Austria 2012

AUSTRIAN ENERGY AGENCY

Basic Data
Bioenergy

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4biomass

CENTRAL EUROPE
COOPERATING FOR SUCCESS.

EUROPEAN UNION
EUROPEAN REGIONAL DEVELOPMENT FUND

Preface

My goal is Austria's energy autarky. We can produce in Austria, on balance, as much energy from domestic, renewable sources as we consume by ourselves. This makes us independent from expensive, fossil energy imports such as oil and gas and brings about a boom in the economy as well as positive employment effects with new green jobs. Even today about 200,000 people are working in Austria in environmentally-friendly, green jobs. With the further development of renewable sources of energy and a strong environmental technology sector another 100,000 new green jobs could be created by 2020.

Energy autarky is an overall concept which is to the benefit of everyone and everything: The people, the environment, the climate, the labour market, and the Austrian economy. We create jobs and generate value-added in Austria and protect at the same time the environment by saving climate-affecting greenhouse gases. The success of this green economy is becoming evident even today, with annually increasing turnover and employment figures in the environmental sector, and sets the direction for a sustainable energy- and economic system. Ecology and the economy are not mutually exclusive, but are perfectly supplementing each-other.

The course towards a sustainable future-proof energy system pursued by us has triggered a rethinking – and it has become clear by now: The conversion to renewable energies doesn't mean that you have to forego something. On the contrary:

Environmental and climate protection by an efficient use of wind, hydro-, and solar energy as well as of biomass brings about more security for energy supply and creates and safeguards quality of life for us and for our children. Therefore I am working to promote the further development of renewable energy systems, energy saving and more energy efficiency.

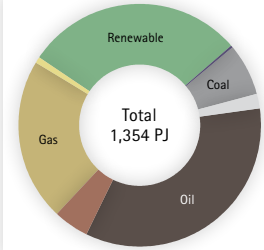
Niki Berlakovich

Federal Minister of Agriculture, Forestry, Environment & Water Management
January 2012

The Basic Data Bioenergy 2012 folder should form the basis of information to the layman in bioenergy, and allows professional audiences quick access to current key data. Valid arguments need to be backed by solid data, the information in this folder provides that foundation.

Energy and Climate

Gross Domestic Energy Consumption 2009

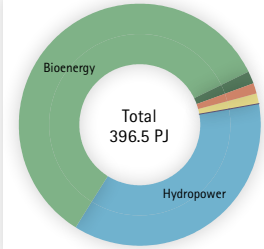


29.3% Renewable energy and waste
0.2% Net import of electricity
6.9% Coal
2.1% Coal, non-energy usage
34.2% Oil
4.9% Oil, non-energy usage
21.6% Gas
0.8% Gas, non-energy usage

Source: Statistics Austria, Energy Balances 1970-2009, Austrian Energy Agency

The gross domestic energy consumption of Austria in 2009 amounted to 1,354 Petajoule (PJ) and is still dominated by fossil fuels (oil, gas, coal). Renewable energy sources have a share of 29.3% or 396.5 PJ. The varying annual net-import of electrical energy (2.8 PJ) is counted as primary energy source, in this case. Regarding fossil fuels (but not for renewables), non-energetic consumption (e.g. crude oil which is used in the production of synthetics and plastics) is included in the graph and amounts to 104 PJ (66.0 for oil, 27.9 for coal and 10.3 for gas). If this value were to be excluded, the gross domestic energy consumption would be reduced to 1,250 PJ, thus increasing the percentage of renewable energy sources to 31.7%.

Gross Domestic Consumption of Renewable Energy Sources 2009

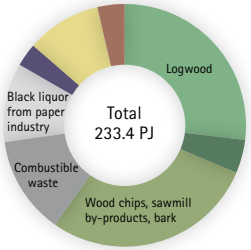


58.9% Bioenergy
1.8% Wind energy
1.4% Geothermal & heat pump
1.3% Solar thermal energy
< 0.1% Photovoltaic
36.6% Hydropower

Source: Statistics Austria, Energy Balances 1970-2009, Austrian Energy Agency

The gross domestic consumption of renewable energy sources is dominated by energy from biomass, with an overwhelming 59% (this takes into account the energy utilised from solid, fluid and gaseous biomass). The amount of energy produced from biomass is larger than that of all other renewable energy sources (hydropower, wind energy, geothermal energy, solar heat and photovoltaic) together. In the year 2009, the share of hydropower amounted to 37%. It varies slightly from year to year, depending on the water supply of the rivers. Wind energy and solar heat have shown the strongest relative growth in the past few years.

Gross Domestic Consumption of Bioenergy 2009

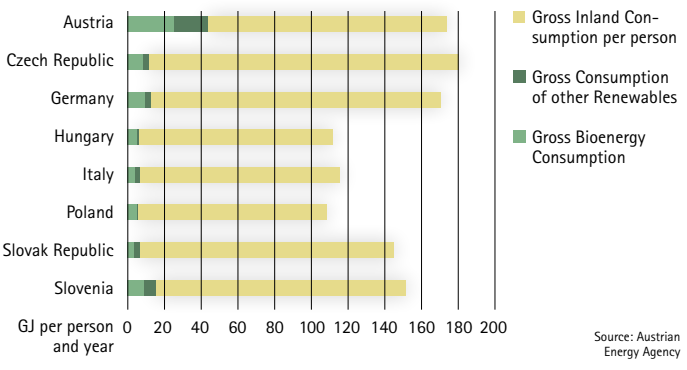


27.0% Logwood
4.3% Pellets
28.5% Wood chips, sawmill by-products, bark
13.1% Combustible waste
10.7% Black liquor from paper industry
3.0% Bio-, landfill-, and sewage gas
9.9% Bioethanol, biodiesel, vegetable oils
3.7% Meat- and bone meal, sewage sludge, straw, various biogenics

Source: Statistics Austria, Energy Balances 1970-2009, Austrian Energy Agency

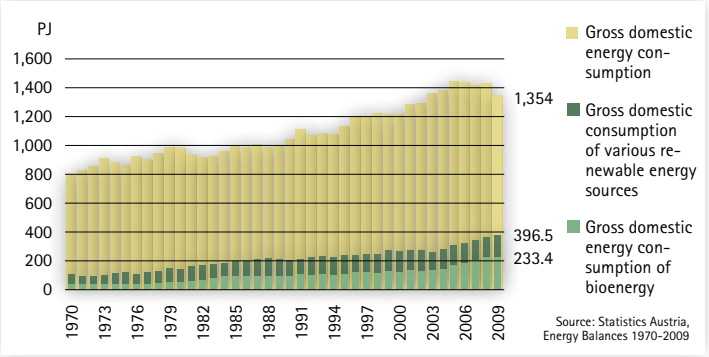
Accounting for 27% of the total use of bioenergy, fuel wood remains the most important biogenic source of energy. Yet in 2009, for the first time, wood chips, bark and sawmill by-products together supplied more primary energy than fuel wood. Wood chips and sawmill by-products are primarily used in the sawmill- and wood processing industry, as well as in cogeneration and district heating plants, whereas pellets are mainly used in growing quantity in domestic heating systems. Waste lye, sludge and bark from the paper industry are used in the paper and pulp industries for the production of electricity and process heat.

Per-capita Primary Energy Demand in the 4Biomass Partner Countries



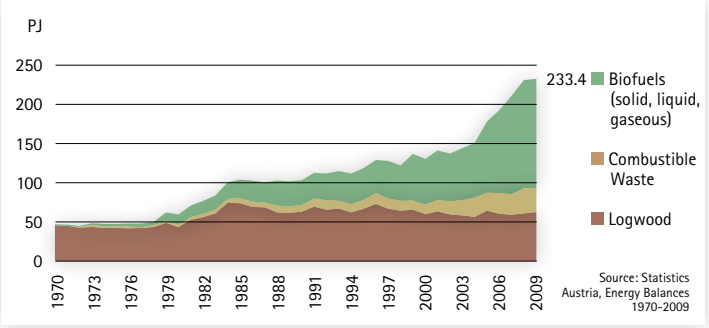
The per-capita demand of primary energy in the partner countries of the 4Biomass project, as of 2008, reveals a non-uniform image: the share of renewables varies between 4.6% in Slovak Republic and close to 30% in Austria, biomass contributes between 2.6% (Slovak Republic) and 17% (Austria) to primary energy demand. The per-capita demand of primary energy varies between 108 GJ per person and year in Poland and 180 GJ in Czech Republic.

Gross Domestic Consumption of Energy 1970 to 2009



Between 1970 and 2009, the gross domestic energy consumption increased from 797 to 1,354 PJ (a peak was reached in 2005 with 1,456 PJ). Improvements in the field of energy efficiency were compensated by an increased overall consumption. As a parallel development to the gross domestic energy consumption, it is notable that the consumption of renewable energy (bioenergy and other renewables such as hydropower) has tripled since 1970, from 124 PJ to 397 PJ in 2009.

Gross Domestic Consumption of Bioenergy 1970 to 2009



The positive development in the gross domestic consumption of bioenergy began in the early 1980s and continued to accelerate until 2008. Fuel wood demand, on the other hand, kept a moderate rate of growth. Since the 1970s, the gross domestic consumption of bioenergy more than quadrupled, and the use of biogenic fuels and combustibles (sawmill by-products, woodchips, bio diesel, bioethanol etc.) continuously increased as well.

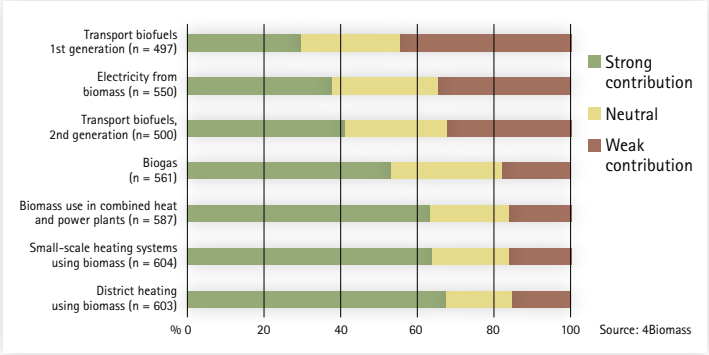
Final Energy Consumption 2009

Unit: PJ	Coal	Oil	Gas	Renewable Energy	Electricity*	District heat	Sum
Space heating, air conditioning, hot water	3.4	65.9	67.9	81.0	30.9	56.0	**305.1**
Steam generation	3.1	2.6	45.5	37.7	0.4	0.2	**89.6**
Process heat	15.3	12.0	53.6	25.0	46.9	7.4	**160.2**
Stationary engines	0.0	16.5	0.4	0.7	87.0	0.0	**104.5**
Mobility	0.0	325.5	7.9	21.4	11.9	0.0	**366.7**
Lighting, IT	0.0	0.0	0.0	0.0	31.0	0.0	**31.0**
Electrochemical purposes	0.0	0.0	0.0	0.0	0.3	0.0	**0.3**
Sum	**21.9**	**422.5**	**175.2**	**165.8**	**208.4**	**63.5**	**1,057.3**

* incl. hydro electricity

Source: Statistics Austria, Energy Analysis 2009

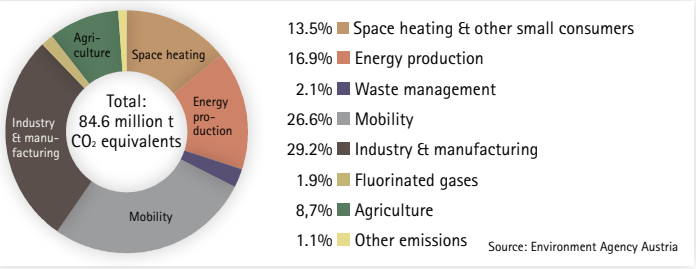
The structure of the final energy consumption with a total of 1,057 PJ clearly indicates which field of application the individual sources of energy are used for. Bioenergy is a preferred energy source in the domestic and process heating sectors, while oil is primarily used in the transport sector and coal is mainly used in industrial furnaces of the steel industries.



Importance of biomass to achieve the renewables´goals. Full report on http://www.4biomass.eu/en/news-events/news-results-of-the-trans-national-stakeholder-dialogue

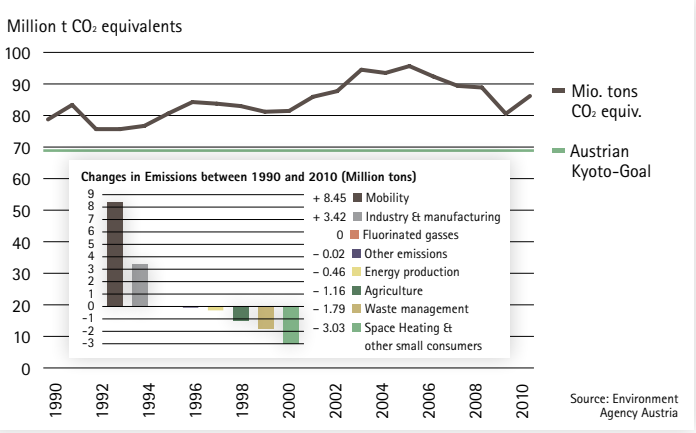
In 2009/10, 1,221 biomass stakeholders from the eight 4Biomass partner countries expressed their respective opinion and assessment concerning the framework conditions of bioenergy, measures and instruments for the support, and the prospects and most favourable markets of bioenergy deployment. As an important result, biomass for heat should most significantly contribute to reach the respective national renewables´goals. This clear message keeps its significance throughout all participating countries and with respect to all sectors of stakeholders analyzed, it remains furthermore applicable when biomass is compared to the other renewable energy sources like wind and hydro.

Greenhouse Gas Emissions 2010 (CO_2 equivalents)



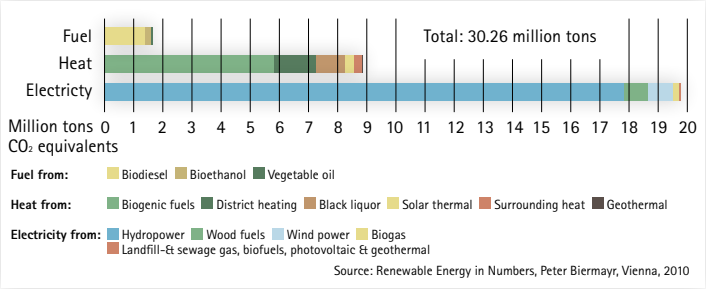
In 2010, Austria recorded total greenhouse gas (GHG) emissions equivalent to 84.6 million tons of CO_2, missing the 68.8 million tons target set by the Kyoto Protocol for Austria by 6.2 million tons (taking into consideration flexible mechanisms and net forest growth). The Kyoto Protocol commits Austria to a GHG emissions reduction of 13%, as compared to 1990. The use of fossil fuels is to a large extent responsible for the greenhouse gas emissions.

Development of Greenhouse Gas Emissions 1990 to 2010



While the areas of small-scale emissions, agriculture, waste management, energy production, fluorinated gases and other emissions were able to moderate their emissions, the sector of transportation shows an increase of 0.6 million tons compared to 2009, and industry experienced a significant increase of 1.4 million tons. The emission in the area of domestic heating in 2010 mounted up to 11.4 million tons, which means a significant increase compared to 2009, due to a very cold winter.

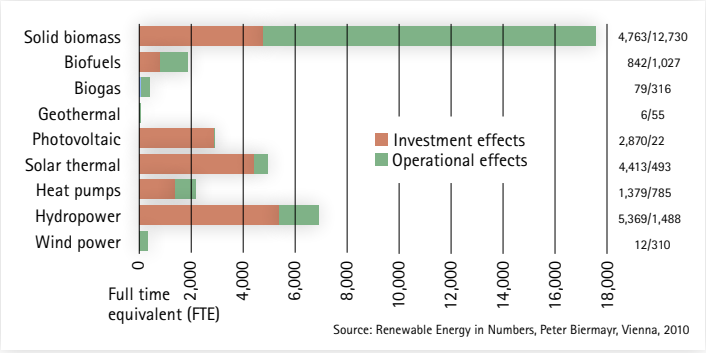
Greenhouse Gas Emissions offset by Renewable Energy Sources (CO_2 equivalents) 2009



Source: Renewable Energy in Numbers, Peter Biermayr, Vienna, 2010

Through the utilisation of renewable energy sources, an amount of 30.26 million tons of CO_2 equivalents could be saved in 2009. The supporting pillars of this outcome are electricity from hydropower, followed by heat from fuel wood, and other biogenic fuels such as biodiesel. Combined with the share of renewables in district heating systems, these four pillars contributed 87.5% to the total emission reductions.

Primary Employment Effects from Investment in and Operation of Technologies for Renewable Energy 2009

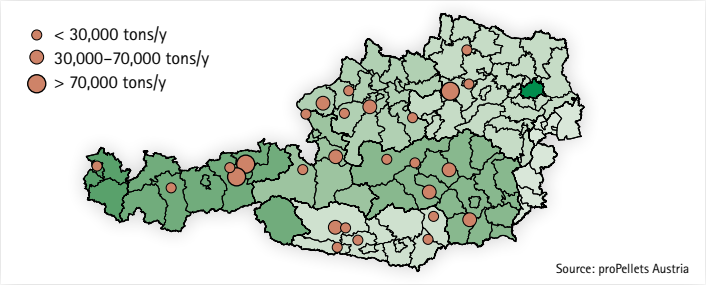


Source: Renewable Energy in Numbers, Peter Biermayr, Vienna, 2010

The biomass industry has the highest number of employees in the sector of renewable energy sources, due to the operation of biomass plants utilising solid biomass. Most of the employees are busy in the fuel production and supply (wood chips and wood pellets). At present, almost every second employee in the renewable energy branch is active in this business.

Pellet Production in Austria

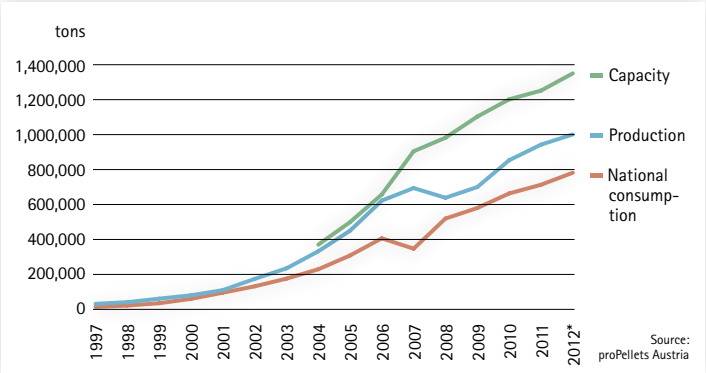
Production Locations for Pellets 2011



Source: proPellets Austria

The Austrian pellet market was steadily growing until 2006, but slowed down in 2007 due to a shortage of produce and low oil prices. This led to a drop in boiler sales and pellet usage. Pellet manufacturers reacted with an expansion of their production capacities and reached 1.25 million tons per year by 2011. The national pellet consumption in 2011 amounted to 710,000 tons, clearly below the total pellet production of that year (940,000 tons), leaving considerable amounts for export (mainly to Italy).

Austrian Pellet Production, Production Capacity and Pellet Consumption 1997 to 2011



*2012 projected figures

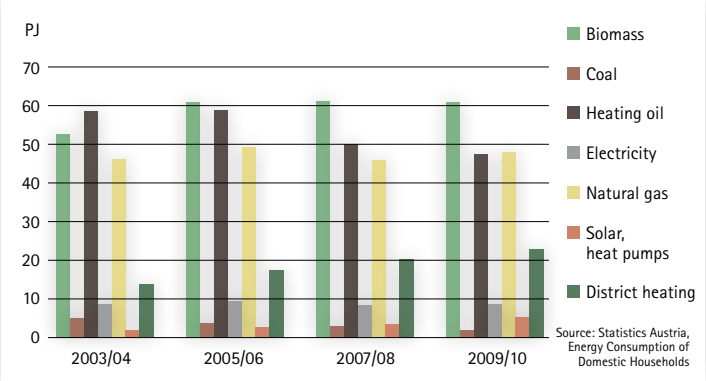
Consumption of Bioenergy in Austria – Development & Potential from 2005 to 2020

	2005	2009	Potential 2015	Potential 2020
Heat from biomass				
Energy sources	PJ	PJ	PJ	PJ
Wood-based	97.2	95.4	103.9	110.9
Black liquor	15.6	17.5	18.4	19.0
Landfill gas	0.3	0.3	0.3	0.3
Biogas	0.5	0.4	2.8	4.8
Other solid biomass	2.2	5.5	6.5	7.4
Heat from biomass – single units	**115.8**	**119.1**	**131.8**	**142.4**
Domestic waste (bio-shares)	1.2	1.9	1.9	1.9
Wood-based	10.4	20.6	26.1	30.7
Biogas	0.2	0.4	1.0	1.4
Liquid biomass	0.3	0.3	0.3	0.3
Black liquor	0.0	0.3	0.3	0.3
Other solid biomass	0.6	0.9	2.5	3.8
Heat from biomass – district heating	**12.7**	**24.5**	**32.1**	**38.4**
Total heat from biomass	**128.5**	**143.5**	**163.9**	**180.9**
Electricity from biomass				
Energy sources	PJ	PJ	PJ	PJ
Domestic waste (bio-shares)	1.0	1.1	1.1	1.1
Wood-based	2.6	7.3	8.4	9.3
Biogas	1.1	2.3	3.6	4.7
Liquid biomass	0.2	0.1	0.1	0.1
Black liquor	4.0	4.0	4.4	4.6
Other solid biomass	0.3	0.6	0.7	0.8
Total electricity from biomass	**9.3**	**15.5**	**18.3**	**20.7**
Biofuels				
Energy sources	PJ	PJ	PJ	PJ
Pure biofuel	**0.9**	**5.0**	**6.2**	**8.0**
Bioethanol – admixture	0.0	2.7	4.9	5.3
Biodiesel – admixture	1.4	14.9	17.6	22.3
Biofuel – admixture	**1.4**	**17.5**	**22.5**	**27.7**
Total biofuel	**2.3**	**22.5**	**28.7**	**35.7**
SUM OF BIOENERGY	**140.2**	**181.5**	**210.9**	**237.2**

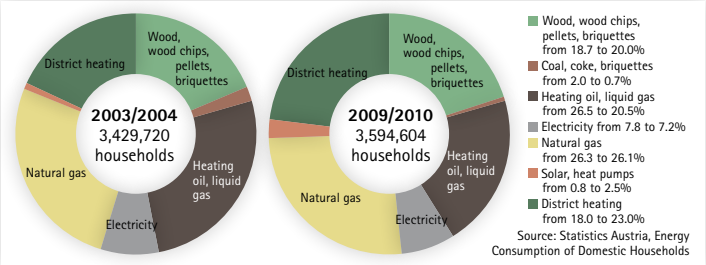
Source: Statistics Austria, Energy Balances 1970-2009, Potential Analysis, Austrian Biomass Association

Heat from Biomass

Energy Consumption from Space Heating in Austrian Households 2003/04 to 2009/10

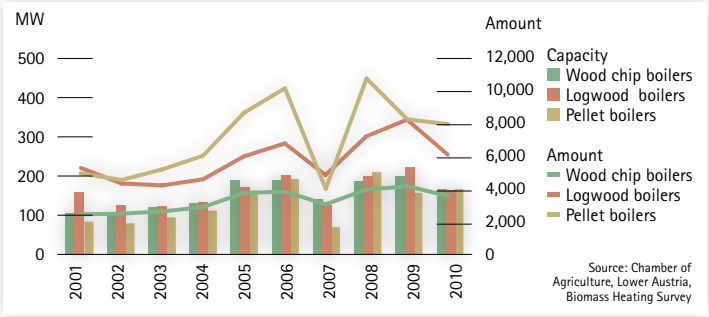


Heating Technologies used in Austrian Households



The trend of heating in domestic homes between the heating seasons of 2003/04 and 2009/10 clearly shows a decrease in households using coal-fired systems (dropping from 67,831 to 24,048). A significant decline of 170,000 households could also be observed in the use of heating oil and liquid gas systems, from a previous 738,666 households. There are no noticeable changes in the domestic use of natural gas and electrical energy. Translated into market shares, the total percentage of households heating with fossil fuels (natural gas, heating oil, liquid gas, coal, coke) dropped from 54.8% in 2003/04 to 47.3% in 2009/10.

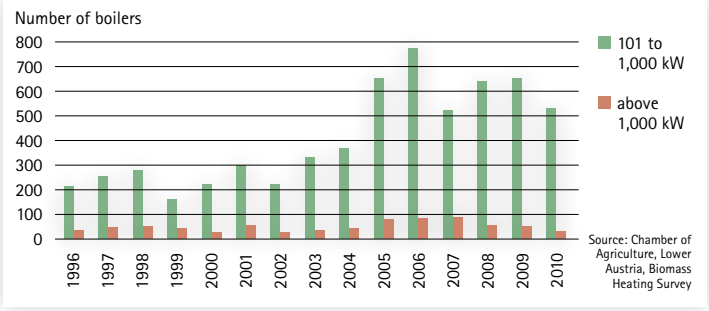
Number and Capacity of annually newly installed Biomass Boilers < 100 kW from 2001 to 2010



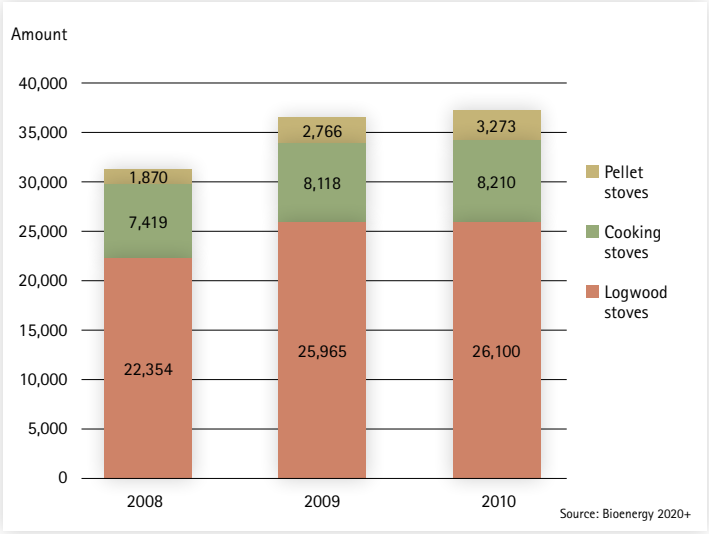
After having experienced a continuous growth between 1994 and 2006 the biomass boiler market slumped due to low oil prices and a shortage in pellets, but recovered in 2008. By 2010 the sale figures dropped once more, most noticeably for domestic logwood boilers. The underlying causes are a reduction in public support schemes and the delayed effects of the economic and financial crisis. The average boiler size for installed systems below 100 kW, are 27 kW for logwood boilers, 47 kW for wood chip systems and 22 kW for pellet boilers.

Biomass district heating has a long tradition in Austria, dating back to the early 1980ies. In 2010, about 1,880 plants with a total power-output of 1,600 MW were in operation, supplying 3,200 GWh of heat to their customers. District heating plants used about 1.2 million tons of wood-residues, bark and wood chips annually to supply this heat. Currently, a trend away from big units in the many MW-range towards smaller units in the range of several 100 kW can be observed.

Number of annually newly installed Biomass Boilers > 100 kW Heat Output from 1996 to 2010

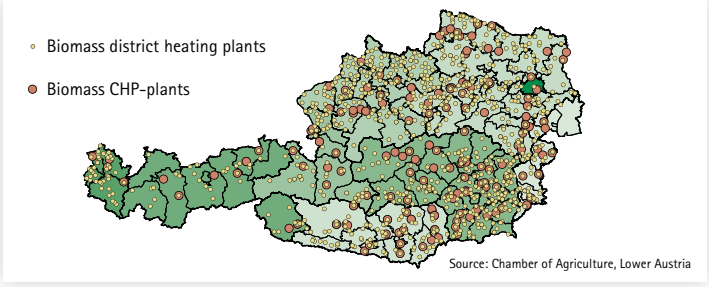


Biomass Stoves* sold in Austria between 2008 and 2010



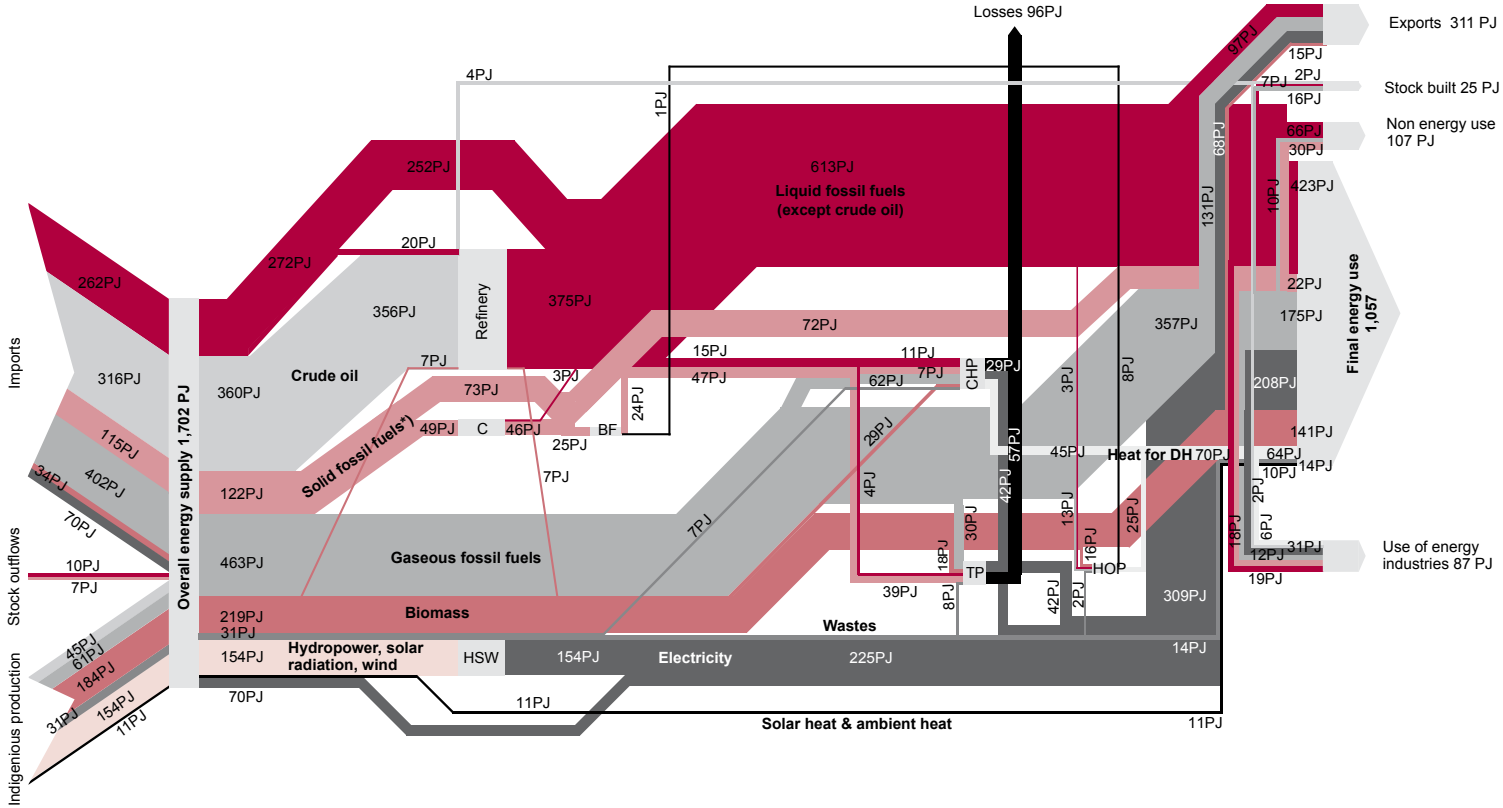
In 2010, the sales figures for biomass-heated cooking- and logwood stoves differ little from those of 2009. An additional 3,273 pellet stoves could be sold, which amounted to a difference of plus 18.3%, as compared to the previous year. The annual installation rate of tiled stoves fluctuates between 12,000 and 15,000. In Austrian households there are approximately 500,000 installed tiled stoves in total.

Biomass District Heating Plants and CHP Plants, as of 2010



* A stove is a heater, and in comparison to a boiler not used for the operation of a central heating system

Energy Flow Chart for Austria 2009

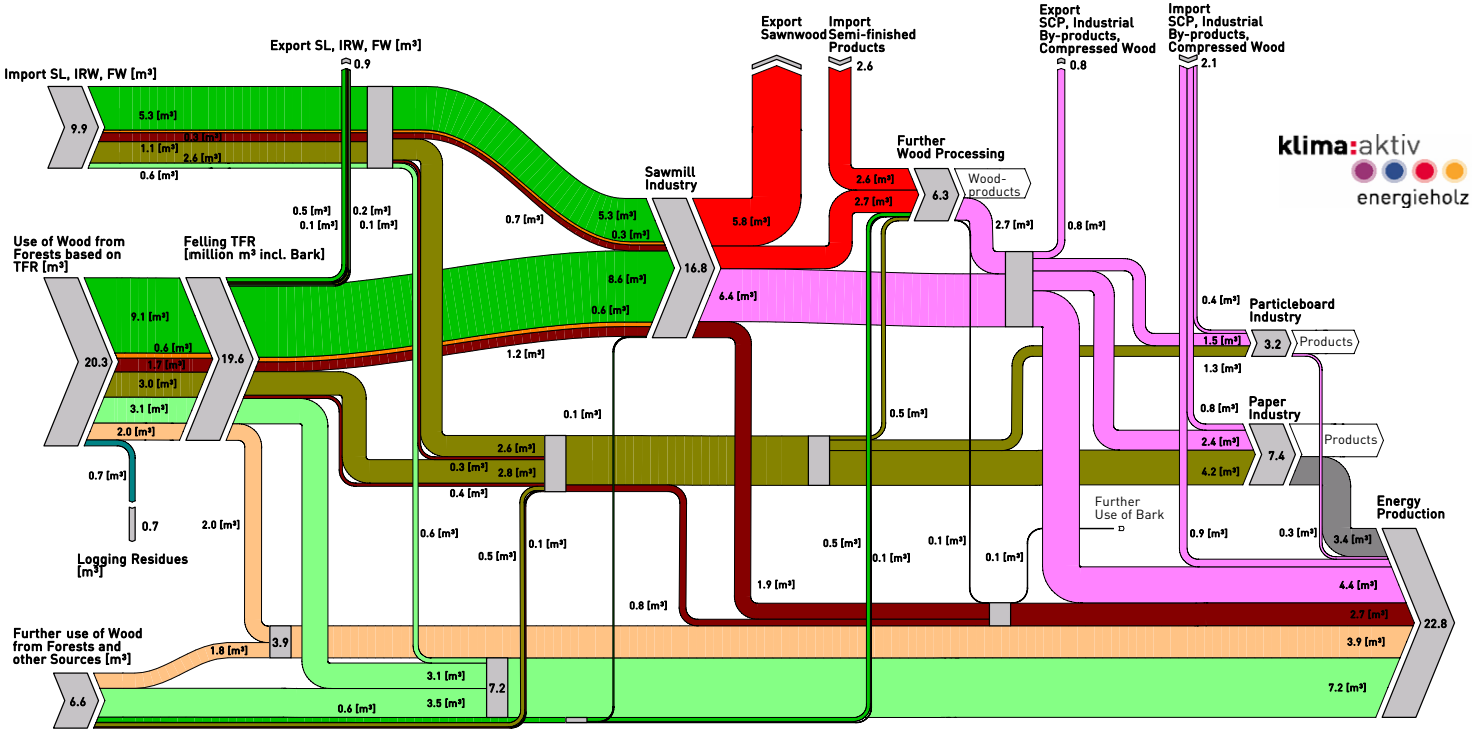


Rounding differences not equalized.
C ... Coke oven; BF ... Blast furnace; HSW ... Hydropower, PV, Windpower plant; TP ... Thermal power plants; HOP ... Heat only production; CHP ... Combined heat and power ; Production of charcoal is not shown because of the low energy flows (< 0,5PJ).

*) including coke oven gas and blast furnace gas, DH ... District heating

Source: STATISTICS AUSTRIA, Energy statistics. Compiled on 28. January 2011.

Woodflow Chart for Austria 2009

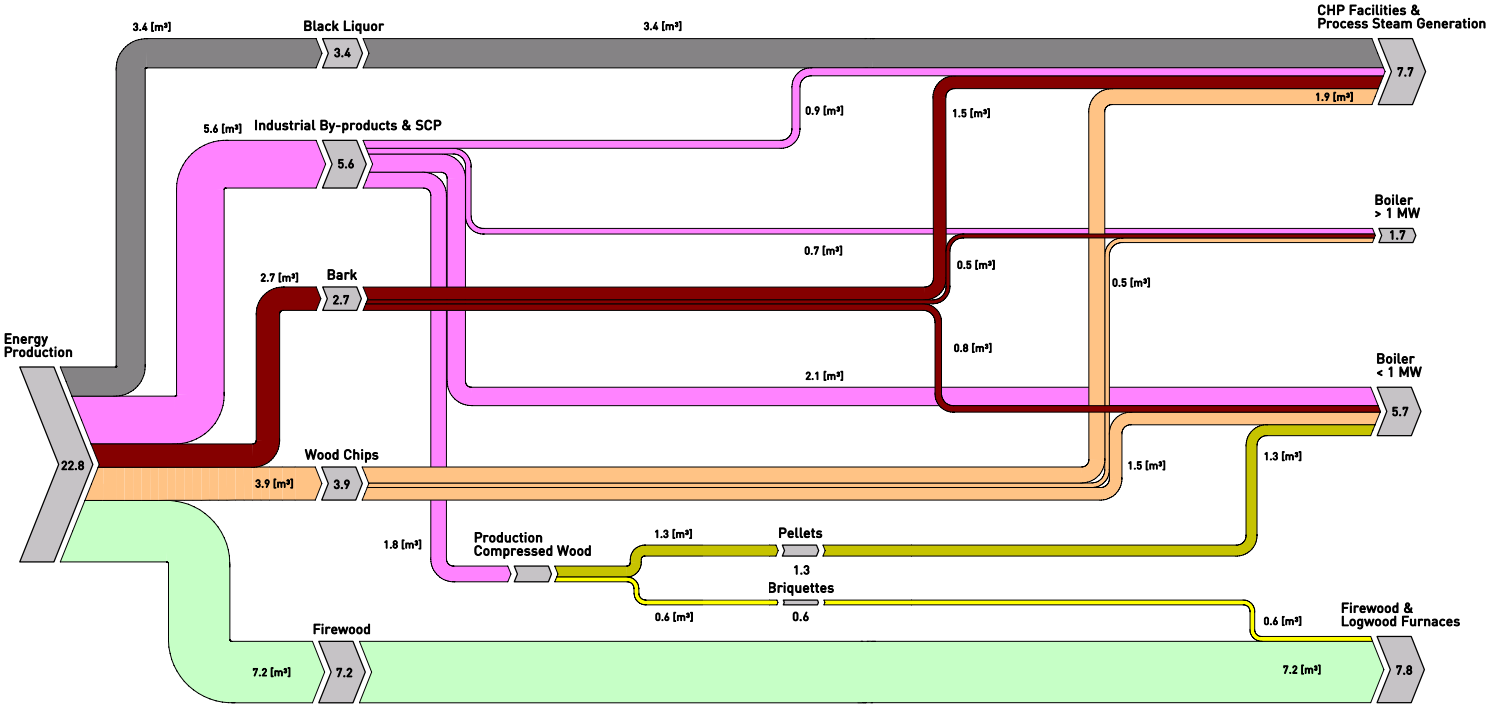


LEGEND (All values are given in [million m³]; values < 0.1 million m³ are not shown)

- Sawlogs (SL)
- Industrial Roundwood (IRW)
- Firewood (FW) incl. Bark
- Logging Residues
- Cross-Cut Ends
- Wood Chips
- Black Liquor
- Bark
- Sawmill Co-Products (SCP), Industrial By-products, Compressed Wood
- Sawnwood & Semi-finished Products

State: November 2011

Woodflow Chart for Austria 2009 – Energy Production



State: November 2011

LEGEND **(All values are given in [million m³]; values < 0.1 million m³ are not shown)**

- Black Liquor
- Bark
- Briquettes
- Wood Chips
- Pellets
- Firewood incl. Bark
- Industrial By-products & Sawmill Co-products

Background Information on Woodflow

There are large quantities of timber resources in the Austrian forests that are used by a variety of customers in both the sawmill, paper and wood processing industry, as well as in the production of energy. To guarantee a constant supply for an increased demand of raw material for both manufacturing and energy related purposes, more wood (fuel) assortments need to be fed into the market.

The **Woodflow Austria 2009** graphic puts visual emphasis on the total woodflow within the Austrian market of 2009. The different manifestations of wood are distinguished by colour, allowing for a simplified tracking of the resource, from its origin (felling, import and other sources), throughout the entire processing chain (sawmill industry, other wood processing) as well as its manifold applications (manufacturing and energy-related purposes). Differently sourced data from the entire chain of value of wood was merged for the creation of this diagram.

The additional graphic „Woodflow Austria 2009 – Energy Production" represents the continuation of the main graphic and shows the different paths of energetic uses for the respective wood assortments.

Short Explanation (selected topics):

Wood assortments

- **Cross-cut ends:** The standard excess length of saw logs in commercial use; it is calculated as a proportion of saw logs.
- **Wood chips:** This assortment includes both forest wood chips and industrial wood chips and waste wood respectively.
- **Wood products:** Various products of the wood processing industry, such as doors, furniture, floors, bridges, roofing, shuttering boards, timber etc.
- **Black liquor:** Residual lye in the production of pulp, that can be used for the production of energy.
- **Industrial by-products and sawmill co-products (SCP):** chips, edgings, slabs, pellets, etc.

Nodes

Use of wood from forests and other sources: the portion of timber that is not represented by imports, nor recognised in the timber felling report (TFR), but distinguishable in the difference in consumer demand (sawmills, panel and paper industry, wood processing, energy production). Sources for this volume include quantities from smaller forests, waste wood and copse.

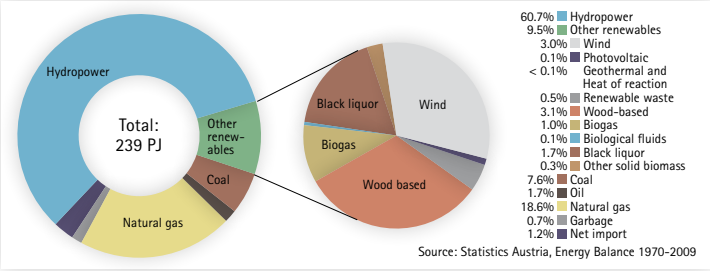
Further wood processing: This includes wood processing facilities (e.g. carpentry, joinery and veneer mills = that consume sawn timber as well as saw logs, and produce both intermediate and final products. The by-products are used for industrial and energetic purposes. Other examples include the torrent and avalanche control, road authorities and the farming and forestry industry.

Energy Production: Wood assortments are brought together in this node and are used in the production of energy (CHP-facilities, wood chip-, pellet- , briquette- and firewood boilers).

Further information: www.energieholz.klimaaktiv.at

Electricity Generation

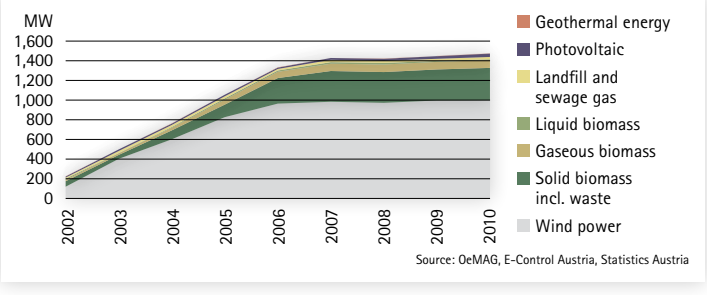
Electricity Generation in Austria 2009



Source: Statistics Austria, Energy Balance 1970-2009

70.2% of the Austrian electricity demand is covered by renewable energy sources, and the remaining 29.8% by fossil fuels and imports. The predominant fossil fuels are natural gas and coal. The electricity produced from renewable energy sources apart from hydropower, primarily comes from bioenergy (wood-based, black liquor, biogas), and from wind. Photovoltaics and geothermal energy play a minor role, so far.

Development of the Bottleneck Power Capacity of other Eco-electricity Facilities with Contractual Relationships*



Source: OeMAG, E-Control Austria, Statistics Austria

The enactment of the first Green Electricity Act in 2002 enabled a dynamic development of renewable generating facilities from 2003 onwards until 2006. Afterwards, development stagnated, meaning that since 2007 only 13.8 MW of bioenergy plants (gaseous biomass, solid biomass incl. waste, liquid biomass) have come up to the grid, accounting for a 3% annual growth only. In March 2011, the total capacity of the solid biomass sector amounts to 325 MW_{el}, with an additional 101 MW_{el} having already been approved, in order to further expand the green-electricity production.

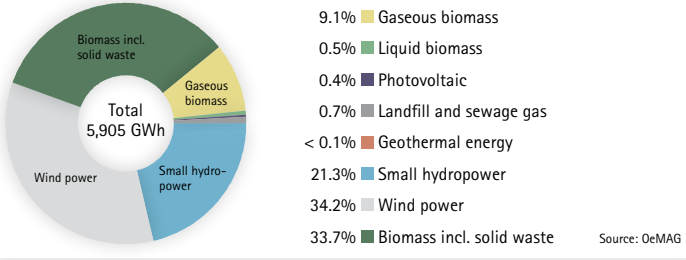
* "Other eco-electricity facilites" include eco-electricity facilites except for small hydropower plants <10 MW

Power Capacity of Approved Facilities and Facilities with a Contractual Relationship

Energy sources	Contractual Relationship (Position at 31. 12.)			Contractual Relationship (Position 31. 3. 2011)		Recognised Facilities (Position 31. 3. 2011)	
	MWel	*MWel*	*MWel*	*MWel*	*Amount*	*MWel*	*Amount*
	2002	2006	2010	2011	2011	2011	2011
Gaseous biomass	14.3	62.5	79.2	79.7	290	104.1	362
Solid biomass incl. garbage	55.0	257.9	324.9	325.2	122	426.4	195
Liquid biomass	12.6	14.7	9.4	9.4	45	25.4	94
Landfill and sewage gas	9.9	13.7	21.2	21.1	44	29.8	68
Subtotal bioenergy	**91.7**	**348.8**	**434.6**	**435.4**	**501**	**585.7**	**719**
Geothermal	0.9	0.9	0.9	0.9	2	0.9	2
Photovoltaic	12.8	15.3	35.0	36.8	5,147	194.5	21,131
Wind power	114.7	953.5	988.2	986.0	135	1,849.6	244
Subtotal other bio energy facilities	**220.1**	**1,318.4**	**1,458.7**	**1,459.1**	**5,785**	**2,630.7**	**22,096**
Small hydropower up to 10 MW	980.0	320.9	303.8	304.1	1,715	1,265.6	2,752
Total	**1,200.1**	**1,639.3**	**1,762.5**	**1,763.2**	**7,500**	**3,896.3**	**24,848**

Source: E-Control Austria

Annual Feed-in of Green Electricity in Austria 2010 within the Green Electricity Support Scheme according to the Green Electricity Act



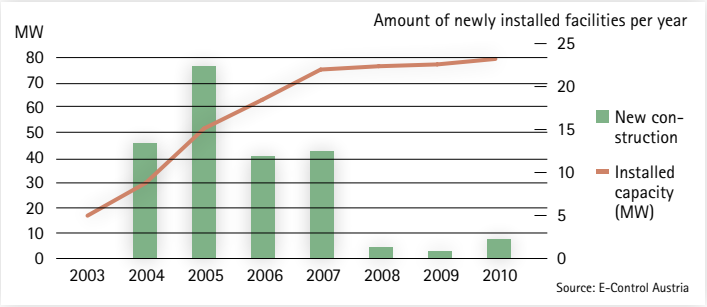
Source: OeMAG

The electricity produced by renewable generating facilities in 2010, amounting to approximately 5,905 GWh (excluding big scale hydropower plants), largely comes from wind power and solid biomass. The eco-electrical input volumes of small-scale hydro plants promoted by feed-in tariffs have subsided from 3,995 GWh in 2004 to 1,258 GWh in 2010, due to a rising market price, convincing many providers to withdraw from the eco-electricity tariffs. At the same time, the input volume of wind-generated electricity rose by more than 1,000 GWh. For comparison, the final energy consumption of electricity in Austria amounted to 57,880 GWh in 2009.

Biogas – Heat, Electric Energy, and Fuel

Biogas is a mixture consisting of 50–75% methane (CH_4), 20–45% carbon dioxide (CO_2), ca. 2–3% water (H_2O) and traces of hydrogen sulphide (H_2S), ammoniac (NH_3), nitrogen (N_2) and hydrogen (H_2). The lower heating value of biogas is 5 to 7.5 kWh/m³ (the lower heating value of methane is about 10 kWh/m³). Biogas can be used to create heat and electrical energy. It can be fed into the natural gas grid when purified, and it can be used as a fuel.

Capacity of Austrian Green Electricity Biogas Facilities 2003 to 2010



Source: E-Control Austria

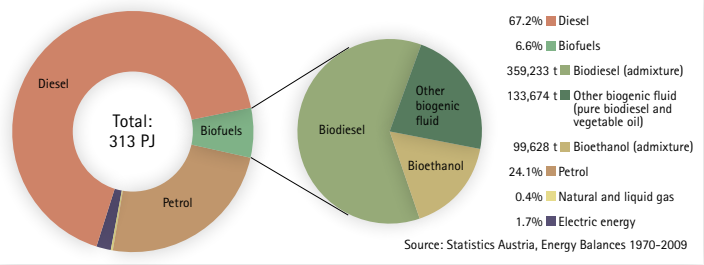
Until the first quarter of 2011, a total of 362 biogas facilities, with an electrical capacity of 104.1 MW, had been recognised as renewable generating stations. 290 of these stations with an electrical capacity of 79.7 MW have a contract with OeMAG. Before the year 2002, only 120 small-scale biogas facilities existed, and they primarily used manure and waste for digestion. Following the enactment of the Green Electricity Act 2002, Austria experienced a strong expansion of biogas facilities. Renewable primary products (NAWARO) can be used as a fermentation substance with a very high production level of gas, with respect to their mass. The average capacity of newly installed biogas plants rose from 30 kW_{el} to 250 kW_{el} between the years 2004 and 2008.

	100 Dairy cows	100 Cattle for fattening	100 Pigs for fattening	100 Breeding pigs	1 hectare Grass-land	1 hectare Silage from corn (18 t dry mass)	1 hectare Lucerne (14 t dry mass)
m^3 Biogas/day	210	60	15	20	14	32	20
kW_{el}	17	5.3	1.2	1.9	1.2	2.5	1.5
kWh_{el}/year	150,000	46,000	10,500	16,500	10,000	21,000	13,500

Source: Arge Kompost & Biogas

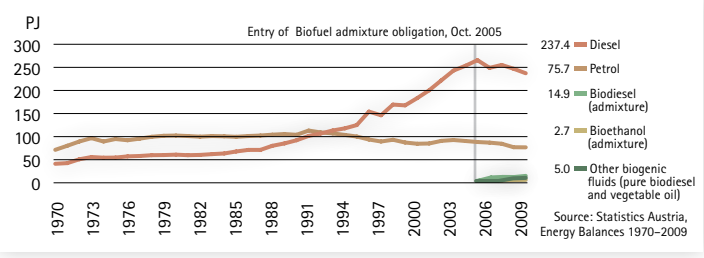
Biofuels

Energy Consumption in the Traffic Sector* 2009



The Austrian fuel consumption has been rising rapidly since the mid 1980s and marked 8.34 million tons or approx. 357 PJ in 2005, while having only slightly slowed down since then. The demand for diesel in particular has more than quadrupled over the past 20 years. Since 2005, it has become mandatory to mix fossil fuels with biofuels (EU-Directive 2003/30/EC). The application of biofuels has grown from 2.7 PJ in 2005 to 22.5 PJ in 2009. In 2009, Austria utilised 19.2 PJ of biodiesel, 2.7 PJ of bioethanol, and 0.7 PJ of plant oil. A share of 78% of the biodiesel was utilised for the mandatory admixture to fossil diesel, the remaining 22% in purified forms and other mixtures. Bioethanol was primarily used in addition to fossil petroleum; plant oil was used in purified forms.

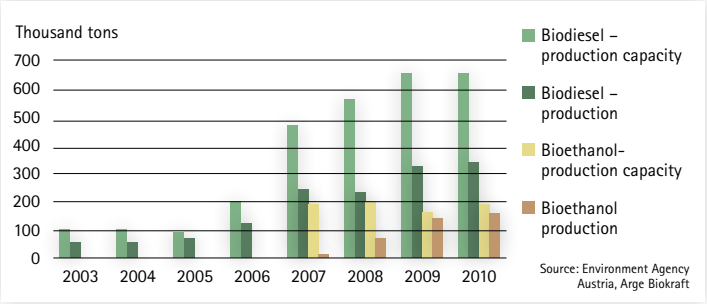
Fuel Consumption** in Austria 1970 to 2009



* Traffic excluding railroad, shipping, air traffic and transportation in pipelines.

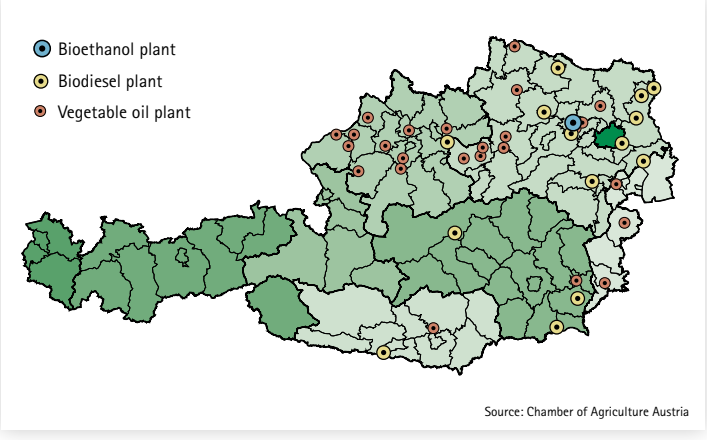
** The final energy consumption of the following resources: petrol, biodiesel (admixture), bioethanol (admixture) and other biogenic fluids (pure biodiesel and vegetable oil). The final consumption includes all sectors (domestic, agriculture, manufacturing, traffic, public and private services).

Biofuel Production in Austria 2003 to 2010

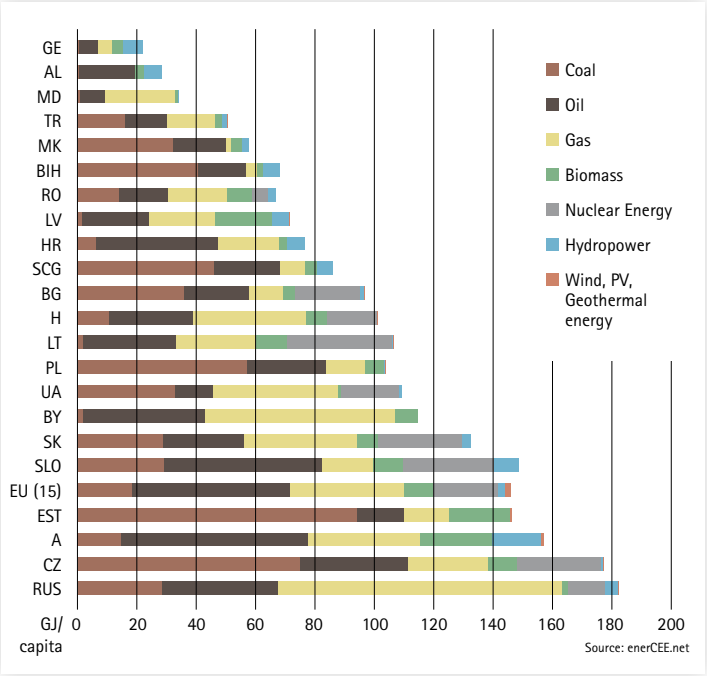


In 2010 Austria had 14 biodiesel plants with an approximate annual output capacity of 650,000 tons. Subsequently, the biofuel admixture obligation was easily covered by Austrian production. In addition, the annual production capacity of 240,000 m³ (~ 190,000 t) bioethanol in Pischelsdorf/Lower Austria covers the entire national demand for bioethanol. The primary resources for the production of bioethanol are wheat- and corn surpluses from Central and Eastern Europe, as well as from crops non usable for the production of food.

Biofuel Production Sites in 2009



Primary Energy Demand per capita 2009

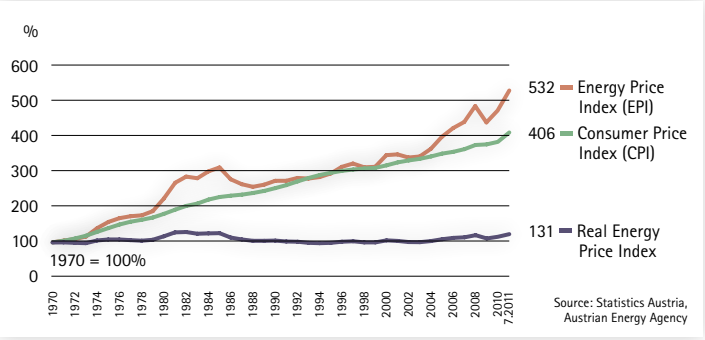


The graph depicts the primary energy demand per capita of a selection of Central- and Eastern European countries, as well as an EU 15 average in 2009. (Source: enerCEE.net – Energy in Central and Eastern Europe, statistical data provided by ENERDATA)

enerCEE.net
Energy in Central & Eastern Europe

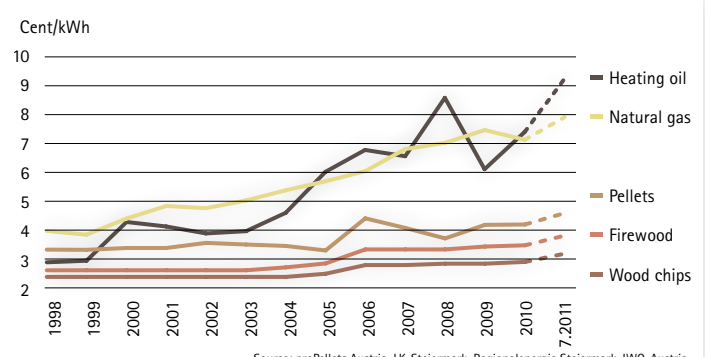
The web-platform enerCEE.net provides in-depth energy profiles of Central and Eastern European countries. The profiles follow a clear structure and provide up-to-date and comparable data, time series and overviews of the respective national energy landscape, the energy market and energy policies with a special focus on renewable energy and energy efficiency. The web-platform also shares cross-country information on green electricity in the CEE region and new developments concerning EU energy policies and EU enlargement processes.

Energy Price Index Development for Domestic Households and Consumer Price Index in Austria from 1970 to July 2011

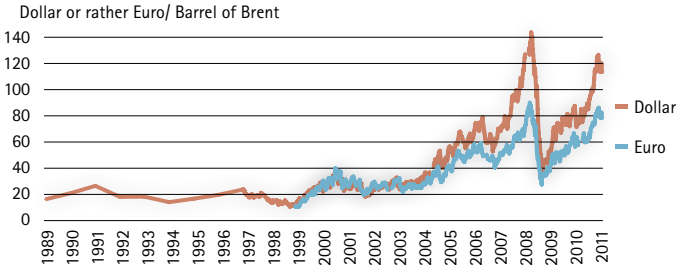


The energy price index (EPI) is continuously rising. Taking inflation into consideration, it is clear that the effective energy price index, with the exception of the second oil crisis in the 80ies, has stayed fairly unchanged until 2004. The resource market boom of 2007 evidently led to a rise in the price of energy, interrupted only by the economic and financial crisis, and held its rising course until 2010. There are similar price increases for bioenergy, but the price gap in the household sector is continuously increasing in favour of firewood, wood chips and pellets.

Price Development of individual Energy Sources for Domestic Households from 1998 to 2010



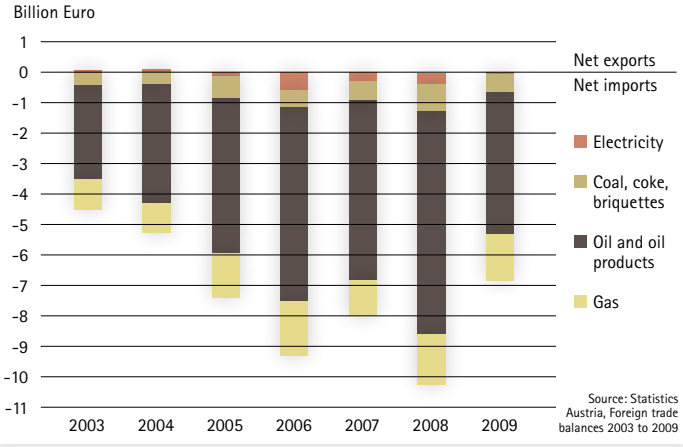
Crude Oil Prices between 1989 and 2011



Source: U.S. Energy Information Administration eia, ECB Exchange rate

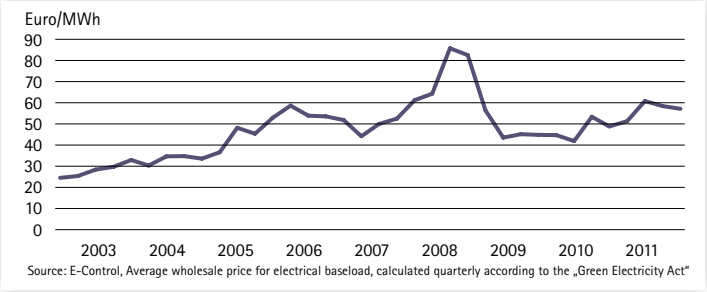
The rapid price increase for fossil fuels reached a peak of 143 dollars per barrel of oil in 2008, creating a hike in prices for various conventional energy forms and affecting Austrian energy trade balance negatively. The net-import volume of coal, oil, gas and electricity amounted to 4.44 bill. Euro in 2003, and increased from 9.33 bill. in 2006 to 10.3 bill. Euro in 2008. By 2009 the effects of the economic and financial crisis had lead to a decreased net-import volume of 6.686 bill. Euro.

Austrian Foreign Trade Balance for Energy from 2003 to 2009



Source: Statistics Austria, Foreign trade balances 2003 to 2009

Wholesale Price for Electricity from 2003 to 2011



Source: E-Control, Average wholesale price for electrical baseload, calculated quarterly according to the „Green Electricity Act"

In mid 2008, the wholesale price for electricity rose over 80 Euro per MWh and for the first time ever, the wholesale price exceeded the feed-in tariffs for wind energy. In a short period of time, it was possible to generate electricity from wind power, which is the second most important eco-electricity technology (besides small scale hydropower plants), at market prices. Due to the beginning of the economic crisis in the fourth quarter of 2008, prices for fossil fuels sank abruptly. This also affected electricity prices to decrease to their 2007 levels in 2011.

Mission

4biomass

The project 4Biomass fosters usage of bioenergy throughout Central Europe (CE) via turning know-how to show-how.

The project contributes to sustainable exploitation of biomass in different ways:

1. The exchange of best practice concerning technology, demonstration projects and management approaches throughout CE will contribute to territorial cohesion. It will provide an equal level of knowledge regarding available technologies, investment possibilities and operation of bioenergy systems.

2. Direct support to regional stakeholders by turning know-how to show-how (workshops, project development, field trips). A Joint Management Tool consisting of a databank will pool information on CE demonstration projects and best practise. It will help stakeholders to find tailor-made solutions for investments in bioenergy plants, and for their operation.

3. A Transnational Action Plan gives advice on how an integrated and transnationally coordinated sustainable bioenergy policy could be implemented. It contains recommendations for policy makers and implementing authorities towards sustainable bioenergy development by a joint and consistent policy approach. During Transnational Forums stakeholders discuss practical implementations and exchange experiences of national policies.

Important Numbers

Heating Value, Moisture Content and Wood Moisture

Biomass	Moisture content
Wood, crop condition	50–60%
Wood, stored for one summer	25–35%
Wood, stored for several years	15–25%
Straw, crop condition	15%

Fuel	Heating value* in kWh
Spruce	1,400/m³(stacked)
White pine	1,660/m³(stacked)
Larch	1,800/m³(stacked)
Beech	1,960/m³(stacked)
Oak	2,060/m³(stacked)
Hardwood	3.9/kg
Softwood	4.1/kg
Pellets	4.8/kg
Bark	600/m³(loose)
Wood chips spruce	790/m³(loose)
Wood chips beech	1,100/m³(loose)

* Heating value based on a moisture content of 20%, pellets 9%, bark 50%

Moisture content (defined on a wet weight basis) = $\frac{\text{mass (water)}}{\text{[mass (water) + mass (wood)]}}$ x 100 (in%)

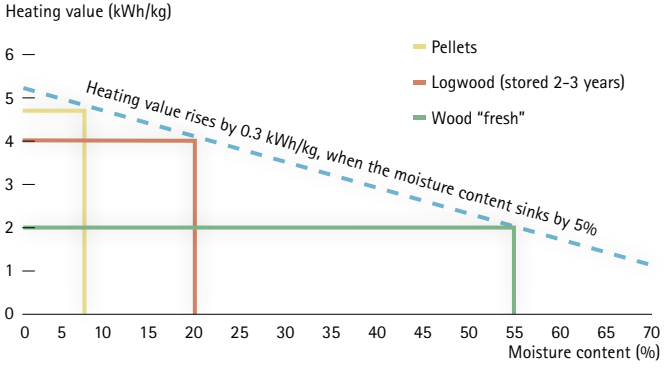
Wood moisture (defined on a dry weight basis) = $\frac{\text{mass (water)}}{\text{mass (dry wood substance)}}$ x 100 (in%)

1 m³ = 1 solid cubic meter of wood
1 m³ (stacked) = 1 cubic meter of stacked logwood
1 m³ (loose) = 1 cubic meter of piled woodchips, pellets or chopped wood

1 m³ = 1,4 m³ (stacked)
1 m³ = 2,5 m³ (loose) woodchips
1 m³ (loose) pellets = 650 kg

Fresh-cut trees have a moisture content of 50% and need to be air dried and properly stored at a dry place for two years before they reach an optimal moisture content for combustion of 15–25%. The heating values of different types of wood – from leaf trees or from coniferous trees – are almost equal with respect to their mass in kg, but they differ with respect to their volume.

Lower Heating Value of Wood, depending on the Moisture Content



Conversion Factors for Energy Units (rounded)

		MJ	kWh	kg oe	Mcal
1 MJ	=	1	0.278	0.024	0.239
1 kWh	=	3.60	1	0.086	0.86
1 kg oe	=	41.868	11.63	1	10.00
1 Mcal	=	4.187	1.163	0.10	1

1 PJ	=	0.278 TWh	=	0.024 Mtoe	=	139,000 m³ wood	=	5,900 ha energy forest*
1 TWh	=	3.6 PJ	=	0.086 Mtoe	=	500,000 m³ wood	=	21,400 ha energy forest*
1 Mtoe	=	41.868 PJ	=	11.63 TWh	=	5.8 Mio. m³ wood	=	248,500 ha energy forest*

*Short rotation (poplar, willow), 4-year harvest rhythm, harvest volume: 9 tons (dry matter) per ha per year

Units		
MJ	=	Megajoule
kWh	=	Kilowatt hour
kg oe	=	Kilogramm of oil equivalent
Mtoe	=	Million tons of oil equivalent
Mcal	=	Megacalorie
1 Barrel	=	159 Litre

Calculation of multiples and fractions of the units according to DIN 1301

da = Deka	= 10^{1}	d = Dezi	= 10^{-1}
h = hecto	= 10^{2}	c = Centi	= 10^{-2}
k = Kilo	= 10^{3}	m = Milli	= 10^{-3}
M = Mega	= 10^{6}	µ = Micro	= 10^{-6}
G = Giga	= 10^{9}	n = Nano	= 10^{-9}
T = Tera	= 10^{12}	p = Pico	= 10^{-12}
P = Peta	= 10^{15}	f = Femto	= 10^{-15}
E = Exa	= 10^{18}	a = Atto	= 10^{-18}

Energy source	Lower heating value	CO_2 emissions (based on the lower heating value)
Coal	7.43 kWh/kg	0.338 kg/kWh
Coke	8.06 kWh/kg	0.382 kg/kWh
Lignite briquettes	5.28 kWh/kg	0.353 kg/kWh
Heating oil	9.79 kWh/l	0.269 kg/kWh
Natural gas	10.00 kWh/m³	0.199 kg/kWh
Wood (average with 20% moisture content)	4.00 kWh/kg	0.000 kg/kWh

Sources pp. 30–31: Austrian Biomass Association, Environment Agency (Gemis Austria), IWO-Austria, Austrian Energy Agency

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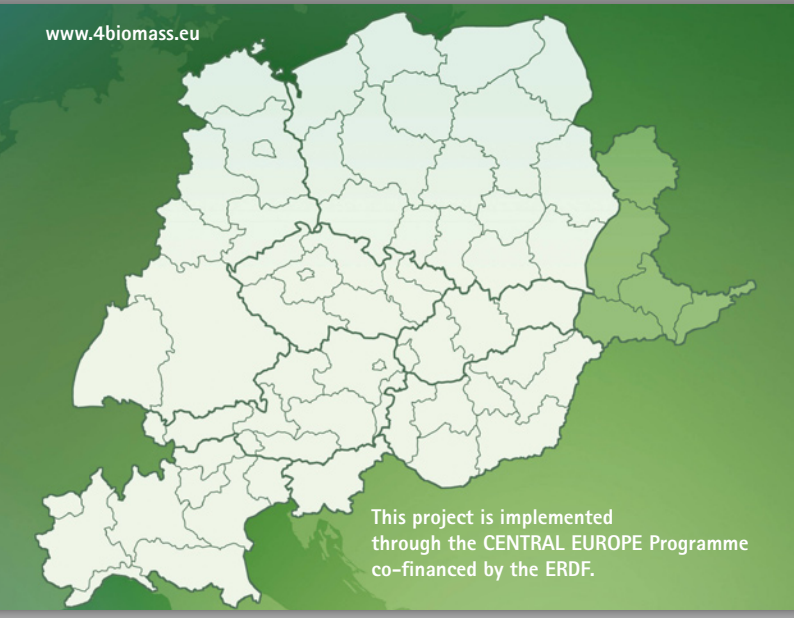

4biomass

CENTRAL EUROPE
COOPERATING FOR SUCCESS.

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DEVELOPMENT FUND