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FEDERAL MINISTRY OF

ECONOMICS AND LABOUR

AUSTRIA

Report

Based on Article 3(3)

Article 5(5) and

Article 3(2)

Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources

With ENGLISH SUMMARY

Produced by Energie-Control GmbH, Rudolfsplatz 13a, 1010 Vienna and revised by the Federal Ministry of Economics and Labour

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1 Introduction

In its letter of 2.8.2007 (E-Control PE: 9329) the Federal Ministry of Economics and Labour requested that Energie-Control GmbH issue a draft report in accordance with the requirements of Article 3(2) and (3) and Article 5(5) of Directive 2001/77/EC of the European Parliament and the Council of 27 September 2001 on the promotion of electricity produced from renewable energy sources (Directive 2001/77/EC). This took place in respect of Section 24 of the Green Electricity Act, BGBI I No. 149/2002, as currently in force, according to which Energie-Control GmbH is required to monitor continuously the attainment of the targets defined in the Green Electricity Act. The report was drafted by Ms. Heilig and Mr DI Schönbacher and forms the basis, in slightly revised form, of this report.

This report on the attainment of targets is based on the requirements of Article 3(3) and Article 5 (5) Directive 2001/77/EC. It also refers to the content of Article 3(2) Directive 2001/77/EC.

Article 3(3) Directive 2001/77/EC provides as follows:

> *The Member States shall initially publish no later than on 27 October 2003 and subsequently every two years a report, analysing the extent to which the national indicative targets have been attained in particular consideration of climatic factors, which may hinder the fulfilment of these targets, and which indicates the extent, to which the relevant measures comply with the national climate change commitments.*

In conjunction with the traceability system, Article 5(5) Directive 2001/77/EC provides as follows:

> *The Member States or competent bodies create appropriate mechanisms in order to guarantee the accuracy and reliability of guarantees of origin, and describe in the report, in accordance with Article 3(3), the measures taken to guarantee the reliability of the traceability system.*

Article 3(2) Directive 2001/77/EC provides as follows:

> *Not later than 27 October 2002 and every five years thereafter, Member States shall adopt and publish a report setting national indicative targets for future consumption of electricity produced from renewable energy sources in terms of a percentage of total electricity consumption over the next ten years. The report shall also outline the measures taken or planned, at national level, to achieve these national indicative targets. In order to set these targets to be achieved by 2010, the Member States shall:*
>
> - *take account of the reference values in the Annex;*
> - *ensure that the targets are compatible with any national commitments accepted in the context of the climate change commitments accepted by the Community pursuant to the Kyoto Protocol to the United Nations Framework Convention on Climate Change.*

In order to evaluate the above-mentioned areas, the analyses are preceded by a detailed description of the existing legal conditions and current developments. Detailed reports and assessments of the development of renewable energy in Austria can also be found in the 2007 Renewable Energy Report, which is published – both in German and English language – on the website of Energie-Control GmbH at www.e-control.at.

2 Overview

With over 64%, Austria has the largest share in Europe in terms of renewable energies in electricity consumption. The EU average is less than 14%, while Sweden has the second highest share with almost 56%.

Austria = **64.21** / 78.1, Sweden = **55.82** / 60, Latvia = **49.9**/ 49.3, Finland = **27.42** / 31.5, Denmark = **27.39** / 29, Slovenia = **24.52** / 33.6, Slovakia = **18.25** / 31, Spain = **16.05** / 29.4, Portugal = **15.90** / 39, Italy = **13.93** / 25, France = **11.61** / 21, Germany = **10.37** / 12.5, Greece = **10.26** / 20.1, Ireland = **7.19** / 13.2, Netherlands = **6.35** / 9, Czech Republic = **4.96** / 8, United Kingdom = **4.32** / 10, Lithuania = **3.61** / 7, Luxembourg = **3.36** / 5.7, Poland = **2.90** / 7.5, Hungary = **2.52** / 3.6, Belgium = **2.36** / 6, Estonia = **1.76** / 5.1, Malta = - / 5, Cyprus = - / 6, European Union = **13.97** / 21.

Bold type: **2005**
Other figures: 2010 objectives

[Source: European Commission, http://ec.europa.eu/energy/res/index_en.htm / 18.6.2007]

Figure 1: Share of renewable energies in gross electrical consumption in European Union Countries and Austria

In 2006, electricity consumption in Austria was approximately 70 244 GWh, of which 40 287 GWh were produced from renewable energy sources, with the majority produced from hydropower. 1 806 GWh of this hydropower originated from supported small hydropower. Yet other renewable energy sources also make a major contribution to electricity supply: 3 895 GWh of other supported green electricity (e.g. wind, biomass, biogas) were fed into the grid and 1 450 GWh non-supported renewable non-supported electricity produced from renewable sources (e.g. waste lye).

Due to the high feed-in tariffs defined in the Green Electricity Act, a major growth in additional green electricity has taken place in Austria over the last few years.

In the first half of 2007, 1 345 MW other supported renewable generating stations and 398 MW small hydropower[1] were under contract to the "Green Electricity Settlement Centre". Wind power (955 MW), biomass (270 MW) and biogas (64 MW) account for the largest shares of the above.

In the first half of 2007, these generating stations produced and fed in a total of 2 104 GWh of other green electricity and 661 GWh of electricity from small hydropower. In relation to the total output volume from public grids this represents 10% (7.6% of other green electricity and 2.4% of small hydropower).

Table 1 shows a comparison of these values with those from the first half of 2006: The amounts fed in by other green electricity generating stations increased during this period by almost 50% from 1 419 GWh to 2 104 GWh. It was possible to increase the share of the total output volume from 5.2% to 7.6%. The amounts of supported electricity from small hydropower decreased, as many facilities left the support scheme in order to sell their electricity on the liberalised market.

Amounts of renewable power fed in and attracting compensation in the first half of 2007 as compared with the first half of 2006

Energy source	Amount injected in GWh H1 2007	Net compen-sation in € H1 2007	Green electricity injection as % of total supply[1]	Support payments net of market value in € m HY1 2007[3]	Ave. compen-sation in cent/kWh HY1 2007	Amount injected in GWh H1 2006	Net compen-sation in € H1 2006	Green electricity injection as % of total supply[2]	Support payments net of market value in € m H1 2006	Ave. compensation in cent/kWh H1 2006
Small hydro (supported)	661	36.9	2.4%	5.32	5.58	1,081	57.2	4.0%	-2.6	5.52
"Other" green electricity	2,104	224.1	7.6%	123.72	10.65	1,419	144.0	5.2%	65.5	10.08
Wind	1,018	79.0	3.7%	30.39	7.76	811	63.1	3.0%	18.2	7.83
Solid biomass inc. HBF waste	804	104.6	2.9%	66.17	13.00	382	48.1	1.4%	27.0	12.59
Biogas	209	28.9	0.8%	18.90	13.80	173	23.8	0.6%	14.2	13.74
Liquid biomass	38	5.2	0.1%	3.40	13.78	19	2.6	0.1%	1.6	13.93
PV	7	4.5	0.0%	4.19	64.44	7	4.3	0.0%	3.9	63.96
Landfill and sewage gas	26	1.8	0.1%	0.61	7.13	25	1.9	0.1%	0.5	7.83
Geothermal	1	0.1	0.0%	0.06	9.45	2	0.1	0.0%	0.0	9.60
Total small hydro and "other" green electricity	2,764	261.0	10.0%	129.04	9.44	2,500	201.2	9.2%	62.8	8.60

[1] Relative to total supply to end users from the public grid (55 468 GWh (est.) in 2007) [2] Relative to total supply to end users from the public grid (54 221 GWh in 2006) [3] Market price in HY1 2007 was €47.73/MWh [4] Market price in HY 1 2006 was €55.37/MWh

[Source | OeMAG, August 2007 – preliminary figures]

[1] A major proportion of small hydropower generating stations have left the support scheme. The total installed capacity of small hydropower in Austria is 1 161 MW.

Table 1: Amounts of renewable energy fed in and attracting compensation in the first half of 2007, as compared with the first half of 2006

The following table shows the development of electricity generation from renewable energy sources in Austria in 1997 and 2006 in comparison with gross national electricity consumption. The development is complemented by a projection for 2010 based on the Green Electricity (Amendment) Act. This development is compared to the average development in the European Union.
In the Evaluation Report of the European Commission of May 2004 (Com (2004) 366 FINAL) it is predicted that the EU-15 will not meet the indicative target of 22% in 2010 (according to EU Directive 2001/77/EC) with the forward projection of the current developments and only 18%-19% is anticipated. This means that the increase in the base value of 13.9% in 1997 will only be half as great EU-wide as predicted as an indicative target.

Attainment of targets under Directive 2001/77/EC	1997**	2006 Actual	Additional capacity expected to come on line in 2006-2007[1]	Additional capacity expected to come on line in 2008-2010[2]	Additional capacity expected to come on line in 2006-2010[3]	Total output in 2010	Growth 1997-2010
	GWh	GWh	GWh	GWh	GWh	GWh	GWh
Gross domestic electricity consumption (inc. pumped storage) ****	56,083	70,244				74,725	18,642
Large hydro (> 10 MW) excl. pumped storage***	31,400	31,102			1,202	33,600[4]	2,200
Small hydro (< 10 MW) inc. 5% own use	4,152	3,840	720	100		4,842[4]	690
Whereof supported small hydro		1,806					
Medium-sized hydro (investment grants under Green Electricity Act [Amendment])				375	-	375	375
"Other" supported green electricity (wind, biogas, etc.) inc. 5% own use	605	3,895	1,325	643	-	5,863	5,258
"Other" non-supported green electricity (lye, etc., incomplete statistical capture)*****	845	1,450			150	1,600	755
Total renewable generation	37,002	40,287	2,045	1,118	1,352	46,280	9,278
Pro rata Austrian contribution to EU-25 target scenario (from 12.9% in 1997 to 21% in 2010)	7,235					15,692	8,458
Pro rata Austrian contribution to forecast EU-15 scenario (from 14% in 1997 to 19% in 2010)	7,852					14,198	6,346
RES contribution 56,100 GWh ***	66%	72%	4%	2%	2%	82%	
RES contribution to gross domestic electricity consumption	66%	57%				62%	

1 On basis of Green Electricity Act, BGBl I No. 149/2002
2 On basis of Green Electricity Act, BGBl I No. 105/2006
3 Increase of 780 GWh (2.4%) in large hydro capacity expected to result from plant upgrading; 150 GWh (10.3%) gain in "other", non-supported green electricity expected to arise from industrial capacity expansion, e.g. lye utilisation in the paper industry

4 Energy capability factor for run-of-river generating stations was 0.96 in 2006. 2010 assumed to be an average year so production of hydro is increasing not only because of additional capacity.
* Own use by "other" renewable generating stations and small hydro stations estimated
** Data for small hydro and biomass drawn from 1998 operating statistics

*** 70% base level in 1997 in EU directive apparently arrived at by inadvertent inclusion of pumped storage; energy capability factor for run-of-river generating stations was 0.98 in 1997 and 0.96 in 2006; generation by pumped storage stations (less pumping power) can vary between approximately 9.5 TWh/year and approximately 10.8 TWh/year; increase between 1997-2004 was principally due to Freudenau (plus 960 GWh) and Lambach (plus 64 GWh) generating stations and increased output from pumped storage stations (plus 700 GWh). 2010 assumed to be an average year. Efficiency of 70% assumed for pumped storage.
**** Estimated annual electricity demand growth in 2004-2010 period 1.6% (on basis of WIFO high efficiency scenario of June 2005, p.75)
*****Figures for "other non-supported green electricity can vary from 1,200-1,500 GWh depending on the primary energy sources used

[October 2007 | Source: Energie-Control GmbH]

Table 2: Attainment of the indicative target established by Directive 2001/77/EC

Due to this development, in 2010 Austria will produce 9.278 GWh more electrical energy from renewable energy sources than in 1997. This increase is significantly higher than the European Union average. For the EU-15, according to the Evaluation Report of the DG TREN an increase of 14% to 18-19% is expected between 1997-2010; a pro-rata allocation to the various shares in Austria would mean an increase in electricity generation from renewable energy sources of approximately 6 300 GWh, in other words significantly less than the anticipated 9,278 GWh. Even when the average target of an increase from 12.9% to 21% were applied to Austria, the forecast increase of 9 278 GWh would still exceed the increase of 8 458 GWh required for attainment of the initial target.

The following chart shows the annual volume of support for the funding of other green electricity until 2022 divided according to the 2002 Green Electricity Act and the 2006 Green Electricity (Amendment) Act.

Volume of support according to the Green Electricity (Amendment) Act of 2006 (+17 million/year)
...% Share of RES-E (%)
Volume of support based on the Feed-In-Tariff Order December 2002
Total charge based on the Feed-In-Tariff Order 2002

RES-E generating stations accredited until end 2004

[Source | Energie-Control]

Figure 2: Volume of support for other green electricity until 2022

The implementation of the Austrian Green Electricity Act of 2002 results in a total budget need of 3 billion Euro. The Green Electricity (Amendment) Act of 2006 added another billion Euro to this amount. Overall, this means a financial need of 4 billion Euro for green electricity. With a population of approximately 8 million in Austria, this means 500 Euro per capita.

With 1 018 GWh, wind power accounts for the majority of supported green electricity. This is a large amount for a landlocked country of this size: Table 3 is an itemised list of the EU-25 countries according to installed wind power output per inhabitant.

With an accredited wind capacity of 1 033 MW (118 MW per inhabitant), Austria comes sixth - the highest position for a landlocked country. All the countries ranked higher than Austria (Denmark, Spain, Germany, etc.) have large wind-rich coastal regions with considerable potential for offshore wind power.

Country	**MW wind power per capita**	**Watts per capita**	**Capacity at end of 2005 in MW**	**Capacity at end of 2006 in MW**	**Increase since 2005**
Denmark	1,726	579	3,136	3,128	8
Spain	3,468	**288**	11,615	10,028	1,587
Germany	3,997	250	20,622	18,415	2,207
Ireland	5,328	188	745	496	250
Portugal	6,133	163	1,716	1,022	694
Austria	**8.471 (7.914)**	**118 (126)**	**965 (1,033 approved)**	**819**	**146**
Netherlands	10,460	96	1,560	1,219	341
Luxembourg	13,220	76	35	35	0
Greece	14,273	70	746	573	173
Sweden	15,679	64	572	510	63
Italy	27,347	37	2,123	1,718	405
UK	30,703	33	1,963	1,332	631
France	38,560	26	1,567	757	810
Estonia	41,928	24	32	32	0
Belgium	53,618	19	193	167	26
Finland	60,635	16	86	82	4
Lithuania	65,007	15	56	4	49
Latvia	85,422	12	27	27	0
Hungary	164,466	6	61	18	44
Czech Republic	204,924	5	50	28	22
Poland	253,288	4	153	83	70
Slovakia	1,084,720	1	5	5	0
Malta	-	0	0	0	0
Slovenia	-	0	0	0	0
Cyprus	-	0	0	0	0

[05-02-2007 | Sources: Wind data EWEA, data as of February 2007; population data www.welt-in-zahlen.de, February 2006; Austrian approvals as of end of 2006]

Table 3: Installed wind capacity per capita in the EU-25

Despite the very rapid expansion of green electricity in Austria, it has been very difficult to increase its share in total electricity consumption. Firstly, Austria had a very high base value in 1997 in terms of its share of green electricity (with 70% by far the highest value in the EU – no other EU country has a share of over 50%) and secondly, a major increase in electricity consumption counteracted any further increase. This was also discussed in detail at a meeting attended by representatives of the European Commission (Director Finat and Ms Yordi), representatives of the Federal Ministry of Economics and Labour and a representative from Energie-Control GmbH on 2 July 2007. Due to this situation, the above-average development of green electricity in Austria scarcely results in any further increase in the renewables share of total energy consumption even with average increases in electricity consumption.

In 1997, with 70% of its electricity produced from renewable sources, Austria had by far the largest share in the EU-25. Alongside Austria, no other country had a share of over 50%.

A further increase in the proportion of electricity produced from renewable sources is considerably more cost-intensive, if the base value is already higher than with a low base value, as a much greater proportion of the available potentials is already being exploited.

In a similar vein, in 2006 a study was published by the Fraunhofer Institut et al, in which it was also shown that the potential is already exhausted to the greatest extent in Austria compared to the other EU countries. While in Austria approximately 80% of potentials are already being exploited, most other countries have not yet even converted 50%. In countries where the potential is exploited to a lesser extent further development can be achieved more easily (and more cost-effectively).

RES-E - Electricity generation potential (TWh/yr.)

(graph)

Additional potential 2020
Additional potential 2004

(graph)
Biogas
(Solid) Biomass
Geothermal electricity
Hydro small-scale
PV
Solar thermal electricity
Tide and Wave
Wind onshore
Wind offshore

[August 2006 | Sources: Fraunhofer Institut, Ecofys and EEG]

Figure 3: Achieved (2004) and additional potential (2020) of RES-E generation in the EU-15 (left) and according to energy sources (right)

It is considered that potentials for further development of green electricity in Austria exist in hydro and wind power, in each of which a potential further increase of 700 MW is anticipated. This would represent additional electricity volumes of 5 TWh (Table 4).

Biomass and biogas can make a maximum additional contribution of 1 -2 TWh.

	Assumptions	*Electricity output in TWh*
Hydro	700 MW	3.5
Wind	700 MW (approximately 300 – 350 wind turbines)	1.3 – 1.6
Solid biomass	1 m cu m only for electricity generation of approximately 3 m cu m	0.5
Energy crops on arable land and cultivated pasture	0.1 – 0.5m ha	0.4 – 1.8

Compared to: Gross national electricity consumption 2006 70.2 TWh

Table 4: Parameters for additional utilisation of renewable energy sources until 2015

The second largest obstacle for an increase in the green electricity share in Austria is, as already mentioned, the annual growth in electricity consumption (Fig. 4). Since 1990, the consumption of electrical energy increased by 2.2% per year, mainly due to economic and population growth.
Even if efficiency measures are implemented, the growth in electricity consumption is dampened but still increases nevertheless.
Model calculations from Energie-Control GmbH assume a further annual growth in electricity consumption of 1.7% with the implementation of energy efficiency measures. This forecast is broadly in line with those of the Austrian Economic Research Institute and UCTE.

(graph)

GWh
Final energy consumption

E-Control forecast (ECG)

Source: E-Control, WIFO, UCTE, DG TREN

Figure 4: Energy consumption in Austria 1990-2016 / 2007-2016: various projections

Despite these difficult circumstances, the development of renewable energy is above average in comparison with other EU countries.

The traceability system in Austria

Austria was one of the first countries to introduce a highly comprehensive traceability system. Back in 2002, Austria introduced the legal basis for guarantees of origin and power labelling as part of its national legislation and also has a fully functioning traceability system. Guarantees of origin are issued for the majority of green electricity according to a standard uniform database system based on grid operator reports, which are subsequently used for power labelling.

Since 1 July 2006, the environmental effects of electricity generation (CO2 emissions and radioactive waste) must also be indicated on electricity bills.

4 General Framework Conditions

4.1 Electricity generation in Austria

Electricity generation in Austria is characterised by the high share of renewable energy sources, particularly hydropower. In comparison to other EU countries, Austria uses by far the highest proportion of renewable sources for electricity generation.

(graph)

Austria = **64.21** / 78.1, Sweden = **55.82** / 60, Latvia = **49.9**/ 49.3, Finland = **27.42** / 31.5, Denmark = **27.39** / 29, Slovenia = **24.52** / 33.6, Slovakia = **18.25** / 31, Spain = **16.05** / 29.4, Portugal = **15.90** / 39, Italy = **13.93** / 25, France = **11.61** / 21, Germany = **10.37** / 12.5, Greece = **10.26** / 20.1, Ireland = **7.19** / 13.2, Netherlands = **6.35** / 9, Czech Republic = **4.96** / 8, United Kingdom = **4.32** / 10, Lithuania = **3.61** / 7, Luxembourg = **3.36** / 5.7, Poland = **2.90** / 7.5, Hungary = **2.52** / 3.6, Belgium = **2.36** / 6, Estonia = **1.76** / 5.1, Malta = - / 5, Cyprus = - / 6, European Union = **13.97** / 21.

Bold type: **2005**
Other figures: 2010 objectives

[Source: European Commission, http://ec.europa.eu/energy/res/index_en.htm / 18.6.2007]

Figure 9: Share of renewable energies in gross domestic consumption in Austria and the EU-25

The high proportion of hydropower implies that the electricity generation mix is highly reliant upon climatic conditions, which can be seen in Figure 10.

(graph)

Other
Renewables
Thermal power
Hydropower

[25.09.2007 | Source: Energie-Control GmbH]

Figure 10: Proportion of primary energy sources in total energy production 1970-2006 in Austria

Figure 10 shows the proportions of the total power mix, which must be distinguished from proportions of gross domestic electricity consumption. However, it can be seen that the extremely dry year of 2003, for example, immediately led to a fall in the hydropower share.

Together with climatic conditions, in future the hydropower share will also be influenced significantly by the implementation of the Water Framework Directive (2000/60/EC). According to the intensity of future requirements for the decommissioning of hydro generating stations and residual water flow, the associated fall in green electricity generation may amount to approximately 5%-15% of hydropower production and would consequently be greater than the effects of support for green electricity provided by the Green Electricity Act from 2002.
Figure 11 shows schematically an electricity demand scenario together with the electricity generation structures from 2002 – 2015.

(graph)

2% p.a. increase in requirement
10% supported “other” green electricity
Reduction through EU Water Framework Directive (2-7%)

Hydropower
Output to end consumer
Reduction in production due to Water Framework Directive
Fossil
Hydropower Water Framework Directive
10% other green electricity
Increase in consumption

Figure 11: Influence of increased consumption and the Water Framework Directive on the green electricity share – forecast until 2015

It can be seen that the implementation of the Water Framework Directive, associated reductions in hydropower generation and the extent of the increased demand for electricity may assume greater significance than the expansion of electricity generation from hydropower, biomass and biogas (“other” green electricity). It will therefore be decisive for the production of electricity from renewable energy sources in Austria, whether the interests of electricity generation will be sufficiently taken into account together with the environmental interests when the Water Framework Directive is implemented in Austria. Based on the Austrian legal situation, the water regulation authorities based in the federal states decisively assume joint responsibility for the balanced implementation of this legislation, taking into account the requirements of hydropower.

In addition, the major impact of increased demand for electricity can be seen. According to all the available forecasts from economic research institutes, demand for electricity will increase significantly with growing gross domestic production and also due to rapid efficiency programmes. Increased demand for electricity is anticipated particularly in the domains of household and services. As hydropower in Austria cannot be further expanded to the same extent, partly due to the requirements of the EU Water Framework Directive, as the anticipated electricity demand increases and exploitable potentials for electricity generation are sensibly very limited, this may lead to a falling share of electricity generation from renewable energy sources.

This is the case, although Austria is not only remarkable for its contribution to green electricity generation compared to the European Union average but its development of wind power and biomass utilisation is also way above average.

4.2 Climatic conditions and resource availability

Climatic conditions have a significant direct influence on two technologies, which make an important contribution to the electricity supply in Austria: hydropower and wind power. Photovoltaic power is also directly affected, but as this field does not contribute significantly to the power supply in Austria, this point is not examined in any greater detail.

4.2.1 Hydropower

Electricity generation using hydropower facilities is highly dependent on climatic conditions. Events such as lack of snow, drought or floods lead to marked reductions in electricity generation using hydropower. Figure 12 shows clearly the extent to which production volumes from different years can vary between individual months. In 2006, a total of 34.9 TWh were produced by hydropower generating stations (after pumping electricity has been deducted).[2] The production coefficient was approximately 0.96. 36.4 TWh would be generated in a normal year.

[2] Estimated value of approximately 1 800 GWh

(graph)
Max 1986 to 2005
Min 1986 to 2005
[October 2007 | Source: Energie-Control GmbH]

Figure 12: Monthly production coefficient for run-of-river generating stations 2005 – September 2007

Over the last few years, a number of run-of-river generating stations have been modernised, so that their output has been increased.
Further expansion is possible but hindered both by the entry in force of the Water Framework Directive and the reluctance of the population to accept such developments. Energie-Control GmbH assumes that further expansion (in the form of the extension of existing and construction of new generating stations) of 700 MW is still possible. An expansion of this nature would provide an additional 3.5 TWh of electricity.

4.2.2 Wind power

In Austria, average wind speeds are lower than in the wind-rich coastal regions of other European countries. Electricity generation using wind power therefore leads to higher costs than in other countries. Despite this, Austria is the only landlocked country in Europe where wind power has been developed to a major extent.

(map)

Wind Resources at 50 (45) m Above Ground Level

Colour	Sheltered terrain		Open plain		At a sea coast		Open sea		Hills and ridges	
	m/s	W/m3	m/s	W/m3	m/s	W/m3	m/s	W/m3	m/s	W/m3
	>6.0	>250	>7.5	>500	>8.5	>700	>9.0	>800	>11.5	>1800
	5.0-6.0	150-250	6.5-7.5	300-500	7.0-8.5	400-700	8.0-9.0	600-800	10.0-11.5	1200-1800
	4.5-5.0	100-150	5.5-6.5	200-300	6.0-7.0	250-400	7.0-8.0	400-600	8.5-10.0	700-1200
	3.5-4.5	50-100	4.5-5.5	100-200	5.0-6.0	150-250	5.5-7.0	200-400	7.0-8.5	400-700
	<3.5	<50	<4.5	<100	<5.0	<150	<5.5	<200	<7.0	<400
			>7.5							
			5.5-7.5							
			<5.5							

[Source: http://www.windpower.org/en/tour/wres/euromap.htm, 25.05.2005]

Figure 13: Wind resources in Europe, average wind speeds at 50 (45) m above ground level

Despite the unfavourable wind conditions of a landlocked country, electricity generation using wind power increased significantly following the entry into force of the Green Electricity Act in 2003. According to situation in June 2007, in Austria 965 MW wind power are in operation and 1 033 MW are approved. In Austria, these generating stations produced over ,018 MWh of electricity in the first half of 2007. This represents approximately 3.7% of the power supply to the end user in Austria from public grids. Based on these figures, Austria ranks sixth in terms of the extent of wind power expansion per inhabitant. Apart from Austria, no other landlocked country without wind-rich coastal regions is included in the 18 European countries with the highest rate of wind power expansion.

Country	MW wind power per capita	Watts per capita	Capacity at end of 2005 in MW	Capacity at end of 2006 in MW	Increase since 2005
Denmark	1,726	579	3,136	3,128	8
Spain	3,468	**288**	11,615	10,028	1,587
Germany	3,997	250	20,622	18,415	2,207
Ireland	5,328	188	745	496	250
Portugal	6,133	163	1,716	1,022	694
Austria	**8.471 (7.914)**	**118 (126)**	**965 (1,033 approved)**	**819**	**146**
Netherlands	10,460	96	1,560	1,219	341
Luxembourg	13,220	76	35	35	0
Greece	14,273	70	746	573	173
Sweden	15,679	64	572	510	63
Italy	27,347	37	2,123	1,718	405
UK	30,703	33	1,963	1,332	631
France	38,560	26	1,567	757	810
Estonia	41,928	24	32	32	0
Belgium	53,618	19	193	167	26
Finland	60,635	16	86	82	4
Lithuania	65,007	15	56	4	49
Latvia	85,422	12	27	27	0
Hungary	164,466	6	61	18	44
Czech Republic	204,924	5	50	28	22
Poland	253,288	4	153	83	70
Slovakia	1,084,720	1	5	5	0
Malta	-	0	0	0	0
Slovenia	-	0	0	0	0
Cyprus	-	0	0	0	0

[05-02-2007 | Sources: Wind data EWEA, data as of February 2007; population data www.welt-in-zahlen.de, February 2006; approvals in Austria as of end of 2006]

Table 9: European comparison of population per MW of installed wind power capacity (EU-25)

Even if the majority of sites available for wind power have already been exploited, there is still a potential of 700 MW, which could produce 1.3 – 1.6 TWh of electricity, if all the available locations were put to optimum use.

4.2.3 Biomass

At the end of June, approximately 350 MW of electrical output were under contract to the Green Electricity Settlement Centre. Only small quantities of raw materials are available for additional quantities. Assuming that another 1 m cu m of wood is used to produce electricity, an additional 0.5 TWh would be produced from biomass (with an average of 2 MWh per solid cubic metre of energy content and an electricity generation efficiency of 25%).

The use of wood for producing electricity, however, is in competition with the use of wood as a material, e.g. in the panel and paper industry, which is also increasing every year. The energetic use of biomass to generate heat should be promoted in comparison with the energetically less efficient conversion into electricity. Approximately twice as much fossil energy is replaced when heat is produced from biomass compared to when electricity is produced from biomass, which means that double the amount of CO2 emissions from fossil energy sources is prevented when heat is generated from biomass compared to electricity generation from biomass.

By cultivating energy crops on up to 20% of agricultural land and cultivated pasture, it would be possible in theory to produce more than 1 TWh if such generating stations were used exclusively for electricity generation, though demand for agricultural products and energy crops has recently increased greatly. The resulting price push compromises economic viability to such a major extent that even with subsidy quotas of 60%, electricity generation from agricultural products is not viable. With the current price level, the costs of raw materials that can be used as feed alone are twice as high as the return from the electricity produced at non-subsidised market prices.

In partnership with experts from the University of Natural Resources and Applied Life Sciences, the Research and Training Centre for Forests, Natural Hazards and Landscape has produced an report on the assessment of the potential of solid biomass, which includes the following key data: The average annual use of wood from Austrian forests between 2000-2005 was around 16.7 million harvest solid cubic metres. But as the wood supply increases annually, wood consumption of 19.3 m cubic metres of timber harvested is assumed for 2020. In addition, another approximately 1.6 m cubic metres of timber harvested of branches, off cuts and treetops can be used. In 2006 19.1 m cubic metres of timber harvested were already used. This produces an additional usable biomass volume of 1.8 m cubic metres of timber harvested for 2006 (19.3 – 19.1 + 1.6 = 1.8). This represents an energy content of approximately 3.6 TWh fuel heat output.

Million cubic metres of timber harvested

1.9 m cubic metres of timber harvested from treetops, branches, etc.

19.3 m cubic metres of timber harvested of wood consumed

Figure 14: Wood consumption 2000-2005, 2006 and projected wood consumption for 2020

A further study produced by Brainbows in partnership with Raiffeisen considers that there is an additional potential of 0.5 – 1.7 m cubic metres of wood fuel from the forest sector until 2010 depending on the scenario (equivalent to 1 – 3.4 fuel heat output, at 2 MWh per cubic metre of wood).

Approximately 3 million cubic metres will be required per year to produce electricity from solid biomass at the generating stations approved until the end of 2004. This is the case even if one assumes relatively high average net efficiency levels for biomass (25%) and assumes that the additional demand for wood at some green electricity generating stations is lower for electricity generation due to the simultaneous use of heat.

1,680.000 MWh_{el} / 2 MWh_{th}/fm / 0.25 MWh_{el}/MWh_{th} (average elect. efficiency = 3.36 m cubic metres[3]

The provision of these large biomass volumes for electricity generation is currently not fully explained. It is expected that it will only be possible to provide additional biomass raw materials to a very limited extent.

The following chart shows the evolution of wood fuel and maize prices, the most significant raw materials for solid and gaseous biomass:

[3] Projected biomass electricity generation 1,680,000 MWh_{el}, average heat value 2 MWh_{th} per cubic metre, average electricity generation efficiency 0.25 MWh_{el} MWh_{th}

(graph)

% / C per tonne
Wood fuel index in % (base year 1979)
Maize producer price in €/t

[23-08-2007 | Sources: Austrian Chamber of Agriculture and Statistics Austria]

Figure 15: Evolution of wood fuel and maize prices, 2000–2007

Since the end of 2005, these prices have increased significantly due to the scarcity effects that have already occurred and partly also due to energy use.

4.2.4 Austrian resources for renewable energy and further expansion of green electricity

The following table provides an overview of the parameters, according to which renewable energy sources from national resources (in addition to existing use) can contribute to the power supply in the long term.

	Assumptions	*PJ* *T TWh = 3.6 PJ*	*Constraints*
Hydro	Max. 700 MW / 3.5 TWh (possible despite EU Water Framework Directive)	13	Acceptance by the population, EU Water Framework Directive (question of national implementation with emphasis upon energy generation)
Solid biomass, total additional supply	3 m cu m	22	Competition with use for production of materials. Heat use more efficient than electricity generation. Low price competition from neighbouring countries.
Energy crops on agricultural land and cultivated pasture	Max. 14% - 20% of agricultural land (1.4m ha) and cultivated pasture (0.9 m ha)	14 – 36	Competition with use for foodstuffs and animal feed, large-scale restructuring required, low price competition from neighbouring countries.
Wind power	700 MW approximately 300-350 additional wind turbines	5 – 7	Subsidy requirement 1.5 billion Euro, conservation (640 wind turbines currently in operation in Austria, in practice only the wine-growing region is suitable for new additional generation due to its (poorer) wind quality, acceptable tower height.
Thermal solar (warm water, heating)	500,000 households – 5000 kWh	9	Use in urban, highly developed areas
Photovoltaic	10,000 houses with 3 kW (approximately 30m2) would produce 30 MW. 1,000 full burden hours would produce 30 GWh	0.1	Very high costs despite minimal contribution to electricity supply (subsidy requirement for 30 MW approximately 180 m Euro)
Geothermal	Not assessed, research and technology development potential		
Heat pumps	Not assessed		
Other	Not assessed		

Total additional renewables in the long term 80 -90 PJ

Comparison: Total gross domestic energy consumption/total electricity consumption 2005 1440 PJ

Table 10: Parameters for additional electricity generation from national resources

On the assumptions outlined above in the long term it can be assumed that an additional 80 -90 PJ (approximately) will be produced from national renewable energy sources (in comparison to the gross energy consumption of 1,440 PJ in 2005).

The following table shows the parameters for a green electricity expansion programme until 2015.

	Assumptions	*Electricity output in TWh*
Hydro	700 MW	3.5
Wind	700 MW (approximately 300 - 350 wind turbines)	1.3-1.6
Solid biomass	1m cu m only for electricity output from approximately 3 m cu m total additional supply	0.5
Energy crops on arable land and cultivated pasture	0.1-0.5m ha land for energy crops	0.4-1.8 but in competition with other possible uses
Compared to gross domestic electricity consumption 2006		70.2 TWh

Table 11: Parameters for additional electricity generation from renewable energy sources until 2015

The greatest green electricity expansion potentials are in hydropower (further expansion of up to 700 MW, including the upgrading of existing generating stations, additional electricity generation of approximately 3.5 TWh) and in wind power (also approximately 700 MW, 1.3 – 1.6 TWh). Additional electricity generation from other new biomass generating stations is assessed as far lower, from which an additional TWh (max.) of biomass (solid, liquid and gaseous) are anticipated, as only very limited resources are available and there is also major competition with other possible uses.

Accordingly, Austria is also assessed in comparison with the other EU Member States (EU-15) in a study published in August 2006 by the Fraunhofer Institut et al: As Figure 16 shows, in Austria the potential is approximately 80% exhausted. In contrast, almost all other states have converted less than 50% of their available potential. In countries that have only realised a small proportion of the possibilities available to them, the further expansion of renewable energy is significantly more cost-effective than if a major proportion has already been realised.

(graph)

RES-E – Electricity generation potential (TWh/yr.)

Additional potential 2020
Achieved potential 2004

Biogas
(Solid) Biomass
Biowaste
Geothermal electricity
Hydro large-scale
Hydro small-scale
Photovoltaics
Solar thermal electricity
Tide and Wave
Wind onshore
Wind offshore

[August 2006 | Source: Frauenhofer Institut, Ecofys, EEG]

Figure 16: Potential achieved in 2004 and additional potential of green electricity in the EU-15 (left) and according to green electricity technology (right)

4.3 Increased demand for electricity

The expansion of green electricity generation is combined with a continuous increase in electricity consumption.
The following table shows public and total electricity supply in Austria during the period of 2000-2006. [4]

Supply via the public grid system in Austria				Total supply in Austria		
Calendar year	Demand	Change		Total supply including pumped storage*, excl. physical exports	Change	
	in GWh	in GWh	in %	in GWh	in GWh	in %
2000	50,138	1,588	3.3	60,502	2,032	3.5
2001	52,216	2,078	4.1	62,341	1,839	3.0
2001 (a)	52,213	2,075	4.1	61,891	1,389	2.3
2002	52,861	648	1.2	63,370	1,479	2.4
2003	55,215	2,354	4.5	65,832	2,462	3.9
2004	56,545	1,330	2.4	67,819	1,987	3.0
2005	57,159	613	1.1	69,144	1,325	2.0
2006	58,883	1,725	3.0	70,769	1,626	2.4

(a) Reconciliation with 2002 survey standards (partly estimated)

* Pumped storage (approximately 1 800-3 500 GWh per year, estimated)

1: These quantities differ from the volumes supplied to the end user that give entitlement to support payments in that the grid losses and power consumed by generating stations are included.
[25.09.2007 | Source: Energie-Control GmbH]

Table 12: Supply via the public grid system, including grid losses and energy consumed by the power plant, excluding ÖBB (Austrian Federal Railways) 16 2/3 Hz grid

[4] These quantities differ from the volumes supplied to the final consumer that give entitlement to support payments in that the grid losses and power consumed by power generating stations are included.

The rates of increase shown in the table are always based on the previous year. In total, the increase between 2000-2007 for public and total generation amounted to 17%.
Figure 17 shows the development of electricity consumption since 1970 according to sector. It is noticeable that public and private services, private households and the electricity generating sector have increased the most.

(graph)

Electricity generating sector
Transport
Public and private services
Private households
Agriculture

(Source: Statistik Austria, Energie-Control GmbH)

Figure 17: Electricity consumption 1970-2005 according to sector

Electricity consumption in private households can also been explained to a large extent by the population increase in Austria, which amounted to 11% during the period 1970-2006.

Forecasts also take account of increasing electricity consumption in the future (Figure 18).

(graph)

GWh
Final energy consumption

E-Control (ECG) forecast

Source: E-Control, WIFO, UCTE, DG TREN

Figure 18: Electricity consumption in Austria 1990-2016/2007-2016: various projections

According to the demand model MEDA.07 of Energie-Control GmbH, a final energy consumption of 67 845 TWh is anticipated for 2016, which corresponds to an average annual electricity consumption increase of 1.7% or 1 042 TWh.
Taking into account the electricity consumption inherent in the system, Energie-Control GmbH anticipates for 2016 gross domestic electricity consumption without pumped storage of 79 674 TWh.

If one compares the forecast of Energie-Control with the (also model-based) consumption forecasts of WIFO and the European Commission for Energy and Transport (DG TREN) and the non-heuristic forecasts of the UCTE, it can be noted that a further deceleration of the growth in electricity consumption is expected across the board. In real terms, in its efficiency scenario, which assumes an improvement in energy efficiency of 0.5% per year based on the energy policy guidelines of the European Commission, WIFO forecasts a 1.5% growth in electricity consumption by 2010 and increase of 1.9% between 2010 and 2020. In comparison, using the PRIMES model, the DG TREN estimates an average increase of 2.3% between 2000 and 2010 and 0.6% between 2010 and 2020. This also explains the ‘bend’ in the forecast.

In turn, in its “System Adequacy Forecast 2007-2020” the UCTE anticipates an average electricity consumption increase of between 1.5% and 2% (by 2020).

Purely in order to retain the share of green electricity in electricity consumption, the relevant additional quantities must therefore be increased each year.

5 The support system for renewable energy sources in Austria

5.1. Overview

Since 2003, the support system in Austria has been based on a standardised feed-in tariff system across the country.
In the years 2006 and 2007 there were two amendments to the Green Electricity Act. On 27 June 2006, the Green Electricity (Amendment) Act was announced (BGBl I No. 105/2006), which included an increase to the support budgets and regulations for future budget limits. On 7 March 2007, the Green Electricity (Amendment) Act was announced, which assigned the legislative power for transfer prices to the Federal Minister for Economics and Labour for constitutional reasons and amended the definition of new CHP generating stations.

The detailed contents of the 2006 amendment are as follows:

- Increase to the green electricity target (supported green electricity including hydropower) to 10%
- Possibility of investment allowances for medium-scale hydropower (10 MW - 20 MW, budget limit 50 million Euro)
- Possibility of investment allowances for new fossil CHP generating stations (budget limit 60 million Euro)
- Budget limit for new additional renewable green electricity generating stations and for investment allowances (accumulated via the feed-in tariff guarantee period of 10 years plus 2 years reduced by 1 billion Euro in total)
- Changes to funding based on European Commission requirements for existing support payments per kWh to future lump sum payments per metering point and far higher transfer prices, which electricity traders are required to pay for the supported green electricity assigned to them
- Establishment of a Green Electricity Settlement Centre for uniform processing throughout the country (“first come, first served” principle)

With the Green Electricity (Amendment) Act 2006, in addition to the funding commitments of 3 billion Euro contractually awarded within the framework of the previous implementation of the Green Electricity Act 2002, another (approximately) 1 billion Euro were released in order to support further, new green electricity generating stations.

30% of these additional funds were set aside for wind power, 30% for solid biomass, 30% for biogas and 10% for other green electricity generating stations, excluding hydropower.

The following chart shows how funding is allocated for green electricity following the establishment of the Green Electricity Settlement Centre, which commenced its work on 1 October 2006 after receiving its license in September 2006 and thus replaced the three previous Green Power Balancing Groups.

Operator of a small Hydro Power Plant
Feed-in tariff
Settlement price for pro rate Small Hydro Power
Settlement price for pro rate "other" Green Electricity
Electricity Trader
10 MW restriction and 1 MW restriction
Feed-in tariff
Operator of an "other" Green Electricity Plant
Green Electricity Company (state owned)
Balancing group
End User
Further charging of settlement price
Green Electricity Fee per metering point
Wind Power, Biomass, Biogas, etc.

Flow of "other" green electricity
Flow of small hydro power
Cash flow
Cash flow end consumer – electricity trader

[01-10-2006 | Source: Energie-Control GmbH]

Figure 19: Schematic diagram of the green electricity support payment system under the Green Electricity (Amendment) Act 2006

On 24 October 2006, the Green Electricity Order 2006 was announced (BGBl II No. 401/2006), in which the feed-in tariffs for new green electricity generating stations are defined, provided it is possible to conclude a contract with the Green Electricity Settlement Centre within the budget provided. The following table shows a comparison of these new feed-in tariffs with the earlier values of Order BGBl II No. 508/2002 from December 2002.

FEED-IN TARIFFS FOR RENEWABLE GENERATING STATIONS		NEW Tariff in cent/kWh under BGBI II No. 401/2006 10 plus 2 years (reduced)		OLD Tariff in cent/kWh under BGBI II No. 508/2002 13 years
		2007	2006	Old
Wind		7.55	7.65	7.80
Solid biomass (e.g. forest wood chips or straw)	Up to 2 MW	15.65	15.70	16.00
	2-5 MW	14.95	15.00	15.00
	5-10 MW	13.30	13.40	13.00
	Over 10 MW	11.10	11.30	10.20
HBF waste	Key no.17, Tab.2, e.g bark or sawdust	Minus 25%	Minus 25%	Minus 20%
	Key no.17, Tab 1, e.g. particle board waste	Minus 40%	Minus 40%	Minus 35%
	Other 5-digit key nos. in Tab.1 and 2 GEA	4.90	5.00	2.70
Cofiring		Pro-rata	Pro rata	Pro rata
Cofiring at thermal power stations	Solid biomass (e.g. forest wood chips or straw)	6.30	6.40	6.50
	Key no.17, Tab.2, e.g bark or sawdust	Minus 25%	Minus 25%	5.00
	Key no.17, Tab 1, e.g. particle board waste	Minus 40%	Minus 40%	4.00
	Other 5-digit key nos. in Tab.1 and 2 GEA	Minus 50%	Minus 50%	3.00
Cofiring		Pro rata	Pro rata	Pro rata
Liquid biomass	Plant oil, cold pressed biooil, RME up to 300 kW	12.50	13.00	13.00 (up to 200kW)
	Plant oil, cold pressed biooil, RME over 300 kW	9.50	10.00	10.00 (over 200 kW)
	Other liquid biofuels	6.00	6.50	
Biogas derived from agricultural products (e.g. maize or slurry)	Up to 100 kW	16.95	17.00	16.50
	100-250 kW	15.15	15.20	14.50
	250-500 kW	14.00	14.10	14.50
	500-1,000 kW	12.40	12.60	12.50
	Over 1,000 kW	11.30	11.50	10.30
Biogas derived from cofermentation of wastes		Minus 30%	Minus 30%	Minus 25%
Landfill and sewage gas	Sewage gas	5.95	6.00	3.00 (up to 1 MW)
	Landfill gas	4.05	4.10	6.00 (over 1 MW)
Geothermal		7.30	7.40	7.00
PV	Up to 5 kWp	46.00	49.00	60.00 (up to 20 kWp)
	5-10 kWp	40.00	42.00	47.00 (over 20 kWp)
	Over 10 kWp	30.00	32.00	
Small hydro – NO NEW TARIFFS AS YET Tariff in cent/kWh under BGB II No. 508/2002 (construction by 31 Dec. 2007)				
a) "Old" existing stations up to 31 Dec. 2008 (expiring) b) Following investments resulting in an electricity output increase of at least 15% c) New station or increase of at least 50% in electricity output		a)	b)	c)
First 1,000,000 kWh		5.68	5.96	6.25
Next 4,000,000 kWh		4.36	4.58	5.01
Next 10,000,000 kWh		3.63	3.81	4.17
Next 10,000,000 kWh		3.28	3.44	3.94
Over 25,000,000 kWh		3.15	3.31	3.78
(Feed-in tariff graduated according to annual amounts of electricity injected)				
CHP support payments for "old" biomass stations (approved 2003-2004) Heating support tariff possible (but capped)				
Heating tariff (HT) = Feed-in tariff/4.4 heating price (HP)				
HP = 2.6 cent/kWh$_{th}$ for stations with capacities up to 10 MW$_{el}$ and HT = 1.8 cent/kWh$_{th}$ for stations with capacities greater than 10 MW$_{el}$				

[Source: Energie-Control GmbH]

Table 13: Comparison of feed-in tariffs under the Green Electricity Order 2006 and the Feed-In Tariff Order 2002

5.2 Legal basis

Directive 2001/77/EC was implemented in national law in Austria within the framework of the Green Electricity Act (BGBl I No. 149/2002). On 1 July 2006 (BGBI I No. 105/2006) and on 2 April 2007 (BGBI I No.10/2007) this Act was amended. The Green Electricity Act itself provides the general framework for the support system. This legal basis is complemented by various orders, which regulate sub-sections such as the actual amounts of feed-in tariffs. The following orders have been issued based on the Green Electricity Act:

- Order of the Federal Minister of Economics and Labour, in which the support contributions for the payment of additional expenses of the ECO Regulation are defined for 2003.
- Order of the Federal Minister of Economics and Labour, in which the support contributions for the payment of additional expenses of the ECO Regulation are defined for 2004; BGBI II No. 642/2003 (valid 1.1.2004 – 31.3.2004)
- Order of the Federal Minister of Economics and Labour, in which the support contributions for the payment of additional expenses of the ECO Regulation are defined for 2004; BGBI II No. 135/2004 (valid 1.4.2004 – 31.12.2004)
- Order of the Federal Minister of Economics and Labour, in which the support contributions for the payment of additional expenses of the ECO Regulation are defined for 2005; BGBI II No. 533/2004 of 30.12.2004
- Order of the Federal Minister of Economics and Labour, in which the support contributions for the payment of additional expenses of the Green Power Balancing Group officials are defined for 2006; BGBI II No. 470/2005 of 29.12.2005
- Order of the Federal Minister of Economics and Labour, in which the maximum amount of the average total cost burden for the support of green energy is redefined from 1.1.2005; BGBI II No. 525/2004 of 28.12.2004
- Order of the Federal Minister of Economics and Labour, in which the maximum amount of the average total cost burden for the support of green energy is redefined from 1.1.2006; BGBI II No. 462/2005 of 28.12.2005
- Order of the Federal Minister of Economics and Labour on the definition of a CHP surcharge for all quantities of electricity supplied to the end user (KWK Zuschlagsverordnung 2003); BGBI II No. 509/2002 of 20.12.2002

- Order of the Federal Minister of Economics and Labour on the definition of a CHP surcharge for all quantities of electricity supplied to the end user (KWK Zuschlagsverordnung 2004); BGBI II No. 631/2003 of 30.12.2003
- Order of the Federal Minister of Economics and Labour on the definition of a CHP surcharge for all quantities of electricity supplied to the end user (KWK Zuschlagsverordnung 2005); BGBI II No. 524/2004 of 28.12.2004
- Order of the Federal Minister of Economics and Labour on the definition of a CHP surcharge for all quantities of electricity supplied to the end user (KWK Zuschlagsverordnung 2005); BGBI II No. 524/2002 of 28.12.2004
- Order of the Federal Minister of Economics and Labour on the definition of a CHP surcharge for all quantities of electricity supplied to the end user (KWK Zuschlagsverordnung 2006); BGBI II No. 463/2005 of 28.12.2005
- Order of the Federal Minister of Economics and Labour, in which prices for the purchase of electrical energy from green electricity stations are determined; BGBI II No. 508/2002 of 20.12.2002 in the version of 12.08.2005, BGBI II No. 254/2005
- Order of the Federal Minister of Economics and Labour, in which the prices for the purchase of electrical energy from green electricity stations is defined based on contracts, which the Green Electricity Settlement Centre is required to conclude in the calendar years 2006 and 2007; BGBI II No. 401/2006 of 24.10.2006
- Order of the Federal Minister of Economics and Labour, in which the pro rate administrative and financial expenses and the pro rate expenses for balancing energy of the Green Electricity Settlement Centre are determined for 2006 and 2007; BGBI II No. 378/2006 of 10.10.2006
- Order of the Energie-Control Commission, in which the transfer prices for small-scale hydropower and other green electricity are determined for the calendar year 2007 (Transfer Price Order 2007)

6 Attainment of national green electricity objectives

6.1 Basic principles

Section 4 of the Green Electricity Act defines as follows the targets of the act:

- Attainment of the 78.1% target in line with Directive 2001/77/EC in consideration of the base value of 56.1 TWh stipulated in the Directive
- Efficient deployment of funding
- Technological prioritisation aimed at developing market maturity
- Investment security for existing and future generating stations
- Conclusion of contracts for the purchase of other green electricity amounting to 10% of the electricity output of all grid operators in Austria by 2010
- 9% small hydropower in 2008

The reference basis for the above figures is the total annual electricity output of all grid operators in Austria to end-users. This value is not identical to the figure defined as the reference basis for the 78.1% target of 56.1 TWh in compliance with Directive 2001/77/EC. Therefore it is only possible to correlate the indicative values indicated to a limited extent.

6.2 Attainment of national objectives in 2006

In 2006, the total annual electricity output of all grid operators amounted to 54 221 GWh and (provisional value). An output of 55 468 GWh is anticipated for 2007. This is in contrast to the green electricity volumes fed into the public grid and green electricity volumes supported through feed-in tariffs.

Amounts of renewable power fed in and attracting compensation in 2006, as compared with 2005										
Energy source	Amount injected in GWh 2006	Net compensation in € 2006	Renewable electricity injection as % of total supply[1]	Support payments net of market value in € m 2006[3]	Ave. compen -sation in cent/kWh 2006	Amount injected in GWh in € 2005	Net compen -sation in € 2005	Renewable electricity injection as % of market value in € in 2005[2]	Support payments net of market value in € m 2005[4]	Ave. compensation in cent/kWh 2005
Small hydro (supported)	1,806	93.2	3.3%	-4.93	5.16	3,561	162.6	6.8%	17.6	4.57
"Other" renewable electricity	3,304	342.0	6.1%	162.41	10.35	2,212	208.9	4.2%	118.8	9.44
Wind	1,738	135.2	3.2%	40.76	7.78	1,328	102.9	2.5%	48.8	7.75
Solid biomass inc. HBF waste	1,086	137.3	2.0%	78.26	12.64	553	59.1	1.0%	36.6	10.69
Biogas	358	49.2	0.7%	29.74	13.73	220	29.3	0.4%	20.3	13.31
Liquid biomass	54	7.5	0.1%	4.61	13.99	33	4.6	0.1%	3.3	14.16
PV	13	8.7	0.0%	7.95	64.46	13	8.4	0.0%	7.9	65.14
Landfill and sewage gas	52	3.8	0.1%	0.99	7.36	63	4.4	0.1%	1.8	6.91
Geothermal	3	0.3	0.0%	0.10	8.76	2	0.2	0.0%	0.1	8.15
Total small hydro and "other" renewable electricity	5,110	435.2	9.4%	157.49	8.52	5,773	371.5	11.0%	136.4	6.43

1 Relative to total supply to end users from the public grid (54,221 GWh in 2006)
2 Relative to total supply to end users from the public grid (52,674 GWh in 2005)
3 Average market price in 2006 was €54.35/MWh
4 Average market price in 2005 was €40.725/MWh

[18-07-2007 | Source: Notifications from green power balancing group representatives (GPBGRs) and adjustment by APG in May 2007]

Table 14: Amounts of renewable power fed in and attracting compensation in 2006, as compared with 2005

In 2006, 1 806 GWh of electricity from supported small hydropower (3.3% of the total output from public grids) and 3 304 GWh of other supported green electricity (6.1%) were fed in.

Amounts of renewable power fed in and attracting compensation in the first half of 2007, as compared with the first half of 2006										
Energy source	Amount injected in GWh Q1 2007	Net compensation in € Q1 2007	Renewable electricity injection as % of total supply[1]	Support payments net of market value in € m Q1 2007[3]	Ave. compen -sation in cent/kWh Q1 2007	Amount injected in GWh in € Q1 2006	Net compen -sation in € Q1 2006	Renewable electricity injection as % of market value in € in 2005[2]	Support payments net of market value in € m Q1 2006[4]	Ave. compensation in cent/kWh Q1 2006
Small hydro (supported)	661	36.9	2.4%	5.32	5.58	1,081	57.2	4.0%	-2.6	5.52
"Other" renewable electricity	2,104	224.1	7.6%	123.72	10.65	1,419	144.0	5.2%	65.5	10.08
Wind	1,018	79.0	3.7%	30.39	7.76	811	63.1	3.0%	18.2	7.83
Solid biomass inc. HBF waste	804	104.6	2.9%	66.17	13.00	382	48.1	1.4%	27.0	12.59
Biogas	209	28.9	0.8%	18.90	13.80	173	23.8	0.6%	14.2	13.74
Liquid biomass	38	5.2	0.1%	3.40	13.78	19	2.6	0.1%	1.6	13.93
PV	7	4.5	0.0%	4.19	64.44	7	4.3	0.0%	3.9	63.96
Landfill and sewage gas	26	1.8	0.1%	0.61	7.13	25	1.9	0.1%	0.5	7.83
Geothermal	1	0.1	0.0%	0.06	9.45	2	0.1	0.0%	0.0	9.60
Total small hydro and "other" renewable electricity	2,764	261.0	10.0%	129.04	9.44	2,500	201.2	9.2%	62.8	8.60

1 Relative to total supply to end users from the public grid (55,468 GWh (est.) in 2007)
2 Relative to total supply to end users from the public grid (54,221 GWh in 2006)
3 Average market price for the first half of 2007 was €47.73/MWh
4 Average market price for the first half of 2006 was €55.37/MWh

[23-08-2007 | Source: OeMAG, August 2007 – preliminary figures]

Table 15: Amounts of renewable power fed in and attracting compensation in the first half of 2007, as compared with the first half of 2006

In the first half of 2007, 2 104 GWh of other supported electricity was fed into the public grid – this is approximately 50% more than in the first half of 2006, in which 1,419 GWh were fed in (Table 15). In relation to the total output from the public grids this amounts to 7.6% in the first half of 2007 (compared to 5.2% in the corresponding period of the previous year).
The amounts of supported small-scale hydropower for this period of 1 081 GWh (4%) fell to 661 GWh (2.4%), as many operators of small hydro generating stations left the support scheme and now sell their electricity on the liberalised market.

6.2.1 Performance of small hydropower

The Green Electricity Act stipulates 9% of electricity generation from small hydropower as the target for 2008.

According to the situation in March 2007, 952 MW existing (approved before 2003) small hydro generating stations were accredited as green electricity generating stations (for which no revitalization measures were reported). In addition, 140 MW new small hydropower generating stations were accredited. Revitalisations have been reported for 17 MW existing small hydro generating stations with an increase in electricity output of more than 50%. Revitalisation measures with a minimum electricity output increase of 15% have been notified for 51.3 MW[5].

In 2006, 3,840 GWh of electricity were produced from small hydropower. The generation coefficient from this year is approximately 0.96. In an average year 4,000 GWh of electricity would therefore be generated using small hydropower at the existing generating stations.

This is 7.25% of the output volume from public grids of 55 200 GWh forecast for 2008.

The indicative target of 9% (of 55,200 GWh) defined the Green Electricity Act in 2008 of approximately 5,000 GWh will then be achieved if further electricity output increases of approximately 1,000 GWh are achieved through additional investment measures.

Further support measures are required in order to fulfil the 9% hydropower target in 2008.

[5] Data concerning revitalisation measures incomplete.

6.2.2 Performance of "other" green electricity

The Green Electricity Act sets the objective of working towards contracts for the purchase of electrical energy from renewable energy sources, with the exception of hydropower, through the Green Electricity Settlement Centre to such an extent that the resulting share amounts to 10% when measured against the total annual electricity output of all grid operators in Austria to end users connected to the public grids.

Energy source	Under contract to OeMAG as at 30.6.2007	Accredited generating stations as at 31.03.2007	Generation first half of 2007	2010 generation from all accredited generating stations 2007*
	MW	MW	MWh	MWh
Biogas	64	86	209	561
Solid biomass	270	402	804	2,391
Liquid biomass	15	26	38	138
Landfill and sewage gas	22	30	26	74
Geothermal	1	1	1	2
PV	17	36	7	31
Wind	955	1,033	1,018	2,201
Total "other" green electricity	1,344	1,614	2,104	5,397
Total output from public grids (MWh)**			27,734***	58,345
Share of total output			7.6%	9.3%
* From operation of all generating stations accredited as at 31.3.2007 ** Assuming annual growth in electricity consumption of 1.7% according to MEDA 07 *** Provisional value				
[02.11.2007 | Source: Energie-Control GmbH, OeMAG)				

Table 16: Performance of "other energy from renewable sources" in compliance with Section 4 of the Green Electricity Act

On 30.6.2007 1 344 MW of other green electricity were reported as being under contract to OeMAG and on 30.3.2007 1 614 MW of other green electricity were accredited.
Assuming that the total accredited capacity will be subject to a contract for the purchase of green electricity by 2010 and the output from the public grids increases by 1.7% each year, the total injection of other green electricity would amount to 9.3% of output. 9.3% is the maximum value for this purpose, as the best locations tend already to have been allocated for wind power and it must be assumed that the number of full load operation hours will be lower than at present.

In order to achieve the 10% target it is therefore necessary that further generating stations, in addition to the generating stations already approved, enter into contracts for the purchase of green electricity, or that the growth in electricity consumption falls.

6.3 Volume of support and production costs per kWh

6.3.1 Development of output volumes of supported green electricity

The development of green electricity in Austria is described in great detail in the Green Electricity Report of Energie-Control GmbH (download: www.e-control.at). For this reason, only a brief extract from this report is included here.

Figure 20 shows the growth in supported other green electricity from 2004-2007, which has increased in terms of volume ever since the Green Electricity Act 2002.

(graph)

Increase + 767
Increase + 1,092
Increase + 1,519
1st half of 2006: 1,419 GWh
1st half of 2007: 2,104 GWh
Projections as at November 2006

Figure 20: Support payments for electricity produced from renewable energy sources 2004-2007 (forecast), excluding hydropower

In the first half of 2007, 2,100 GWh of other supported green electricity were fed into the public grid. This corresponds to 7.6% of the electricity supply from public grids.

(graph)

Wind power
Solid biomass
Biogas

[September 2007 | Source: OeMAG, Energie-Control GmbH]

Figure 21: Support payments for electricity produced from renewable energy sources 2002-2007 (forecast), according to technology, excluding hydropower

During the period 2003-2007, there was a major growth in volume for all green electricity technologies (Figure 21). For 2007 with approximately 2 000 GWh roughly the same amount of green electricity from wind power is expected as from solid biomass.
For the years 2007 and 2008 approximately 4 800 GWh of other supported green electricity is forecast (Table 17).

Supported green electricity amounts (in GWh)							
Energy source	2002	2003	2004	2005	2006	2007 (Projections situation in Nov. 2006)	2008 (Projections situation in Aug. 2007)
Windpower	203	366	924	1,328	1,738	2,077	2,100
Solid biomass	95	99	313	553	1,086	2,003	2,000
Biogas	20	42	102	220	358	522	500
Liquid biomass	3	2	18	33	54	120	90
PV	3	11	12	13	13	13	14
Other supported green electricity	88	78	76	65	55 [1)]	88 [1)]	51 [1)]
Total “other” green electricity	412	598	1,445	2,212	3,304	4,823	4,755
Small hydro (supported)	4,243	3,386	3,995	3,561	1,806 [1)]	2,000 [1)]	1,600 [1)]
Total supported green electricity	4,655	3,984	5,440	5,773	5,110	6,823	6,355

[1)] A significant proportion of small hydropower (and landfill and sewage gas) is leaving the support system as greater profits can be made on the free market.
[23.07.2007 | Source: Energie-Control GmbH, OeMAG]

Table 17: Support payments for renewable electricity 2002-2008 (2007 and 2008: projections)

However, the actual amounts of biomass and biogas electricity generated could be significantly lower than these projections, as due to increased raw material prices a larger proportion of already approved generating stations may not be constructed.
It is currently difficult to estimate the proportion of these already approved generating stations that will be constructed over the next few years, as planning permission remains valid for several years. For example, this depends on how the prices and availabilities of wood fuel and feed (fuels used in biogas generating stations) develop in the future.
Table 18 compares the amounts of renewable power fed in and attracting compensation in Austria in the first half of 2007, as compared with the first half of 2006.

Amounts of renewable power fed in and attracting compensation in the first half of 2007 as compared with the first half of 2006

Energy source	Amount injected in GWh H1 2007	Net compen-sation in € H1 2007	Green electricity injection as % of total supply[1)]	Support payments net of market value in € m HY1 2007[3)]	Ave. compen-sation in cent/kWh HY1 2007	Amount injected in GWh H1 2006	Net compen-sation in € H1 2006	Green electricity injection as % of total supply[2)]	Support payments net of market value in € m H1 2006 [4)]	Ave. compensation in cent/kWh H1 2006
Small hydro (supported)	661	36.9	2.4%	5.32	5.58	1,081	57.2	4.0%	-2.6	5.52
"Other" green electricity	2,104	224.1	7.6%	123.72	10.65	1,419	144.0	5.2%	65.5	10.08
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Solid biomass inc. HBF waste	804	104.6	2.9%	66.17	13.00	382	48.1	1.4%	27.0	12.59
Biogas	209	28.9	0.8%	18.90	13.80	173	23.8	0.6%	14.2	13.74
Liquid biomass	38	5.2	0.1%	3.40	13.78	19	2.6	0.1%	1.6	13.93
PV	7	4.5	0.0%	4.19	64.44	7	4.3	0.0%	3.9	63.96
Landfill and sewage gas	26	1.8	0.1%	0.61	7.13	25	1.9	0.1%	0.5	7.83
Geothermal	1	0.1	0.0%	0.06	9.45	2	0.1	0.0%	0.0	9.60
Total small hydro and "other" green electricity	2,764	261.0	10.0%	129.04	9.44	2,500	201.2	9.2%	62.8	8.60

[1] Relative to total supply to end users from the public grid (55 468 GWh (est.) in 2007

[2] Relative to total supply to end users from the public grid (54 221 GWh in 2006)

[3] Market price in HY1 2007 was €47.73/MWh

[4] Market price in HY 1 2006 was €55.37/MWh

[23.08.2007 / Source: OeMAG, August 2007 – preliminary figures

Table 18: Support payments for renewable electricity and compensation for the first half of 2007 as compared with the first half of 2006

At 5.58 cent/kWh in the first half year, the average feed-in tariffs paid by the Green Electricity Settlement Centre for small hydropower are close to the market price, while for wind power they amount to 7.76 cent/kWh (in addition to approximately 1.2 cent/kWh for balancing energy costs). In contrast, for green electricity technologies that depend upon raw materials, the tariffs are significantly higher at 13 cent/kWh – 14 cent/kWh. With an average feed-in tariff of 64 cent/kWh grid-connected

PV power was compensated over ten times more than small hydropower.

6.3.2 Development of the maximum capacity of supported green electricity generating stations

Table 19 shows the development of the capacity of those generating stations that are under contract to the GPBGRs, according the individual technologies between 2003 and mid-2007 and this value is then compared to the current figures for the accredited generating stations on 31.3.2007.

Comparison of accredited green generating stations and renewable generating stations under contract to GPBGRs						
Energy source	Under contract to GPBGR as at 31.12.2003	Under contract to GPBGR as at 31.12. 2004	Under contract to GPBGR as at 31.12. 2005	Under contract to GPBGR as at 31.12. 2006	Under contract to GPBGR as at 31.12. 2007	Accredited as at 31.03. 2007
Biogas	14.97	28.36	50.67	62.48	64.23	86.16
Solid biomass	41.07	87.54	125.95	257.92	270.42	402.03
Liquid biomass	1.97	6.84	12.41	14.69	14.55	26.12
Landfill and sewage gas	22.73	20.28	21.18	13.67	21.66	30.28
Geothermal	0.92	0.92	0.92	0.92	0.92	0.92
PV[1]	14.18	15.07	15.36	15.31	17.34	36.13
Wind	395.59	594.56	816.90	953.48	955.38	1,032.62
Total "other" renewable electricity	491.43	753.57	1,043.39	1,318.47	1,344.50	1,614.27
Small hydro up to 10 MW (supported)[2]	858.10	851.54	709.69	320.86	397.73	1,161.04

1 Section 10(2) Green Electricity Act requires GPBGRs to accept electricity from PV generating stations even if the 15 MW quota has already been met

2 Due to the high market prices in 2005 and 2006 many small hydro generating stations left their green power balancing groups, meaning that the capacity figures at the various cut-off points are not entirely reliable

[28-08-2007 | Sources: E-Control, GPBGRs and OeMAG)

Table 19: Performance of renewable energy technologies in operation 2003-2007 and authorised on 31.3.2007

In mid-2007, 1,345 MW of other green electricity and 398 MW small hydropower were supported as part of this support scheme. Wind power (955 MW), solid biomass (270 MW) and biogas (64 MW) account for the major proportion.

In the case of solid biomass and biogas there is a major difference between the output of generating stations accredited at the end of March 2007 and generating stations under contract to the OeMAg in the middle of 2007 (Figure 22).

(graph)

Wind power
Solid biomass
Biogas

1,033 MW wind power (accredited)
402 MW solid biomass (accredited)
86 MW biogas (accredited)

[September 2007 | Source: Energie-Control GmbH, OeMAG)

Figure 22: Output of renewable energy source technologies in operation 2003-2007 and approved on 31.3.2007

Of the approved 402 MW biomass generating stations, 132 MW (33%) have not yet been constructed.
Of the approved 86 MW biogas generating stations 22 MW (25%) have not been constructed.

(graph)

Biomass
Biogas

MW increase per quarter
Green Electricity Act 2002

MW accredited
Accreditation decision
Increase

MW under contract to GPBGR
Increase

Upturn in the number of approvals at the end of 2004

Commissioning by the end of 2007 of generating stations approved in 2004

[03.08.2007 | Source: Energie-Control GmbH]

Figure 23: Authorisations and commissioning of biomass and biogas generating stations 2002-2007

During the period 2002 – mid-2007, approximately 10 -15 MW new biomass generating stations per quarter entered into a contract with the GPBGRs; only in the first and second quarter of 2006 was this figure significantly greater, with over 50 MW per quarter. During the same period, 3-5 MW biogas generating stations concluded a contract during each quarter. The boom in accreditations in the last quarter of 2004 amounting to over 100 MW biomass and over 20 MW biogas is currently being followed up with the commissioning of further generating stations. However, it is assumed that not all approved generating stations will be constructed.

6.3.3 Development of feed-in tariffs and allocation of subsidies

(graph)

cent/kWh

13.80 biogas
13.00 solid biomass
7.76 wind
5.58 small hydro
5.0 market price

(24.09.2007 | Source: Energie-Control, Öko-BGV)

Figure 24: Average feed-in tariffs compared to the market price 2003-2007

The average feed-in tariffs paid by the Green Electricity Settlement Centre have increased significantly, particularly for biomass and biogas green electricity technologies that depend upon raw materials, and are very different from the market price (Figure 24).

According to the Green Electricity Act, operators of green electricity generating stations must be paid fixed feed-in tariffs as defined in an ordinance for electrical energy that is fed into the public grid. If these feed-in tariffs are set according to the market price that electricity consumers pay for electrical energy, this produces the subsidy component to be financed by the electricity consumers in addition to the actual cost of electricity (without taking into account balancing energy and other support) as a percentage according to the following formula:

$$\textit{Subsidy component} = \frac{\textit{(feed-in tariff – market price)}}{\textit{Feed-in tariff}} \times 100$$

The following figures show the results of calculations using the average feed-in tariffs paid in 2006 (for biomass and small biogas generating stations for the average prescribed feed-in tariff of 15 cent/kWh) and the average market price for 2006 (5.43 cent/kWh) (Figure 25) and other market price assumptions (4.5 cent/kWh and 6.5 cent/kWh).

When interpreting these results it should be borne in mind that the balancing power expenditure occasioned by wind power is not included in the subsidy component shown here. Moreover, no account is taken of the fact that grid connected wind power capacity generates very low sales revenue because it cannot be stored and output is difficult to forecast.

(chart)
Small hydro
Wind
Solid biomass < 5 MW and biogas < 500 kW
Ave. solid biomass inc. HBF waste
Biogas
Liquid biomass
PV
Landfill and sewage gas
Geothermal

[11-07-2007 | Source: E-Control] Market price of electricity % subsidy

Figure 25: Subsidy component of average feed-in tariffs paid in 2006 at an average 2006 market price of 5.43 cent/kWh

(chart)

Small hydro
Wind
Solid biomass < 5 MW and
biogas < 500 kW
Ave. solid biomass inc. HBF
waste
Biogas
Liquid biomass
PV
Landfill and sewage gas
Geothermal

[11-07-2007 | Source: E-Control] Market price of electricity % subsidy

Figure 26: Subsidy component of average feed-in tariffs paid in 2006 assuming a market price of 4.5 cent/kWh

(chart)

Small hydro
Wind
Solid biomass < 5 MW and
biogas < 500 kW
Ave. solid biomass inc. HBF
waste
Biogas
Liquid biomass
PV
Landfill and sewage gas
Geothermal
[11-07-2007 | Source: E-Control] Market price of electricity % subsidy

Figure 27: Subsidy component of average feed-in tariffs paid in 2006 assuming a market price of 6.5 cent/kWh

The subsidy component is at least 57% for small biomass and agricultural biogas generating stations, which attract average feed-in tariffs of 15 cent/kWh.

In view of the Green Electricity Act's objective of focusing support on technologies capable of attaining commercial maturity, at current costs these systems are unsuitable for further widespread application in full-scale generating stations. Neither would changes of a few percent in the costs of small biomass and biogas generating stations make a significant difference. It should be noted that small biomass and biogas generating stations also attract investment grants of 15–30% in several provinces. These are not included in the subsidy components shown here.

The above chart reveals that even at a market price of 6.5 cent/kWh all the renewable generating technologies apart from small hydro would still be very heavily subsidised. If the market price were to increase from 4.5 to 6.5 cent/kWh, the subsidy component for small biomass and agricultural biogas systems would only decline from 70% to 57 %.

6.3.4 Development of the volume of support payments

The entire support payment for other green electricity has more than doubled between 2004 and 2006 (Figure 28).
In 2008 the support requirement will probably amount to over € 300 m.

(graph)

Increase

2004 – 2008 (2007 and 2008: Projections)

[September 2007 | Source: Energie-Control GmbH, OeMAG]

Figure 28: Support payments for other power produced from renewable energy sources 2004-2008 (2007 and 2008 projections)

Figure 29 shows the development of support payments from 2003 – 2008 for the individual technologies. Demand for biomass has increased the most, for which a support payment of € 171 m is anticipated for 2008.

(graph)

Total “other green electricity”
Solid biomass
Wind
Biogas

(September 2007 | Source: OeMAG, Energie-Control GmbH)

Figure 29: Support payments 2003-2008 according to technology

In contrast, at € 15 m the support requirement for small hydropower is fairly minimal.

Table 20 shows the development of support payments for all technologies (with the exception of small hydropower).

Support payments [in Mio Euro]						
Technology	***2003*** *(market price 2.699 cent/kWh)*	***2004*** *(market price 3.309 cent/kWh)*	***2005*** *(market price 4.073 cent/kWh)*	***2006*** *(market price 4.8 cent/kWh)*	***2007*** *(market price 5.5 cent/kWh)*	***2008*** *(market price 5.0 cent/kWh)*
Wind	24	48	71	78	66	86
Solid biomass	16	25	41	92	150	171
Biogas	17	18	24	34	49	46
Liquid biomass	1	2	3	5	10	8
PV	8	8	8	8	8	8
Other supported renewable electricity (excl. hydro)	3	3	2	2	3	2
Total	**69**	**104**	**149**	**219**	**286**	**321**

[29-08-2007 | Sources: E-Control and GPBGRs]

Please note: The electricity suppliers pass on the green electricity-transfer price-additional expenses based on the market price for futures over the previous years (date of conclusion of contract for the relevant period), for which reason the reference market price for 2006 corresponds to the futures for previous years). This method was not applied to the years 2003-2005 (reference market price as the average value for the relevant year), as no market prices were published by Energie-Control GmbH as stipulated by the Green Electricity Act prior to 2003 and the lower green electricity share would only lead to smaller differences between the two methods.

Table 20: Support payments 2003– 2008 according to technology

The following table shows the annual volume of support payments for the funding of other green electricity until 2022 according to the Green Electricity Act 2002 and the Green Electricity (Amendment) Act 2006.

(graph)

Volume of support payments under the Green Electricity (Amendment) Act (draft bill +17m/year)
% green electricity share
Required support payments according to feed-in tariff order Dec. 2002
Total burdens based on feed-tariff order 2002
Green electricity generating stations approved before end of 2004

[Source: Energie-Control]

Figure 30: Volume of support payments for other renewable energy sources up to 2022

The implementation of the Austrian Green Electricity Act of 2002 results in a total budget need of 3 billion Euro. The Green Electricity (Amendment) Act in 2006 added another billion Euro to this amount. Overall, this means a financial need of 4 billion Euro for green electricity. With a population of approximately 8 million in Austria, this means 500 Euro per capita.

6.3.5 Allocation for new green electricity generating stations

The additional resources earmarked in the Green Electricity (Amendment) Act 2006 for additional, new green electricity generating stations for 2006 (half-year budget) were largely exhausted. In 2007, by 15.10.2007 resources were 50% exhausted for biomass and photovoltaic power, 18% for wind power and only 3% for biogas (Table 17).

Allocation management in € residual available contractable feed-in tariff volume				
Situation	Solid biomass	Biogas	Wind	PV and other
01.10.2006 rounded, half supplement allocation 1.1.2007	4,200,000	4,050,000	5,600,000	950,000
29.12.2006	632,368.91	155,980.08	217,675.96	172,710.79
01.01.2007	9,048,197.00	8,373,919.72	11,403,171.00	2,100,328.0
22.10.2007	8,954,297.28	8,110,523.47	9,392,396.40	1,023,259.19

[Source: OeMAG publications for 1.10.2006 and 1.1.2007: Calculations by Energie-Control GmbH based on OeMAG data]

Table 17: Feed-in tariff allocation management 1.10.2006 – 22.10.2007

The scarcity of raw materials and the associated price increases will also lead to fewer subsidies being claimed for raw material-dependent technologies over the next few years.

These effects due to the scarcity of raw materials should not be compensated for through further increases to subsidies, as these raw materials (biomass, feed, etc.) have also become more expensive and scarce for other uses as well as for electricity generation, and the unilateral promotion of their use for electricity generation would lead to unjustifiable disadvantages for other uses (material use, use as animal feed).

7 Attainment of the objectives of Directive 2001/77/EC

Directive 2001/77/EC establishes the objective of increasing the proportion of electricity generated from renewable energy sources in the EU. The annex to the directive sets a specific indicative (not mandatory) target of increasing the renewable energy sources (RES) contribution to gross electricity consumption in the EU-15 from 13.9% in 1997 to 22% in 2010. [6]
The European Commission evaluation report of May 2004[7] predicts that on current trends the 22% indicative target for the EU-15 will be missed, and that a share of only 18–19% will be achieved. In other words, the increase from the initial level of about 13.9 % in 1997 will be only about half as high as that required by the indicative target.

Indicative targets for the individual member states are set out in the annex to the directive. Austria is a special case in that it was the only country already drawing over half of its electricity consumption - some 70% — from RES in the 1997 base year, mostly from hydropower.[8] It was therefore set an indicative target of 78.1%, explained by a footnote in the annex:

"Austria states that 78.1% would be a realistic figure, on the assumption that in 2010 gross national electricity consumption will be 56.1 TWh."

In view of Austria's far higher starting point than other member states and of growing electricity demand, failure to take account of the absolute reference value for consumption would have resulted in unjustifiable discrimination. Merely to maintain the 70% share, Austria would have had to expand its RES generating capacity much more rapidly than other member states would have to do to attain their indicative targets.

Unlike the sub-targets for small hydro and "other" supported renewable electricity established by the Green Electricity Act, the directive counts all electricity derived from renewable energy sources, including large hydro power, own use and non-supported renewable electricity, e.g. biomass-fired autogeneration stations.

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[6] Subsequently amended to an increase from 12.9 % to 21% for the EU-25
7 Com (2004) 366 FINAL, downloadable from:
http://europa.eu.int/comm/energy/res/legislation/doc/country_profiles/com_2004_366_en.pdf
[8] Followed by Sweden (49.1%), Portugal (38.5%) and Spain (19.9%)

Because of the compound growth rate effect of the high initial level of 70% under conditions of rising electricity demand (large amounts of additional RES generating capacity needed merely to maintain a level of 70%), no forecasts based on realistic demand growth assumptions indicate that Austria has a chance of hitting the 78.1% target by 2010.

(graph)

16% growth in 1997 - 2010
period relative to base value

Despite massive 9 TWh growth over 1997 -2010
period declining share due to high demand growth
and base value

Cumulative increase since 1997 in TWh - right

Share of renewable energy in gross domestic electricity consumption- left
Share of renewable energy in 56.1 TWh - left

Figure 31: Renewable energy sources as a proportion of gross national electricity consumption, 1997–2010

In an average year Austrian hydro power output is about 37 TWh. This corresponds to some 66.5% of electricity consumption in 1997 (56.1 TWh). If hydro power output remains roughly constant in absolute terms its share of total consumption declines by at least 1.2% per annum as a result of demand growth. In other words, a 1.2% annual growth rate for other RES is required merely to make good the fall in hydro power's percentage contribution. The cumulative growth required between 1997 and 2010 would be about 15%.

After 2010 implementation of the Water Framework Directive is likely to present an additional obstacle to renewable electricity generation. Water supply in 2006 was below average, with an energy capability factor of 0.96. Consequently, hydro power provided only around 35 TWh of electricity, meaning that its share of total consumption fell to 57% (based on reference figure of 56.1 TWh). The table below compares the evolution of renewable electricity generation and gross national electricity consumption between 1997–2006. A forecast for the period up to 2010, based on the Green Electricity (Amendment) Act, is also included, as is a comparison of the trend in Austria with average figures for the European Union.

Attainment of targets under Directive 2001/77/EC	1997**	2006 Actual	Additional capacity expected to come on line in 2006-2007[1]	Additional capacity expected to come on line in 2008-2010[2]	Additional capacity expected to come on line in 2006-2010[3]	Total output in 2010	Growth 1997-2010
	GWh	GWh	GWh	GWh	GWh	GWh	GWh
Gross domestic electricity consumption (inc. pumped storage) ****	56,083	70,244				74,725	18,642
Large hydro (> 10 MW) excl. pumped storage***	31,400	31,102			1,202	33,600[4]	2,200
Small hydro (< 10 MW) inc. 5% own use	4,152	3,840	720	100		4,842[4]	690
Whereof supported small hydro		1,806					
Medium-sized hydro (investment grants under Green Electricity Act [Amendment])				375	-	375	375
"Other" supported green electricity (wind, biogas, etc.) inc. 5% own use	605	3,895	1,325	643	-	5,863	5,258
"Other" non-supported green electricity (lye, etc., incomplete statistical capture)*****	845	1,450			150	1,600	755
Total renewable generation	37,002	40,287	2,045	1,118	1,352	46,280	9,278
Pro rata Austrian contribution to EU-25 target scenario	7,235					15,692	8,458
(from 12.9% in 1997 to 21% in 2010							
Pro rata Austrian contribution to forecast EU-15 scenario (from 14% in 1997 to 19% in 2010)	7,852					14,198	6,346
RES contribution 56,100 GWh ***	66%	72%	4%	2%	2%	82%	
RES contribution to gross domestic electricity consumption	66%	57%				62%	

1 On basis of Green Electricity Act, BGBl I No. 149/2002
2 On basis of Green Electricity Act, BGBl I No. 105/2006
3 Increase of 780 GWh (2.4%) in large hydro capacity expected to result from plant upgrading; 150 GWh gain in "other", non-supported green electricity expected to arise from industrial capacity expansion, e.g. lye utilisation in the paper industry
4 Energy capability factor for run-of-river generating stations was 0.96 in 2006. 2010 assumed to be an average year so production of hydro is increasing not only because of additional capacity.
* Own use by "other" renewable generating stations and small hydro stations estimated

** Data for small hydro and biomass drawn from 1998 operating statistics -69-
*** 70% base level in 1997 in EU directive apparently arrived at by inadvertent inclusion of pumped storage; energy capability factor for run-of-river generating stations was 0.98 in 1997 and 0.96 in 2006; generation by pumped storage stations (less pumping power) can vary between approximately 9.5 TWh/year and approximately 10.8 TWh/year; increase between 1997-2004 was principally due to Freudenau (plus 960 GWh) and Lambach (plus 64 GWh) generating stations and increased output from pumped storage stations (plus 700 GWh). 2010 assumed to be an average year. Efficiency of 70% assumed for pumped storage.
**** Estimated annual electricity demand growth in 2004-2010 period 1.6% (on basis of WIFO high efficiency scenario of June 2005, p.75)
*****Figures for "other non-supported green electricity can vary from 1 200-1 500 GWh depending on the primary energy sources used

In the first version of the 2007 Green Electricity Report a number of figures for green electricity were unintentionally taken from the 2006 Green Electricity Report.

[October 2007 / Source: Energie-Control GmbH]

Table 21: Attainment of the indicative target established by Directive 2001/77/EC

If these projections hold good Austria will be producing 9 278 GWh more renewable electricity in 2010 than in 1997 — well above the average increase in the European Union. The DG-TREN evaluation report of 1997-2010 sees the EU-15 share of electricity production from RES rising from 14% to 18-19%. Austria's pro rata share of this increase would amount to about 6 300 GWh — considerably less than the forecast 9 278 GWh.

Even if the average EU-25 target of an increase from 12.9% to 21% were applied to Austria, the forecast increase of 9 278 GWh would still exceed the 8 458 GWh rise required for attainment of the target.

(graph)

Average EU-25 target
from 12.9% to 21%

On average
Austria overfulfils
target of increase
from 12.9% to
21% by approximately 1
TWh

[Source: Energie-Control GmbH]

Figure 32: Austria's pro rata contribution to attainment of the target established by Directive 2001/77/EC

This above-average growth in renewable energy output is all the more remarkable in view of the fact that Austria's wind farm sites are less favourable than those of coastal countries, and thus require far higher subsidies, and that wind power has been the main driver of renewable development across Europe in recent years. Looking at Europe as a whole, the potential of biomass and biogas is relatively limited compared to wind power.

On present trends, Austria already seems to be well on the way to making its pro rata contribution to attainment of the 2010 target of 21%, although the latter will not be met by the EU as a whole, and as a landlocked country it is at a disadvantage in exploiting the key RES — wind power.

8 Evaluation of the development of green electricity and CO2 reduction from the viewpoint of national climate protection

In 2006, 40 287 GWh of electricity were generated from renewable energy sources in Austria.
If this volume of electricity were produced from combined cycle gas and steam generating stations[9], this would lead to almost 18 million tonnes of CO2 emissions, which can be prevented by means of electricity generation using renewable energy sources.
The generation of electrical energy using new combined cycle gas and steam generating stations actually causes CO2 emissions of approximately 0.44 tonnes per MWh of electricity generated, while no CO2 is emitted when electrical energy is generated from renewable energy sources (hydropower, wind) or in the case of sustainable forest or agricultural management only to the extent to which it is extracted from the atmosphere and absorbed during forest and energy crop growth.
The additional amounts of green electricity generated in line with the Green Electricity Act 2002 in 2006 of over 4 000 GWh lead to a CO2 reduction of approximately 1.8 million tonnes.

The CO_2 reduction costs shown in the chart below were calculated by dividing the subsidy per kWh (in simple terms, the feed-in tariff less the average market price) by the average emissions avoided by a modern combined cycle gas and steam generating station (0.44 t CO_2/MWh or 0.44 kg CO_2/kWh).

On the basis of the average feed-in tariffs in 2006 and the above ratios, the Green Electricity Act gives rise to the CO_2 avoidance costs depicted in Figure 33.

The balancing energy costs for wind power of 1.2 cent/kWh lead to CO2 avoidance costs of € 81 per tonne of CO2.

[9] Reference scenario for the assessment of new green electricity generating stations

(graph)

Small hydro
“other” renewables
Wind
Solid biomass inc. HBF waste
Biogas
Liquid biomass
PV
Landfill and sewage gas
Geothermal
CO2 sequestration

CO2 price in the second trading period: 22.67 €/t

[18-07-2007 | Source: Energie-Control GmbH]

Figure 33: CO2 reduction costs for renewable technologies

With the exception of small hydro these are relatively high cost levels as compared to other approaches such as CO2 sequestration (€30–50/t CO2) or the conventional Kyoto mechanisms (emission trading, and the Joint Implementation and Clean Development Mechanism [JI/CDM]) with reduction costs of €5–7/t CO2 for JI/CDM and €20/t CO2 for emission trading.

Please refer to the second National Action Plan for more detailed information concerning the content of the national climate protection strategy.

9 The traceability system in Austria

9.1 Overview

According to the provisions of Directive 2001/77/EC, the requirements concerning traceability were to be implemented in the Member States by mid-2004. In Austria this legislation has already been fully implemented with the entry into force of the Green Electricity Act on 1 January 2003. There is now a fully functional traceability system, including an electronic electricity certificate database, which is administered by Energie-Control GmbH in cooperation with the grid operators.

9.2 Legal basis

Section 8 of the Green Electricity Act implements the requirements concerning the issue of guarantees of origin as described in Article 5 of Directive 2001/77/EC. Based on these principles, every operator of a green electricity generating station has the right to receive from the grid operator, to whose grid the generating station is connected, a guarantee of origin for energy fed into the grid.

According to Section 8 of the Green Electricity Act, a guarantee of origin must include the following information:

- Amount of energy generated
- Nature and maximum capacity of the generating station
- Time and location of the generation
- The energy sources used

The legal requirements allow the issuer to select the format (paper or electronic), while the period and unit are determined by the grid operator.

The supervisory authority for the issue of guarantees of origin is the State Governor.

9.3 Quality criteria for the issue of guarantees of origin and implementation in Austria

In connection with the traceability system, Article 5(5) Directive 2001/77/EC stipulates the following (…) *describe in the report according to Article 3(3) the measures implemented in order to guarantee the reliability of the traceability system.*
The reliability of the traceability system depends essentially on the factual accuracy of the available information. This accuracy may affect several levels of the transfer of information:

1. Issue of the guarantee of origin
   a) Certificate concerning the energy produced
   b) Certificate concerning the energy sources used
2. Transfer of the guarantee of origin
3. Use of the guarantee of origin

9.3.1 Issue of guarantees of origin

9.3.1.1 General quality criteria

At the first level of information transfer two areas can be identified, in which incorrect information can occur. Incorrect information can concern the amount of energy produced and the primary energy source used. It is important that the relevant information is confirmed by an independent third party (e.g. regulator or certification agencies), as an essential quality characteristic aimed at preventing incorrect information in the above-mentioned areas. Together with this requirement, it is also extremely relevant whether one or more agencies is permitted to issue the certificate. Sole authorisation to issue certificates prevents potential errors that may occur when several issuing offices work have to be coordinated.

9.3.1.2 Implementation in Austria

In 2004, Energie-Control GmbH made the electricity certificate database available for the issue of guarantees of origin. For amounts of energy that are handled by OeMag, the guarantees of origin are automatically generated in the database for each month and automatically transferred to the end user for the account of the electricity suppliers according to output.

Each electricity supplier thus receives the same share of renewable energy.[10]

As well as processing these amounts of energy, the database can also be used on a voluntary basis by any grid operator or accreditation agency for the issue of guarantees of origin or certificates in accordance with Section 45a(7) EIWOG. Many grid operators have made use of this facility and a large proportion of Austrian electricity generation is managed using the electricity certificate database. This increases reliability both in terms of guarantees of origin and power labelling, as a database prevents the risk of fraudulent activities or double counting.

In Austria, two independent agencies work to guarantee the quality of information for the issue of guarantees of origin. The use of (different) primary energy sources is confirmed by notification from the relevant State Governor. Confirmation of the amount of energy is provided by the grid operator and thus again by an independent body that has sole authorization in this area. This means that in Austria only one competent body can exist for the issue of guarantees of origin. In terms of quality of information for the issue of certificates, Austria is therefore already at a very advanced stage.

9.3.2 Transfer of guarantees of origin

9.3.2.1 General quality criteria

In the European context, guarantees of origin are used for various purposes. They can be used in the following ways:

- For the transfer of green electricity between Member States in order to meet the indicative targets of Directive 2001/77/EC
- As evidence for power labeling
- In order to secure state assistance (feed-in tariffs, quota models)
- As evidence for a quality label

[10] For more detailed information see https://www.stromnachweis.at

- For marketing purposes

As guarantees of origin are highly valuable on the market, it is vital that the same information cannot be transferred ("sold") several times. In order to avoid the multiple selling of information, the technical design of the traceability system is important. With an electronic database the duplication of information is impossible. If certificates are issued using other media (paper), there is the potential risk of multiple selling.

9.3.2.2 Implementation in Austria

§8 Green Electricity Act does not stipulate which medium should be used by the grid operator for the issue of guarantees of origin. It is possible to use the above-described database or to issue paper certificates. As a result of this option any potential double transfer is prevented by law. There is also scope for improvement in this area and an electronic solution is recommended.

9.3.3 Use of guarantees of origin

9.3.3.1 General quality criteria

The risk of double use of a guarantee of origin is closely linked to a (potential) multiple transfer (e.g. for power labelling and for quality labels, which exist independently). For this reason, it must be ensured that different market participants can be involved in the use of guarantees of origin (e.g. when generating station operators apply for feed-in tariffs or electricity traders apply for tax reductions). Precisely this fact leads to potential interface problems and multiple uses, for which reason the technical design of the traceability system also assumes major significance in this case. Within the database, the guarantee of origin can only be used for one purpose and not multiple purposes. Obviously, several systems can be operated parallel with a guarantee of origin (so that the receipt of assistance does not prevent it being used for power labelling), but clear delimitations must be implemented within the database and particularly at interfaces to other systems.

9.3.3.2 Implementation in Austria

The main area in which guarantees of origin are used in Austria is for power labelling, as Section 45a(7) WIWOG determines that certificates from the accredited agencies may be dispensed with, provided guarantees of origin exist.

As described in Chapter 9.3.2.2, improvements are also necessary at this level of information, as potential fraudulent “double use” is not dealt with by any legal principle that prevents such activities. The mandatory use of an electronic database would represent a solution in this area together with the clear definition of interfaces to other systems (both legally and technically).