3.4 ENERGY INDUSTRY

3.4.1 INTRODUCTION

Energy input has increased in Austria in almost all economic sectors. This rise is considerable since several economic sectors have undertaken measures to reduce energy consumption. However these measures were in part over-compensated by an increase in economic activity, traffic volume and rising demand for space heating. Liberalisation of energy markets led to falling prices for large-scale consumers. Therefore the incentive to invest in energy- saving measures disappeared.

New EU guidelines will decisively influence the energy sector in the next few years. The implementation of some Directives now being prepared should lead to efficient utilisation of energy and to putting financial incentives for energy-saving measures in place. Besides liberalisation of energy markets, in the coming years, development of energy sectors will also be determined according to certain criteria by the planned standardisation of energy taxation, efficient use of energy in accord with the IPPC Directive, trade in CO_2 certificates and promotion of use of combined heat and power generation facilities.

3.4.2 ENVIRONMENTAL POLICY TARGETS

In the Austrian Federal Government programme of 3 February 2000, **liberalisation of energy** received great attention. Full liberalisation of electricity and gas was established as a goal to ensure freedom of choice for households and businesses. A complete opening of electricity and gas markets in Austria should be achieved more quickly than is foreseen for the degree of market openness and timeframe set out in the Directive on the Internal Market for Electricity and Gas. The Energy Liberalisation Act, Federal Legal Gazette I Nr. 121/2000 provides the legal framework on the federal level for a complete opening of electricity markets. At the same time, law makers established a completely open market for natural gas as of 1 October 2002. Gas and electricity are therefore treated as commodities, so customers are free to choose from whom they obtain their supply.

This liberalisation at the Austrian and European levels has influenced both production and consumption behaviour. The objective of liberalisation was not environmental-political. The following paragraphs list regulatory frameworks with environmental policy targets.

3.4.2.1 Uniform taxation of energy

On 27 October 2003 the Council Directive on restructuring the taxation of energy products and electricity 2003/96/EC was passed and went into force on 1 January 2004.

The aim of the Directive is to abolish the distortion of competition that has existed up to now due to differences in taxation between Member States and between individual energy sources. It should also provide incentives to raise energy efficiency and reduce emissions.

Since considerably higher tax rates are already in effect in almost all EU Member States, the effects of this Directive will be modest. Countries where adaptation is required have been granted numerous exceptions and long transition periods - sometimes until 2012. The stipulated energy sources will be taxed only if they are used as fuel or combustibles. Also, Member States may introduce considerable tax reductions for energy-intensive enterprises, although minimum tax rates have to be observed (OFFICIAL JOURNAL OF THE EU, 2004).

3.4.2.2 Use of renewable energy sources

The Biopower Act

The Directive on the promotion of electricity produced from renewable energy sources of October 2001 (Directive 2001/77/EC) aims to increase the existing proportion of electricity produced from renewable energy sources. Austria has made a commitment to increase the existing proportion of electricity produced from renewable energy sources from 70% to 78%. This Directive was issued both for climate protection as well as energy security purposes - to reduce the existing fossil fuel import dependence of EU Member States.

The *Ökostromgesetz* [Biopower Act] (Federal Legal Gazette I Nr. 149/2002) established a legal obligation on electricity suppliers to purchase and remunerate for electricity generated from renewable energy sources (wind, solar, geothermal, wave and tidal, hydropower, biomass, waste with high proportion of biodegradable organic matter, landfill gas, sewage gas and biogas). The Biopower Act confirmed the goal to develop renewable sources that were already identified in the *Elektrizitätswirtschafts- und Organisationsgesetz* [Electricity Supply and Organisation Act] (ELWOG, 1998). By 2008 a minimum 4% of total annual electricity supply from all grid operators must come from new renewable energy sources. This means that by 1 January 2004 about 2% of “biopower“ must be reached, by 1 January 2006 about 3% and by 1 January 2008 about 4%. Electricity generated from meat and bone meal, waste liquor, sewage sludge or wastes - except wastes with a large biodegradable fraction - is not to be included in the target values mentioned above. The Biopower Act intends to make possible the achievement of the set targets through equalisation throughout Austria, which means that the potentials can be used where it is most economic to use them.

Since 1 January 2003 a nation-wide uniform tariff scheme for electricity supply for new renewable energy sources has been in force.

Biofuel Directive

Content and effect of the Biofuel Directive will be discussed in Chapter 3.6.

3.4.2.3 Efficient use of energy

IPPC Directive

Council Directive 96/61/EC concerning integrated pollution prevention and control (IPPC Directive) demands the use of best available technology for the protection of the environment (see Chapter 3.10). The efficient use of energy is one of the approval criteria for IPPC facilities.

As to Austrian implementation of the IPPC Directive, the efficient use of energy was established as a criterion for approval in the *Gewerbeordnung* [Industrial Code] of 1994 (§77 Section 1 (2)), the *Mineralrohstoffgesetz* 1999 [Mineral Raw Material Act] (§121 Section 1 (2)) and the *Abfallwirtschaftsgesetz* [Waste Management Act] of 2002 (§43 Section 3). However, the energy efficiency requirement of the Industrial Code was abolished by the Austrian Constitutional Court on the grounds that the matter was outside federal jurisdiction.

Proposed Cogeneration Directive

The EU Commission submitted a proposal to the European Parliament and the EU Council concerning a Directive on the promotion of combined heat and power generation (cogeneration) as an energy efficient method of generating electricity (COM (2003) 416 of 23 July 2003).

As regards promotion priorities, importance should also be attached to the fact that the useful heat generated does not exceed demand. The following possible promotion mechanisms have been mentioned: more favourable electricity supply tariffs, preferential tax treatment or exemption, or certifications. For the first time an exact definition of highest-efficiency cogeneration facilities with promotion priority has been provided which distinguishes between existing and new facilities. For existing facilities, energy savings of at least 5% must be achieved through cogeneration, while new facilities which have the best available technology must achieve at least 10%. Exceptions are made for the use of renewable energy sources.

Directive on Emission Allowance Trading

The Directive on Emission Allowance Trading (EU Directive 2003/87/EC) provides for Phase I that energy-intensive enterprises may emit carbon dioxide only up to quantities covered by emission allowances. The certificates will be reduced in stages corresponding to national reduction obligations. They are tradable within the European Union. The goal of emissions trading is the targeted and at the same time cost-efficient reduction of CO_2 (see Chapter 3.10).

On 13 October 2003 the European Parliament agreed to the Directive on Emission Allowance Trading. The pilot phase of CO_2 trading is due to begin on 1 January 2005. It will last until the end of 2007. A second phase will follow this pilot phase, which will cover the time frame of the first obligation period under the Kyoto Protocol (2008-2012). The first phase of emission allowance trading covers CO_2 only. In the second phase trading will probably be expanded to include the other five greenhouse gases (see Chapter 6.1).

EU Energy Label for Electrical Appliances

The labelling of electrical appliances is governed by several EU Directives (EU LABEL, 2003).

The most important technical data for each electrical appliance (including data on electricity consumption and water consumption) are to be found on this standard European label in a compact form and in the relevant language. The information enables the consumer to compare at a glance different appliances within a group of appliances and makes his or her decision easier when choosing an appliance.

The most distinctive feature of this label is the information on the appliance's energy efficiency provided in the form of coloured arrows. Energy efficiency rating is carried out by means of seven so-called energy efficiency classes (from A to G). An “A“ rated energy efficient appliance is very efficient as regards energy use, whereas a “G“ rated appliance consumes a lot of energy. Without having to familiarise themselves with technical details, consumers can quickly recognise what the energy efficiency rating of an appliance is.

Energy performance of buildings

Housing subsidies for the construction and rehabilitation of older buildings will partly be restructured by the Federal Provinces. The basis is the new EU Directive on the energy performance of buildings (Directive 2002/91/EC) which came into force on 4 January 2003. Member States must set minimum requirements for the overall energy performance of buildings. These minimum requirements are to be reviewed every five years and if necessary, adapted to the state of the art technologies (EVA, 2003). Individual Member States must now transpose this Directive into national law within three years (on 4 January 2006 at the latest).

3.4.3 SITUATION AND TRENDS

3.4.3.1 Energy input in Austria

In 2002, gross domestic consumption in Austria amounted to 1 279 peta-joules (PJ), that is an increase of about 5.6% in comparison to 2000.

Input of final energy in Austria amounted to about 985 PJ in 2002. The difference of 294 PJ arises from the energetic conversion of energy sources and cannot be utilised.

Final energy is the form of energy that arrives at the consumer, such as heating oil or wood pellets. Final energy is produced by processing primary energy. For example, extra-light heating oil is produced from crude oil in the refinery. Depending on the process, many different types of final energy can be “produced“ from primary energy contained in the raw material. The conversion thus has certain efficiency and conversion losses cannot be avoided. The form of energy actually used by the consumer is called useful energy (for example heat and light).

Renewable energy sources accounted for 296 131 TJ of gross domestic consumption in 2002, which corresponds to a share of about 23.1%.

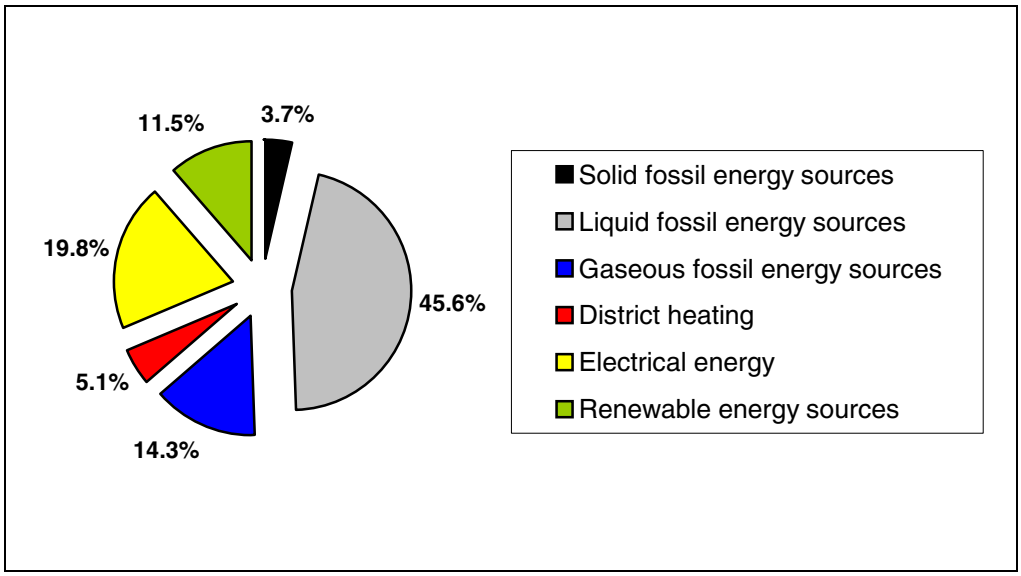

Fig. 3.4-1: Energetic final energy supply in 2002 by energy source in % (renewable energy sources without share in district heating and electrical energy) (STATISTIK AUSTRIA, 2003a)

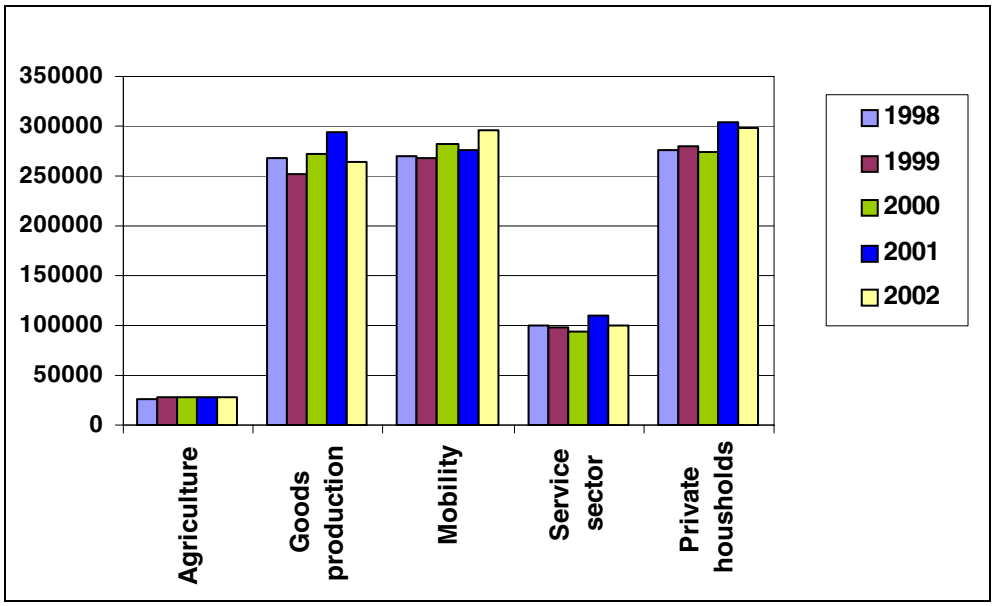

Fig. 3.4-2: Input of final energy in Austria in TJ from 1998 to 2002 by individual sectors (STATISTIK AUSTRIA, 2003a).

The sectors goods production, mobility and private households combined make up more than 87% of final energy consumption in Austria.

Since 2000, more energy has been expended for the first time in the whole of the mobility sector than in the areas of space heating and air-conditioning (STATISTIK AUSTRIA, 2003a). This trend can be interpreted as an over-compensation of sup-

posed reductions (through more efficient engine technologies) in the mobility sector by the steep rise in vehicle transport performance.

3.4.3.2 Supply and input of electricity in Austria

As in the last few years, domestic consumption of electricity has continued to rise. In 2002 it amounted to 60 894 GWh (excluding energy input into pumped-storage power plants). The following table shows the development of domestic electricity consumption:

Year	GWh
1990	48 529
1995	52 606
1999	56 985
2000	58 512
2001	59 897
2002	60 894

Tab. 3.4-1: Development of domestic electricity consumption (excluding pumped-storage power stations) for the years 1990 to 2002 in GWh (E-CONTROL, 2003).

Taking into account the energy input into pumped-storage power stations, the share of hydropower in domestic electricity consumption amounted to about 67%.

Electricity imported into Austria amounted to 13 920 GWh in 2000, and to 15 375 GWh in 2002, which corresponds to an increase of about 10%. Electricity was imported mainly from Germany, Poland (through the Czech Republic), Hungary and Switzerland. The increase in electricity imported into Austria brought an increase of nuclear power to the Austrian supply area.

Electricity exported from Austria saw a decline of about 3.5% from 15 216 GWh in 2000 to 14 676 GWh in 2002 (E-CONTROL, 2003).

Electricity Production from **thermal power plants** amounted to about 20 401 GWh in 2002, an increase of about 12% compared to 2000. This total value includes a share of electricity from “other biodegradables“ not promoted under the Biopower Act.

Renewable energy sources are of great importance in Austria primarily due to the use of hydropower. In 2002, 44 639 GWh of electricity were produced from renewable energy sources (hydropower, photovoltaics, wind energy, biomass (incl. biogas) and other sources (such as waste liquor combustion), which covered about 73% of domestic electricity consumption in Austria (excluding energy input into pumped-storage power plants).

Power supply from approved biopower facilities to the public grid amounted to 4 654 GWh in 2002. Small hydropower stations produced the highest share with

4 243 GWh, followed by wind energy, photovoltaics and geothermal energy (209 GWh) and “bio-facilities“ (202 GWh).

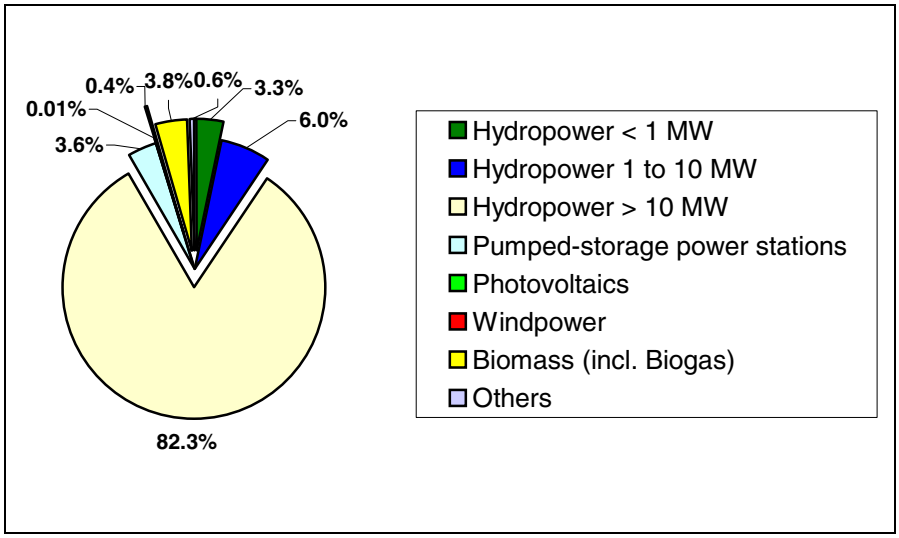

Fig. 3.4-3: Share of renewable energy sources (%) in electricity production in Austria in 2002 (STATISTIK AUSTRIA, 2003b).

3.4.3.3 Energy input into space heating and air-conditioning systems

In 2002, energy input for adjusting room temperature (heating and air-conditioning) in 3 284 000 homes was lower for the first time than the energy used for the mobility sector as a whole (STATISTIK AUSTRIA, 2003a). At about 295 027 TJ in 2001, the input of final energy into the mobility sector was about 1 100 TJ higher than the energy used for the space heating and air-conditioning sector. By comparison, the input of final energy into the space heating and air-conditioning sector amounted to 289 100 TJ in 1995, whereas the mobility sector required 146 400 TJ.

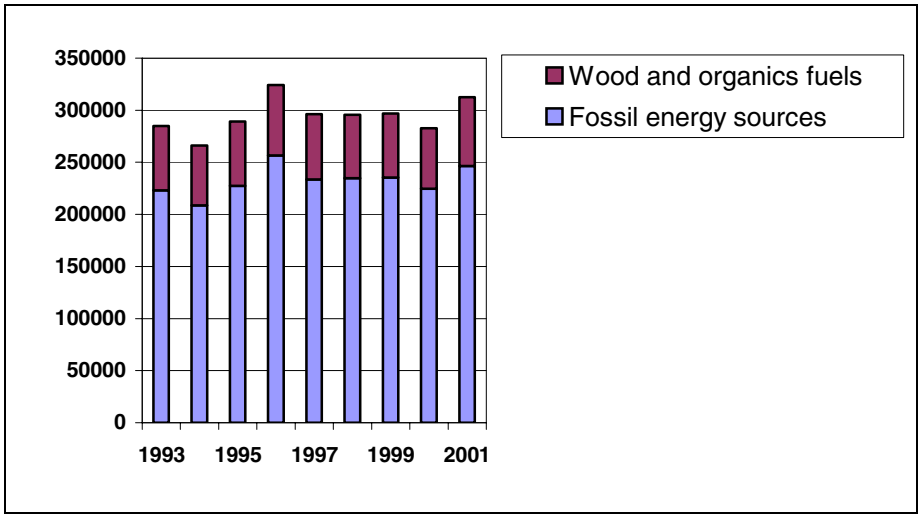

Fig. 3.4-4: Energy input from renewable and fossil energy sources for space heating and air-conditioning in TJ from 1993 to 2001 (Statistisches Jahrbuch Österreichs, 2003).

The final energy input for space heating and air-conditioning (temperature adjustment) amounted to about 312 400 TJ in 2001. Compared to 1995, this represents an increase of about 8%. Renewable energy sources, especially wood-fired heating systems, accounted for about 21% of the energy supply. The share of renewable energy sources in the space heating sector has not changed significantly since 1993.

Energy efficiency of buildings

Based on the comprehensive approach of EU Directive 2002/91/EC, Member States must set minimum requirements for the overall energy efficiency of buildings (for example, in the form of energy performance parameters). Distinction is to be made between new and existing buildings as well as between different categories of buildings (such as single-family houses, multi-family dwellings, offices, education buildings, hospitals, hotels and restaurants) (EVA, 2002). The minimum requirements must be reviewed at least every five years and, if necessary, adapted to the state-of-the-art technologies. Certain types of buildings (buildings under official protection, churches, temporary buildings, stand-alone buildings with a total useful floor area of less than 50 m²) can be exempted from these requirements. In the future, new buildings with a useful floor area over 1 000 m² will be assessed before construction starts in terms of the technical, ecological and economic feasibility of alternative energy supply systems such as renewable energy sources or combined heat and power generation (cogeneration).

Meanwhile the *Österreichisches Institut für Bautechnik* (OIB) [Austrian Institute for Building Technology] has published, in cooperation with experts from the Federal Provinces, a *Leitfaden für die Berechnung von Energiekennzahlen* [Guidance notes on the calculation of energy performance parameters] (OIB, 2003) including a model for an energy performance certificate. For this work, extensive standardisation (as aimed for within certain transition periods) of energy performance parameters already in use in the individual Federal Provinces was necessary. According to an *OIB* recommendation, the area-related demand for heat energy (in kWh of useful energy per m² and year) should be used as the common energy performance parameter in future.

In addition to the legal provisions, the introduction of an energy performance certificate is to create an extra incentive to provide high-value thermal insulation in buildings. In future, demand for heat energy will thus be a more significant criterion when purchasing or renting residential property. Information needs to be made available in a simple and understandable form, perhaps following the example of the “energy class declaration“ for electrical appliances (see Chapter 3.4.2.3). This should give prospective buyers or tenants an idea of the quality of the thermal insulation technology used in a building.

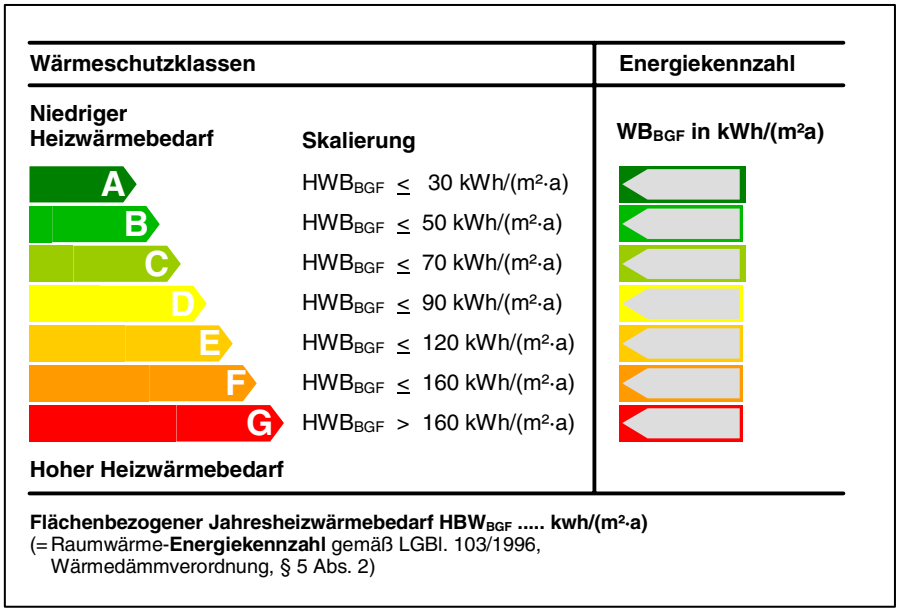

Fig. 3.4-5: Label of the energy performance certificate for residential buildings (OIB, 2003).

Translation of Fig. 3.4-5

Wärmeschutzklassen:	thermal insulation classes
Energiekennzahl:	energy performance parameter
Niedriger Heizwärmebedarf:	low demand for heat energy
Skalierung:	scale
WB:	HD (Heat demand) in kWh/(m²a)
HWB:	HED (Heat energy demand)
Hoher Heizwärmebedarf:	high demand for heat energy
Flächenbezogener Jahresheizwärmebedarf HWB:	area-related annual heat energy demand HED in kWh/(m²a)

(= Raumwärme-Energiekennzahl gemäß LGBl. 103/1995,
Wärmedämmverordnung, § 5 Abs.2):
(= space heating energy performance parameter according to Regional Legal Gazette 103/1995, Heat Insulation Ordinance, § 5 Section 2)

With the implementation of the EU Directive, some aspects of the above label will require adaptation.

3.4.3.4 Renewable energy in Austria

According to the EU White Paper (COM/97/0599 final) the share of renewable energy sources in the energy consumption within the EU should be at least 12% by 2010. The renewable energy sources mentioned in the White Paper include biomass (including biogas, solid biomass and others), wind energy, photovoltaic solar

power (PV), thermal solar power (solar heating), hydropower and geothermal energy.

The definition of biomass gained special importance through the Kyoto Protocol. The emission of CO_2 from the combustion of biomass is “climate neutral“, that is, balances to zero.

According to the IPPC, biomass is divided into solid, fluid and gaseous fuels. Solid fuels include wood and wood waste, charcoal and other solid biomass; fluid fuels include bio-alcohol and FAME (Fatty Acid Methyl Esther), waste liquor from pulp production (black liquor), and gaseous fuels include landfill gas and sewage gas (IPPC, 1996).

A listing of CO_2-neutral biomass was provided by the Decision of the EU Commission of 13 October 2003 in the Monitoring and Reporting Guidelines following Directive 2003/87/EC on greenhouse gas emission allowance trading.

Use of biomass

In Austria solid biomass is primarily utilised to provide heating. Large wood chip heating systems are operated for district heating supply as well as smaller boilers that can be fired with wood pellets. In 2001, 67 194 TJ fuel wood was used for the supply of heat (STATISTIK AUSTRIA, 2003b).

In future solid biomass will be increasingly used for the generation of electricity in combined heat and power generation facilities. The overall efficiency will clearly improve through the simultaneous generation of electricity and heat (BIOMASSEVERBAND, 2003).

At the end of May 2003, 21 liquid biomass facilities were in operation as approved biopower facilities in Austria, with a total nominal capacity of 6.6 MW (E-CONTROL, 2004).

Use of biogas in Austria

In 2003, biopower facilities totalled at 119 in Austria, with an installed electrical capacity of about 16.9 MW (E-CONTROL, 2004). The Institute of Agricultural, Environmental and Energy Engineering at the Vienna University of Natural Resources and Applied Life Sciences (ILUET, 2002) estimated the potential utilisation of biogas at about 40 million tonnes, which represents an energetic output of about 17 600 TJ of electricity and 24 000 TJ of heat. If this very optimistic estimate were to be realised, 10% of the electricity generated in Austria could come from biogas facilities. The rules governing tariffs for electricity supply to the grid of energy supply companies designed for electricity from biogas facilities might lead to the installation of facilities for both central and de-centralised supply in Austria.

Use of solar energy in Austria

Solar collectors

Conventionally, solar energy is used primarily through thermal solar collectors in Austria, which mostly supply hot water and partly space heating in private and pub-

lic buildings. In some cases, solar collectors are used in industrial operations for the heating of process water (EU WHITE PAPER, 1997).

In Austria about 1.8 million m² of thermal solar collectors were installed in 2002, covering about 1% of the demand for heat energy for hot water and space heating (AUSTROSOLAR, 2003).

Photovoltaics

The term photovoltaic effect is used to describe the voltage and the thus induced electric current arising from the absorption of light. This physical process can be achieved through the suitable doping (specific material composition) of semiconductor materials with gradients (energy gradients) in their energy bands, i.e., internal electric fields (BV, 2003).

At the end of May 2003, 2 177 photovoltaic facilities were approved as biopower plants, with a total nominal capacity of 24 MW. The Biopower Act sets a maximum limit for electricity production from photovoltaics at an installed capacity of currently 15 MW (until 2008) (E-CONTROL, 2004). At the end of 2002, the photovoltaic facilities installed in Austria had a total capacity of about 10 777 kW (peak), of which 81.6% was accounted for by facilities connected to the public grid, and 18.4% by independently operated plants ("isolated" operations including small facilities) (FANINGER, 2003). Due to the limits imposed on electricity production from photovoltaics, approved biopower plants are unlikely to be implemented (E-CONTROL, 2004).

Use of wind energy in Austria

At the end of May 2003, 93 wind power plants were in operation as approved biopower plants, with a total nominal capacity of 204.6 MW (E-CONTROL, 2004).

Given the intermittency of electricity production due to strong wind fluctuations, wind power will not lead to the replacement of basic load power plants. However, utilisation of wind power can help reduce some imports of electricity.

Based on the current structure of tariffs for electricity supply, there may be an increase in wind power plants in the next few years (IGW, 2003).

Use of small hydropower plants

Besides the hydroelectric power plants of the big energy supply companies, there is a large number of small and mini-hydropower plants in Austria with a smaller nominal capacity. In the Biopower Act small hydropower plants are defined as having a maximum capacity of 10 MW. Even though the definition of a small hydropower plant is fixed by the Biopower Act with a capacity limit of 10 MW, the maximum capacity reached by around 70% of the small hydropower plants recorded statistically is only 250 kW. A typical Austrian small hydropower plant has a capacity of 100 to 300 kW (ÖVFK, 2003).

In 2002, the total of electrical energy produced by hydropower in Austria amounted to about 42 004 GWh, of which about 10.1% came from small hydropower plants approved under the Biopower Act (E-CONTROL, 2004).

Use of geothermal energy

Only in the thermal spa regions of Styria, the Upper and Lower Austrian Molasse Basin and in the Vienna Basin is it possible to bring hot water to the daylight by deep drillings to depths of more than 1 000 metres.

The installation of between 20 to 40 plants is thought feasible. Six geothermal plants have been built to date, the best-known of which is the 10 MW plant at Altheim, Upper Austria. The newly-developed ORC Turbine (Organic Rankine Cycle) is the core element of the plant with an electrical power of 900 kW even at temperatures of about 100° C (AUSTROSOLAR, 2003).

Under the current economic and geological framework conditions, the potential for geothermal energy in Austria amounts to 2 000 MW of thermal energy, and to about seven MW of electricity (AUSTROSOLAR, 2003).

3.4.4 SUMMARY ASSESSMENT AND OUTLOOK

In 2002, the input of final energy in Austria rose by about 5% in comparison to 1998. During this period, the largest increases in final energy inputs were recorded in the mobility sector with a 9.4% increase, and in the private households sector with an 8.3% increase. The goods production sector saw a slight decrease of about 1.3% between 1998 and 2002. The “goods production“, “mobility“ and “private households“ sectors combined require about 87% of the total final energy input in Austria.

The final energy input for space heating and hot water in 2001 was 5.7% above the input in 1998. Energy supply from renewable energy sources rose by about 13.8% in 2002 compared to 1998.

Domestic electricity consumption (excluding consumption for pumped-storage systems) in 2002 was about 10.5% above consumption in 1998. Physical imports in 2002 rose by about 32% compared to 1999. During the same period, physical exports rose by about 8.6%.

§ 32 of the Electricity Supply and Organisation Act of 2000 (ELWOG) stipulates that the share of electrical energy from biopower plants must be at least 1% by 1 October 2001. The Act obliges grid operators and electricity suppliers to account for the share of renewable energy in the power mix.

As of 30 September 2002, the target of a 1% share was only just missed. The biopower share between 1 October 2001 and 30 September 2002 was 0.86% (E-CONTROL, 2003).

The complete liberalisation of the natural gas and electricity markets in October 2002 did not lead to any remarkable changes as regards small-scale consumers and their choice of suppliers.

The framework conditions for increasing energy efficiency and reducing energy consumption have been provided by the following EU Directives (some of them in preparation): Cogeneration Directive, the Directive on Emission Allowance Trading,

the IPPC Directive, the Energy Taxation Directive, and the Directive on the Energy Performance of Buildings.

3.4.5 RECOMMENDATIONS

The greatest ecological potential in the energy sector lies in the efficient use of energy sources and of the energy supplied, or produced as a “by-product“ (especially heat). Through their buying patterns, ways of living and mobility behaviour, consumers can make a significant contribution here, as can energy supply companies and municipalities, through optimum energy use and by reducing losses in transmission and at home.

To merely **check the increase in input of energy** in Austria, a package of measures is necessary:

- quick and consistent implementation of EU Directives aimed at the efficient use of energy, particularly in areas such as “private households“, “mobility“ and “goods production“
- inclusion of ecological criteria in energy pricing
- efficient waste heat recovery at power plants, waste incinerators and industrial facilities
- planning and implementation of transport concepts and increased incentives for changing over to public transport
- realisation of the potential for thermal rehabilitation in existing buildings by means of high-quality heat insulation
- raising awareness through image campaigns about energy saving measures in private households (key terms: space heating, lighting, electrical appliances, consumer behaviour)
- planning and promotion of energy concepts for municipalities
- planning and promotion of energy concepts for industry and commerce by taking into consideration low energy use
- taking into consideration renewable energy sources when planning local and district heating systems, as well as in private households and industrial facilities.