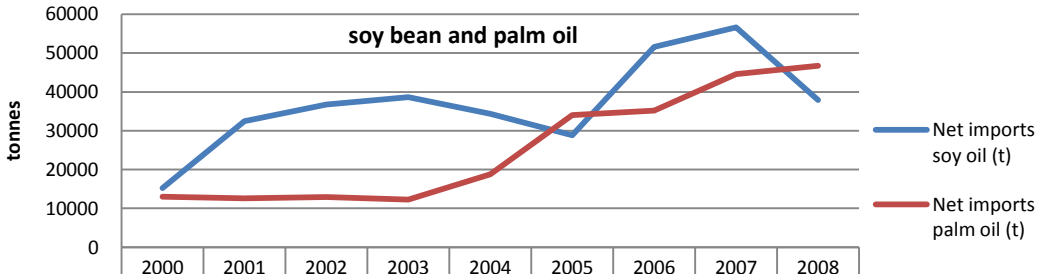



| | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|
| Export (t) | 20931 | 27852 | 17255 | 17699 | 46238 | 29049 | 22457 | 35060 |
| Import (t) | 8254 | 7272 | 9851 | 10969 | 23697 | 61271 | 122826 | 119716 |
| Net Imports (t) | -12677 | -20580 | -7404 | -6730 | -22541 | 32222 | 100369 | 84656 |

Fig 29 Development of foreign trade of rapeseed oil in Austria in tonnes; Source: UN Comtrade Database, 2009

### 7.2.4 Soy and palm oil

Although soybean and palm oil are not used for the production of biodiesel in Austria, there has been a strong increase in the imports of these vegetable oils, as shown in figure 30. It is assumed that more and more rapeseed oil was needed by the biodiesel industry and is therefore missing in the production of margarine and other cooking fats. As a trade-off there has been an increase in the imports of soybean- and palm oil in the same time.




| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|---|---|---|---|---|
| Net imports soy oil (t) | 15201 | 32474 | 36776 | 38652 | 34323 | 28833 | 51588 | 56581 | 37870 |
| Net imports palm oil (t) | 12985 | 12597 | 12938 | 12219 | 18777 | 34053 | 35194 | 44611 | 46744 |

Fig 30 Development of foreign trade of soybean and palm oil in Austria in tonnes; Source: UN Comtrade Database, 2009

Palm oil is imported mainly via the Netherlands and Germany from Malaysia and Indonesia. Soybean oil is mainly imported from Serbia and Germany.

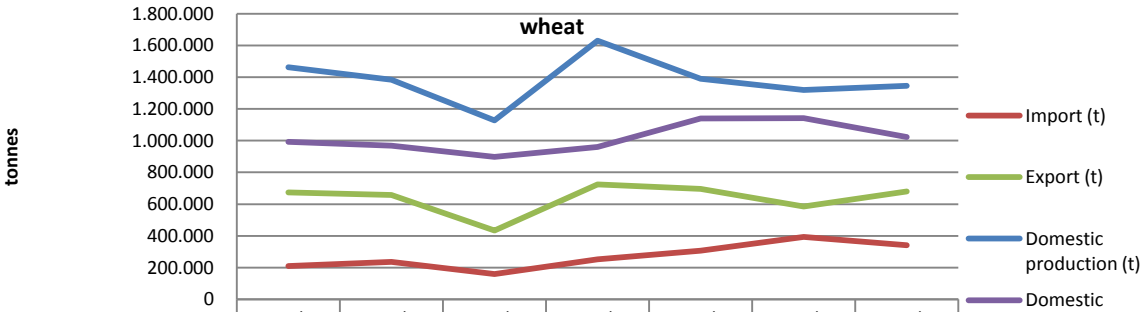
### 7.2.5 Ethanol

As described above there is only one plant for the production of ethanol in Austria (Pischelsdorf) with an annual production capacity of up to 240.000m³ (~190.000t), which is enough to serve the Austrian demand for ethanol. The production of ethanol in this plant started in 2007. After a production of 12.000t of ethanol the production has been stopped because of skyrocketing prices of wheat in the second half of 2007. The blending with gasoline in Austria started in the last quarter of 2007, with a domestic demand of 20.000t. So 8.000t of ethanol had to be imported from other countries. The production in Pischelsdorf was resumed in June 2008, when wheat prices had declined to a lower lever.

In the plant in Pischelsdorf ethanol is produced by using wheat, corn and sugar beet syrup. According to information of the company for the production of 240.000m³ of ethanol 400.000t of wheat, 100.000t of corn and 50.000t of sugar beet syrup are needed. Therefore in the following data on foreign trade of wheat and corn will be presented.

### 7.2.6 Wheat

Up to now, Austria is a net exporter of wheat. In the period of 2007/08 the domestic production of wheat was about 1,35 million tons, while the domestic demand was about 1 million tons. The annual yields of the wheat production are strongly influenced by the weather. Therefore the potential amount of wheat that's available for export is very volatile. With an additional demand of 400.000t of wheat for the production of ethanol in Pischelsdorf in some years Austria could turn from a net exporting to a net importing country.

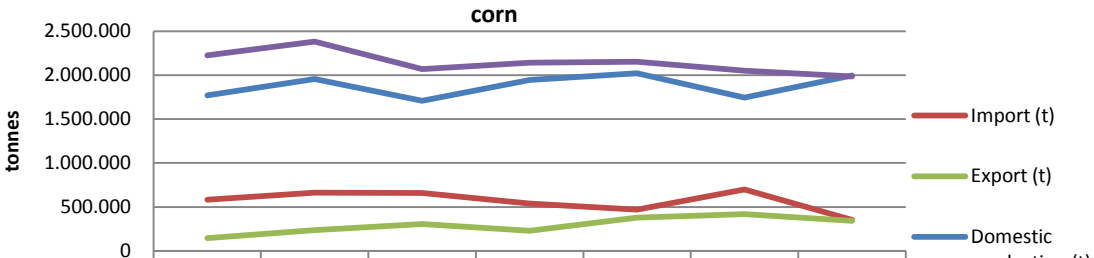



| | 2001/02 | 2002/03 | 2003/04 | 2004/05 | 2005/06 | 2006/07 | 2007/08 |
|---|---|---|---|---|---|---|---|
| Import (t) | 209.652 | 236.233 | 160.171 | 251.287 | 305.913 | 393.933 | 341.265 |
| Export (t) | 672.811 | 657.504 | 433.292 | 723.797 | 696.422 | 585.105 | 680.209 |
| Domestic production (t) | 1.462.162 | 1.384.753 | 1.127.551 | 1.630.234 | 1.390.369 | 1.319.692 | 1.346.124 |
| Domestic demand (t) | 992.263 | 968.232 | 897.300 | 960.336 | 1.139.292 | 1.142.709 | 1.023.165 |

**Fig 31 Development of foreign trade of wheat in Austria in tonnes; Source: Statistik Austria, supply balance sheets for cereals, 2009**

### 7.2.7 Corn

Corn is, at least on a quantity basis, the most important type of grain in Austria. In the period of 2007/08 almost 2 million tonnes of corn have been produced. As shown in figure 32 the ratio of domestic production to domestic demand and the ratio of imports to exports are well balanced. Since the amount of corn that is needed for the production of ethanol in Pischelsdorf is relatively small, it won't affect much the foreign trade of corn in Austria.




| | 2001/02 | 2002/03 | 2003/04 | 2004/05 | 2005/06 | 2006/07 | 2007/08 |
|---|---|---|---|---|---|---|---|
| Import (t) | 581.449 | 664.566 | 660.159 | 539.384 | 471.312 | 699.153 | 353.904 |
| Export (t) | 144.991 | 237.007 | 305.357 | 228.012 | 378.986 | 420.089 | 340.975 |
| Domestic production (t) | 1.771.081 | 1.955.594 | 1.707.771 | 1.944.882 | 2.020.955 | 1.746.184 | 1.994.697 |
| Domestic demand (t) | 2.224.566 | 2.382.797 | 2.069.731 | 2.143.308 | 2.150.972 | 2.048.698 | 1.983.158 |

**Fig 32 Development of foreign trade of corn in Austria in tonnes; Source: Statistik Austria, supply balance sheets for cereals, 2009**

# 8 Bioenergy – Trade: Barriers & opportunities

With regard to trade, there are particularly two biomass and bioenergy products that have to be mentioned: On the one hand oil seeds and accordingly vegetable oil for the production of biodiesel and on the other hand wood pellets.

In the case of vegetable oils Austria has had a high degree of self-sufficiency in the past. With the implementation of the Biofuel Directive in Austria this has changed completely in the period from 2005 to 2007 there has been a strong increase in the imports of rapeseed oil and since then Austria is a net importer of rapeseed and rapeseed oil.

If the projected 10% target for biofuels will be implemented, there will be a further increase in the dependency on imports.

In the case of the production of pellets, which has been a real success story in Austria, the picture is completely different. Austrian producers of pellets were benefiting strongly of the demand from other neighbouring countries in the past and in 2007 about half of the production volume has been exported (mainly to Italy).

Nevertheless, the production of pellets is linked to the development of the wood processing industry. Because of the current economic crisis and the corresponding decrease in the demand for products of the wood processing industry, together with an increase in the domestic demand for pellets there has been a reduction in foreign trade with pellets in the recent past.

Sustainability is very important for the consumer acceptance of biofuels in Austria. The increase in the prices for agricultural commodities (and with it the prices for food) in 2007/08 was attributed to the production of biofuels in the public discussion. To increase the consumer acceptance of biofuels the certification of sustainability will be crucial to the possible future development of bioenergy in Austria.

As a land locked country, Austria doesn´t have direct access to the sea. Therefore with regard to international trade Austria has a cost disadvantage compared to other European countries.

International ports like Rotterdam and Hamburg can be accessed by using the Rhine-Main-Danube Canal. Because of seasonal fluctuations of the water level of the Danube, often the transport on rail and road is preferred.

To sum up: Up to now foreign trade with cereals, oilseeds, cork, wood and animal and vegetable oils and fats in Austria is for the most part limited to European countries. Only in the field of imports of oil-seeds and oleaginous fruits the Americas and Asia and in the field of exports of cork and wood Asia plays a minor role.

Nevertheless, with the ambitious Austrian targets for renewable energy up to 2020, foreign trade with biomass will play a more important role in the future.

Apart from the availability of domestic biomass resources, the future deployment of bioenergy plants and bioenergy imports the main influencing parameter concerning the achievable share of biomass in Austria's energy supply is the total energy consumption. Comprehensive energy efficiency measures, which go far beyond what is discussed today, would be required for achieving such a reduction in the energy consumption.

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