



EWEA
WIND IS POWER

WIND POWER TARGETS FOR EUROPE: **75,000 MW** by 2010

BRIEFING
THE EUROPEAN WIND ENERGY ASSOCIATION

OCTOBER 2003



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Overview

Wind power is the world's fastest growing energy technology. The wind power targets set by the industry and by the European Commission during the last decade have all been exceeded.

The European Wind Energy Association has set new targets for the EU-15 to have installed 75,000 MW by 2010 and 180,000 MW by 2020. This is a 25% increase from the targets set in 2000 and a near doubling from those set in 1997. Against a background of robust market growth and technological progress to date, these targets are conservative, and achievable.

This briefing provides a breakdown of the new target across different parameters such as costs, electricity, employment, greenhouse gas emissions and the impact on the wider electricity generation sector.

Due to its size, scale, speed of deployment and rapid market growth, wind power is essential for the EU to meet the targets set in the 2001 Renewable Electricity Directive, to increase the amount of renewable electricity from 14% in 1997 to 22% in 2010.

The revised target for wind power set by the industry means that wind will meet half of the total Directive target.

The strong development of wind power to date can continue in the coming years as long as the clear commitment of the European Union and Member states to wind power development continues to strengthen, and that this support is translated into construction of wind farms. If these positive trends continue, the 75 GW target will be reached.



At the annual Spring meeting of the European Council in March 2003 the European Heads of State invited Member States to accelerate progress towards meeting the EU target of 22% electricity from renewables by 2010 and encouraged national targets.

Keeping on target will ensure that over this decade, the wind power industry will continue to advance the technology, further reduce generation costs, create thousands of jobs, reinforce Europe's global leadership in wind power technology, manufacturing and markets, create export opportunities, contribute substantially to security of supply, and over this decade become one of the world's most important electricity generating technologies.

SUMMARY OF THE WIND INDUSTRY TARGET IN EU15 by 2010

- 75,000 MW installed including 10,000 MW offshore
- Generating 5.5% of European electricity
- Annual electricity generation of 167 TWh
- 28% of total new generation capacity *
- 10.6% of total European installed generation capacity
- Provide power equivalent to the needs of 34 million European households, 86 million people
- Investment value of €49 billion*
- Deliver 50% of the EU's Renewable Energy Directive target
- Meet more than 30% of the EU Kyoto Protocol commitment
- Cumulative avoided fuel costs of €13.2 billion
- Annual CO₂ savings of 109 million tonnes
- Annual avoided external cost of €1.8-4.6 billion
- Cumulative CO₂ savings of 523 million tonnes*
- Cumulative avoided external costs of €9.4-24 billion*
- 25% increase over previous wind industry target set in 2000

**period 2001-2010*

SUMMARY OF THE WIND INDUSTRY TARGET BY 2020

- 180,000 MW installed, including 70,000 offshore
- Generating 12.1% of European electricity
- Annual electricity generation of 425 TWh
- 37% of total new generation capacity installed 2010-2020
- 21% of total European installed generation capacity
- Provide power equivalent to the needs of 85 million European households, 195 million people

WIND POWER - CURRENT STATUS



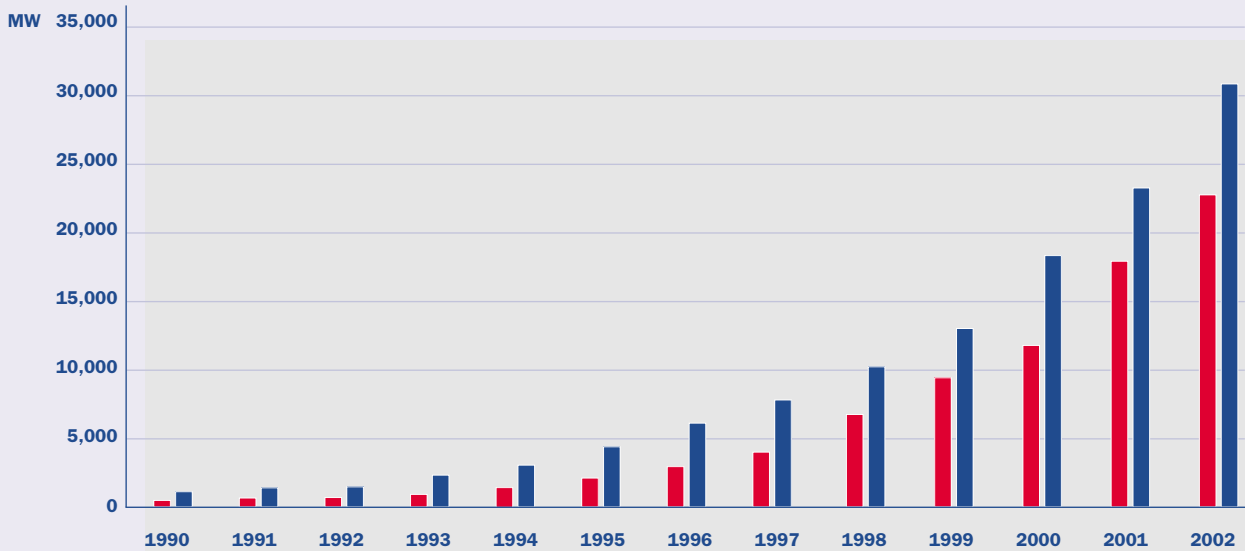
The progress of wind power around the world in recent years has been impressive. By the end of 2002 more than 31,000 MW of electricity-generating wind turbines were operating in fifty countries. Of these, more than 23,000 MW were installed in the European Union. 2002 itself was a record year for the EU, with over 5,800 MW installed.

The average annual market growth in Europe over the last decade has been in the region of 40%. Since 1992 cumulative installed capacity has multiplied twenty seven times (Figure 1), whilst the capacity built in 2002 was twenty seven times bigger than in 1992 (Figure 2). Europe dominates the global wind market. The most successful markets for wind power in recent years have been Denmark, Germany and Spain. Outside Europe, India and the United States are leading markets.

WIND POWER STATUS IN EUROPE BY THE END OF 2002

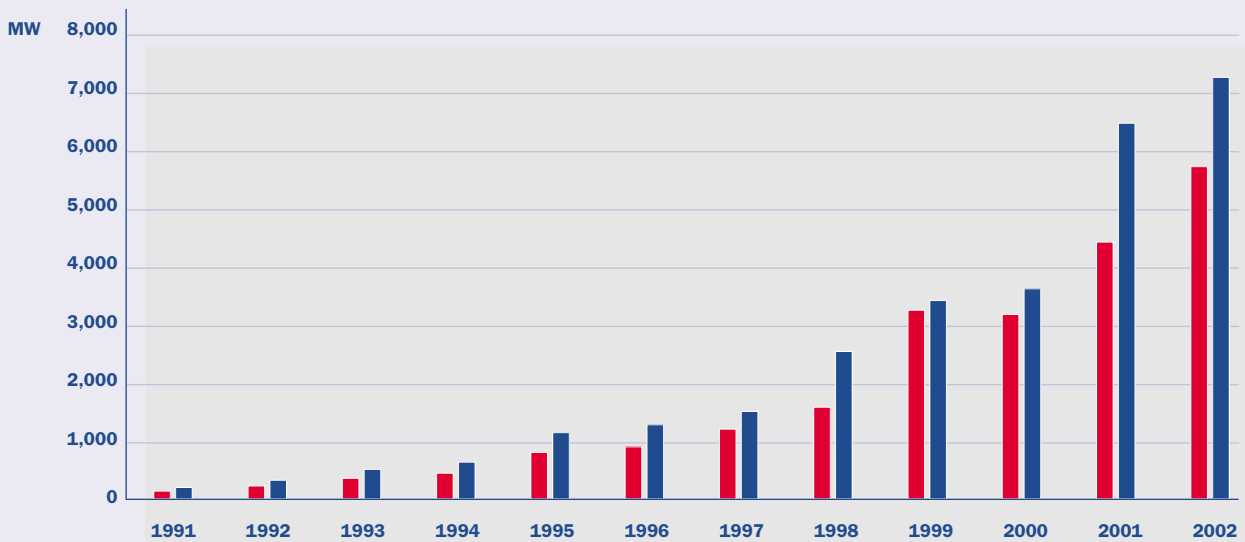
- ❑ Generated enough power to supply the equivalent needs of 10.3 million European households, 25.7 million people
- ❑ Supplied 2% of European electricity needs
- ❑ Over 89% of the global wind power market was supplied by European manufacturers
- ❑ 87% of global wind power capacity installed in 2002 was in Europe
- ❑ 75% of total global wind power capacity is installed in Europe
- ❑ The average growth rate of the European wind industry in the last five years has been 35%
- ❑ By mid 2003, installed wind power in Europe was close to 25,000 MW (See map p.25)

FIGURE 1: CUMULATIVE WIND POWER INSTALLED CAPACITY (MW)



European Union	439	629	844	1,211	1,683	2,497	3,476	4,753	6,453	9,678	12,887	17,315	23,056
World	1,743	1,983	2,321	2,801	3,531	4,821	6,104	7,636	10,153	13,594	17,357	23,857	31,128

FIGURE 2: ANNUAL WIND POWER INSTALLED CAPACITY (MW)



European Union	190	215	367	472	814	979	1,277	1,700	3,225	3,209	4,428	5,871
World	240	338	480	730	1,290	1,283	1,532	2,517	3,441	3,763	6,500	7,271

WIND POWER PROJECTIONS AND TARGETS

In 1997 the European Commission White Paper on Renewable Sources of Energy set the goal of doubling the share of renewable energy in the EU from 6% to 12% by 2010. One of the targets of the EU White Paper was to increase the EU electricity production from renewable energy sources from 337 TWh in 1995 to 675 TWh in 2010. Within this target, the goal for wind power was for 40,000 MW (40 GW) of installed capacity in 2010, which could produce 80 TWh of electricity and save 72 million tonnes of CO₂ per year. The consequent Directive 2001/77/EC on the promotion of electricity from renewable energy sources sets national indicative targets for the contribution of electricity from renewable energy sources as a percentage of gross electricity consumption. The overall Community goal is to increase renewables' share of electricity from 14% in 1997 to 22% in 2010.

The Directive states that:

'The potential for the exploitation of renewable energy sources is underused in the Community at present. The Community recognises the need to promote renewable energy sources as a priority measure given that their exploitation contributes to environmental protection and sustainable development. In addition this can also create local employment, have a positive impact on social cohesion, contribute to security of supply and make it possible to reach Kyoto targets more quickly. It is therefore necessary to ensure that this potential is better exploited within the framework of the internal electricity market.'

'The promotion of electricity produced from renewable energy sources is a high Community priority as outlined in the White Paper on Renewable Energy sources for reasons of security and diversification of energy supply, of environmental protection and economic cohesion.'

In 1997 EWEA adopted the White Paper target of 40,000 MW by 2010 (Fig. 3,4 & 5). Three years later EWEA revised its target to 60,000 MW by 2010 (including 5,000 MW offshore) and 150,000 MW by 2020 (including 50,000 MW offshore).

In 2002, EWEA published the report 'Wind Force 12', which showed that wind power is capable of supplying 12% of the world's electricity within two decades, even if the overall electricity demand increases by two thirds in that period.

The study is not a long-term forecast or a prediction but rather a feasibility study for future scenarios taking into account the physical limitations for large-scale development of wind power. It assesses and compares actual industrial growth patterns seen in the wind power sector so far, with hydro and nuclear power development.

In this 12% global scenario, Europe (defined more broadly as OECD Europe under IEA classifications) will install 100 GW by 2010, 230 GW by 2020, producing 564 TWh/year and save 338 million tonnes of CO₂ per year. Equally important, it is envisaged that around 1,000 GW of wind power will be installed in non-European countries during the same period.

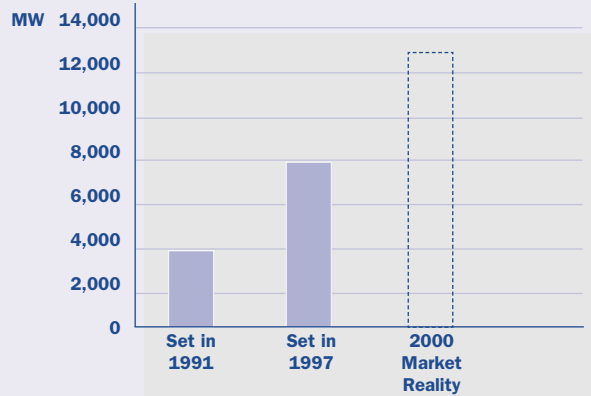
BTM Consult in its recent 'World Market Update 2002' predicts that the cumulative capacity in Europe will reach 58 GW by the end of 2007, and 108 GW by 2012.

The estimated figures for wind power, in the Commission's 1999 study 'EU energy outlook for 2020' are significantly lower: 15.3 GW in 2005, 22.6 GW in 2010 and 45.2 GW in 2020. The 2010 figure has already been reached at the end of 2002.

The International Energy Agency (IEA) estimations in the Reference Scenario, presented in the recent World Energy Outlook 2002, are also very conservative and are not reflecting the current trends in the market: 33 GW in 2010, 57 GW in 2020 and 71 GW in 2030. Given the current rate of installation in the EU (almost 6 GW in 2002) and the actual growth rates during the previous years, it would mean that the trend should be completely reversed in the next few years with continuously decreasing rates of installation. Even the predictions in the Alternative Policy Scenario are very conservative.

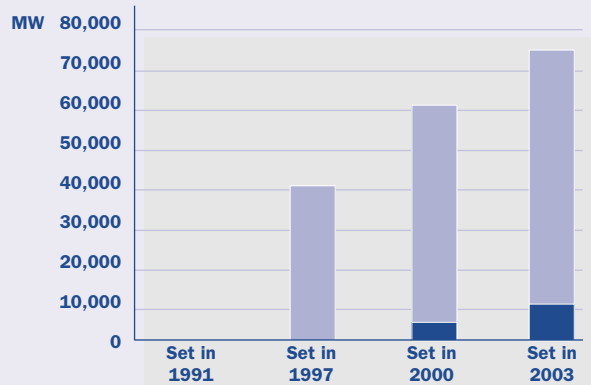
Evolution of EWEA Targets ...

FIGURE 3: EWEA TARGETS FOR 2000 (MW INSTALLED IN EU)



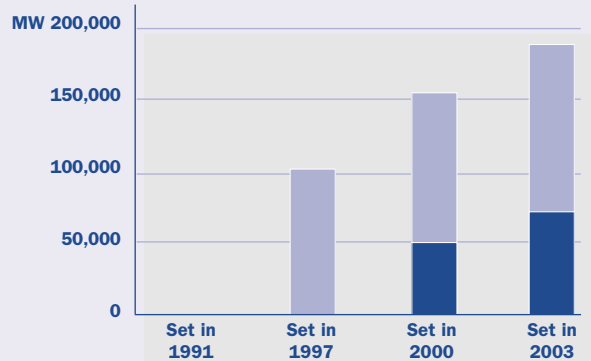
MW Onshore	4,000	8,000	12,887	-
MW Offshore	-	-	-	-

FIGURE 4: EWEA TARGETS FOR 2010 (MW INSTALLED IN EU)



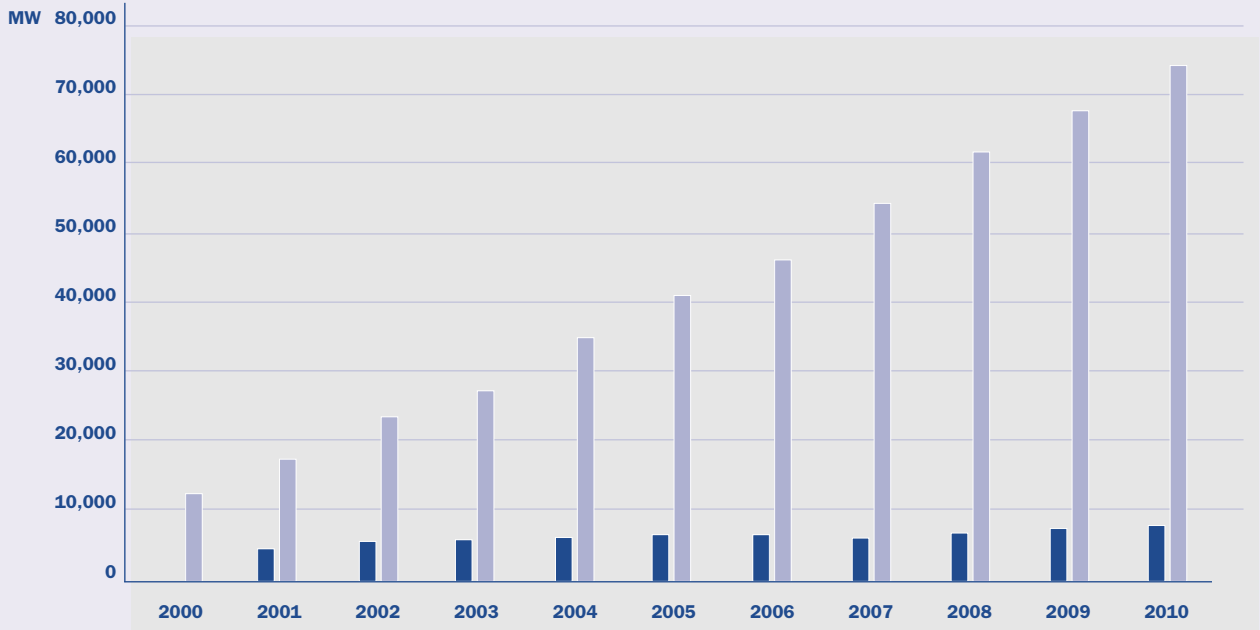
MW Onshore	-	40,000	55,000	65,000
MW Offshore	-	-	5,000	10,000

FIGURE 5: EWEA TARGETS FOR 2020 (MW INSTALLED IN EU)



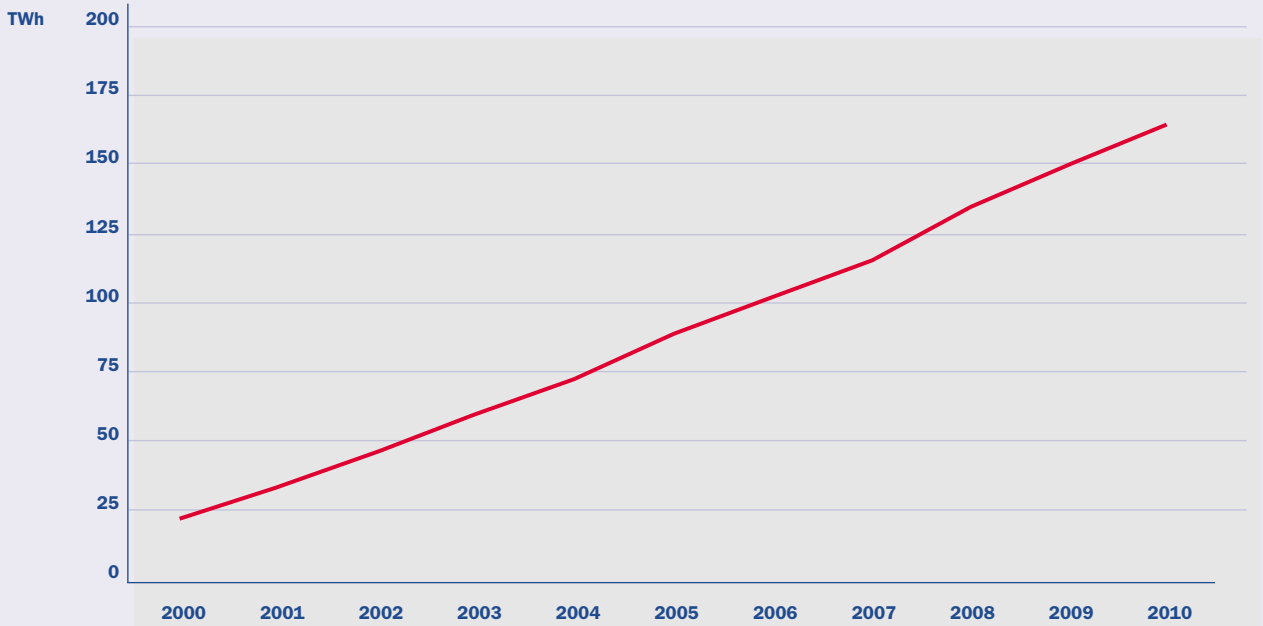
MW Onshore	-	100,000	100,000	110,000
MW Offshore	-	-	50,000	70,000

FIGURE 7: WIND POWER TARGET PROJECTIONS: MW



New capacity (MW)		4,500	5,700	5,900	6,100	6,300	6,450	6,600	6,750	6,900	7,000
Cumulative Capacity	12,800	17,300	23,000	28,900	35,000	41,300	47,750	54,350	61,100	68,000	75,000
Annual Growth of New Capacity			26.7%	3.5%	3.4%	3.3%	2.4%	2.3%	2.3%	2.2%	1.4%
Annual Growth of Cumulative Capacity		35.2%	32.9%	25.7%	21.1%	18%	15.6%	13.8%	12.4%	11.3%	10.3%

FIGURE 8: WIND POWER TARGET PROJECTIONS: TWh



Energy Produced (TWh)	22,5	32,4	44,8	58,3	72,2	86,5	101,8	117,4	133,3	150,3	167,4
Cumulative Capacity	12,800	17,300	23,000	28,900	35,000	41,300	47,750	54,350	61,100	68,000	75,000
Capacity Factor	0.2	0.25	0.25	0.26	0.26	0.26	0.27	0.27	0.27	0.28	0.28

SETTING TARGETS ACROSS EUROPE

Given the current distribution of wind power in the EU 15, the historical rates of growth, the wind potential of each country, and the current status of the policies and targets of each Member State, a possible distribution of the total installed capacity for each Member State in 2010 is shown in Table 1.

In this table, the projected capacities are shown together with the installed capacities during the last seven years for each EU Member State.

For the period 2001-2010, Germany, Spain, France, and the UK comprise 74% of the expected total capacity installed. The increase for a certain number of countries, like the Netherlands, Denmark and the UK is based on the foreseen rapid development of off-shore wind during the second half of the decade. Some of the countries like the UK, France, Ireland and Greece have a possibility to increase substan-

tially their projected installed capacity if the framework conditions become more favourable for renewables and several existing barriers are removed.

The target has been set for the EU15 countries. By mid 2003, wind power in 11 non-EU European countries totals 278 MW, 1.1% of total European installed capacity (See map p. 25). Nevertheless, the potential development in these countries is sizeable, and Directive targets for renewable electricity also apply to Accession countries.

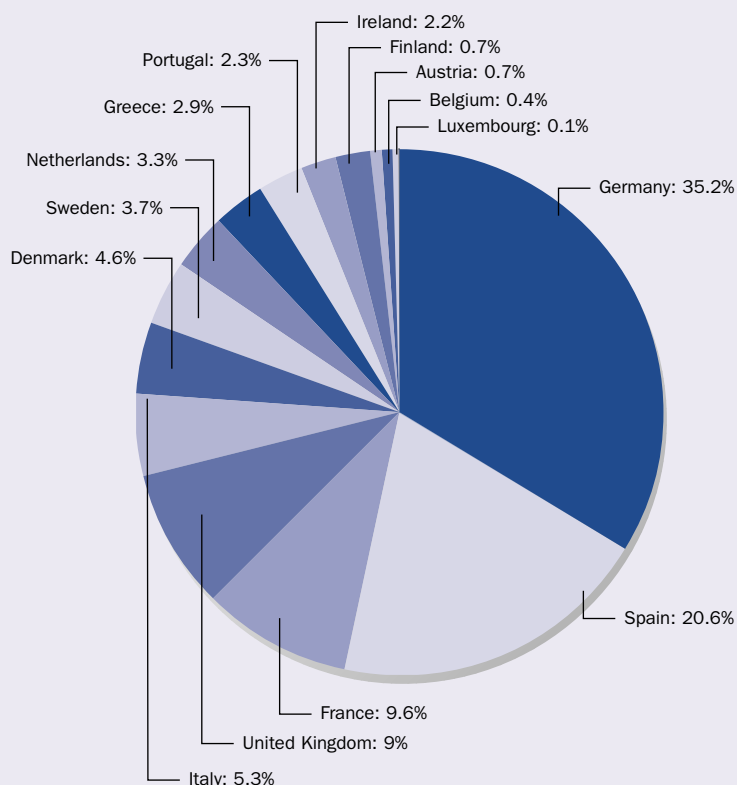
The strong development of wind power to date can continue in the coming years as long as the clear commitment of the European Union and Member states to wind power development continues to strengthen, and that this support is translated into construction of wind farms. If these positive trends continue, the 75 GW target will be reached.



TABLE 1: INSTALLED WIND POWER CAPACITIES BY MEMBER STATE (MW)

	1996	1997	1998	1999	2000	2001	2002	2010
Austria	10	20	30	34	77	94	139	500
Belgium	4	4	6	6	13	31	44	250
Denmark	842	1,129	1,443	1,771	2,417	2,489	2,880	5,000
Finland	7	12	17	39	39	39	41	500
France	6	10	19	25	66	78	145	6,000
Germany	1,552	2,081	2,875	4,442	6,113	8,754	12,001	28,000
Greece	29	29	39	112	189	272	276	2,000
Ireland	11	53	73	74	118	125	137	1,500
Italy	70	103	180	277	427	697	785	3,700
Luxembourg	2	2	9	10	10	15	16	50
Netherlands	299	319	361	433	446	493	688	2,500
Portugal	19	38	60	61	100	125	194	1,500
Spain	249	512	834	1,812	2,235	3,337	4,830	15,000
Sweden	103	122	174	220	231	290	328	2,500
United Kingdom	273	319	333	362	406	474	552	6,000
European Union	3,476	4,753	6,453	9,688	12,886	17,313	23,056	75,000

FIGURE 9: PROJECTED WIND POWER CAPACITY BY MEMBER STATE 2001 - 2010



Countries	Projections 2001-2010: MW
Germany	21,887
Spain	12,765
France	5,934
United Kingdom	5,594
Italy	3,273
Denmark	2,583
Sweden	2,269
Netherlands	2,054
Greece	1,811
Portugal	1,400
Ireland	1,382
Finland	461
Austria	423
Belgium	237
Luxembourg	40
European Union	62,113 MW

WIND TARGETS – HOW MUCH ELECTRICITY WILL THIS PROVIDE ?

The electricity output from the wind targets can be expressed in terms of the equivalent amount of household electricity consumed by the average individuals or households in Europe. The calculations are based on official data and forecasts from Eurostat and Eurelectric, and the European Commission's "Energy Outlook to 2020" report. These forecasts assume that whilst population and number of households increase by only a small amount, average household electricity consumption increases by 16% by 2010 and by 30% by 2020. The number of people per household declines by 2020. Therefore the total amount of households or indi-

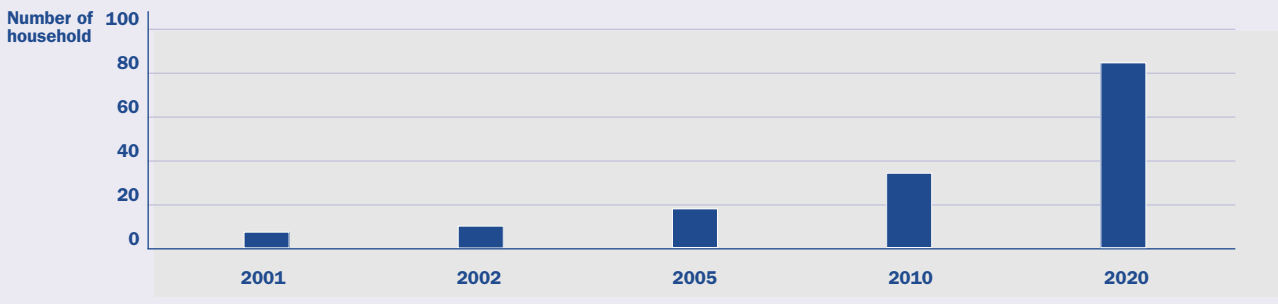
viduals whose average electricity use is provided by the wind power targets is progressively lower as some of the additional wind power targets output is used for the additional consumption patterns. In 2020, for example, wind power will generate 425TWh; this is 50% of the forecast EU household electricity consumption in 2020, but 66% of that consumed in 2001.

TABLE 2: HOUSEHOLD ELECTRICITY CONSUMPTION AND SUPPLY FORECAST

Country	Unit	2001	2005	2010	2020
Austria	TWh	15.00	16.10	17.50	18.70
Belgium	TWh	17.10	18.10	19.50	21.90
Denmark	TWh	9.60	9.50	9.90	10.40
Finland	TWh	19.40	21.50	22.50	23.70
France	TWh	129.74	143.42	157.10	178.20
Germany	TWh	131.00	132.00	132.00	132.00
Greece	TWh	14.50	17.10	20.80	28.40
Ireland	TWh	7.40	8.40	10.00	12.60
Italy	TWh	61.60	65.80	74.20	87.70
Luxembourg	TWh	0.80	0.80	0.90	1.00
Netherlands	TWh	22.90	25.30	28.90	34.50
Portugal	TWh	10.60	11.70	13.60	16.90
Spain	TWh	50.60	60.10	72.60	94.90
Sweden	TWh	43.10	42.40	43.70	44.20
United Kingdom	TWh	115.30	122.50	127.20	136.80
Total EU-15 Consumption	TWh	648	694	750	841
Total EU-15 Consumption	Million KWh	648,640	694,720	750,400	841,900
Total EU-15 Population	Million	378	381	384	386
Average Household Size		2.50	2.50	2.50	2.30
EU-15 Number of Households	Million	151	152	153	167
Average Household Consumption	KWh	4,284	4,558	4,885	5,016
Average consumption per capita	KWh	1,713	1,823	1,954	2,181
Wind Power Production	TWh	32.40	86.50	167.40	425.00
Households supplied by Wind Power	Million	7.56	18.98	34.27	84.72
People supplied by Wind Power	Million	18.91	47.44	85.66	194.86
Households/people supplied by Wind Power	%	5.00	12.45	22.31	50.48

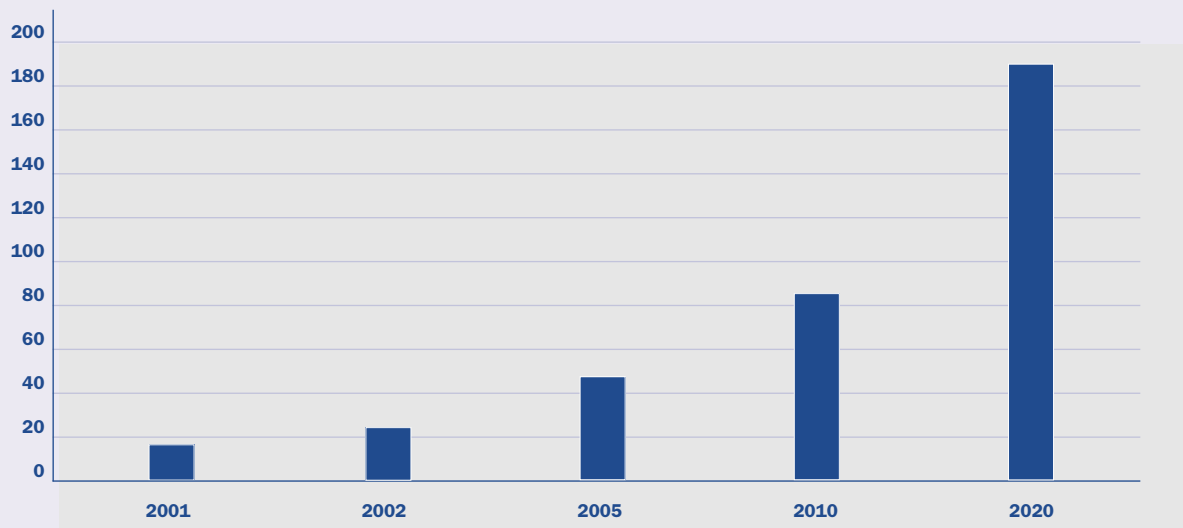


FIGURE 10: EQUIVALENT ELECTRICITY NEEDS MET BY WIND POWER 2001 - 2020 (MILLION HOUSEHOLDS)



European households	7.56	10.29	18.98	34.27	84.72
Wind power production (Twh)	32.4	44.8	86.5	167.4	425

FIGURE 11: EQUIVALENT ELECTRICITY NEEDS MET BY WIND POWER 2001 - 2020 (MILLION PEOPLE)



European people	18.91	25.72	47.44	85.66	194.86
Wind power production (Twh)	32.4	44.8	86.5	167.4	425



ELECTRICITY GENERATION AND WIND POWER IN EUROPE



According to the IEA's World Energy Outlook 2002 the consumption of electricity is expected to increase by 1.6% per year over the period 2001 - 2020. With this assumption the total electricity demand in the EU will increase from 2,572 TWh in 2000 to 3,064 TWh in 2010 and 3,511 TWh in 2020. The total share of the EU's electricity consumption that is generated by wind power will be 5.5% in 2010 and 12.1% in 2020.

The IEA study estimates that the installed power capacity requirements are expected to increase by some 210 GW during this period and additionally approximately 235 GW of new capacity will be required for the replacement of decommissioned plants. Thus, the EU is projected to build approximately 445 GW of new plants over the 2001-2020 period. Wind power can cover a substantial part of this new capacity. As mentioned above, the contribution of wind power is underestimated in the IEA scenario. If we assume that the wind industry targets will be met, wind will then substitute other conventional energies foreseen in the IEA scenario. Assuming that wind power is substituting intermediate loads covered by fossil fuels (gas, oil and coal) with the average efficiency foreseen by the IEA study, the total installed generation capacity of 445 GW will be increased by 63.7 GW in the period 2001-2020 due to the lower capacity factor of wind.

In 2000 wind power represented 2.1% of the total EU generating capacity. This share will increase to 10.6% in 2010 and 21% in 2020.

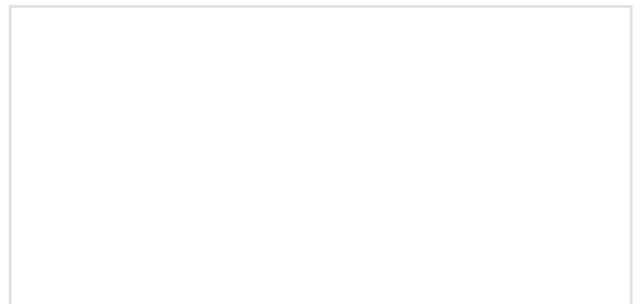
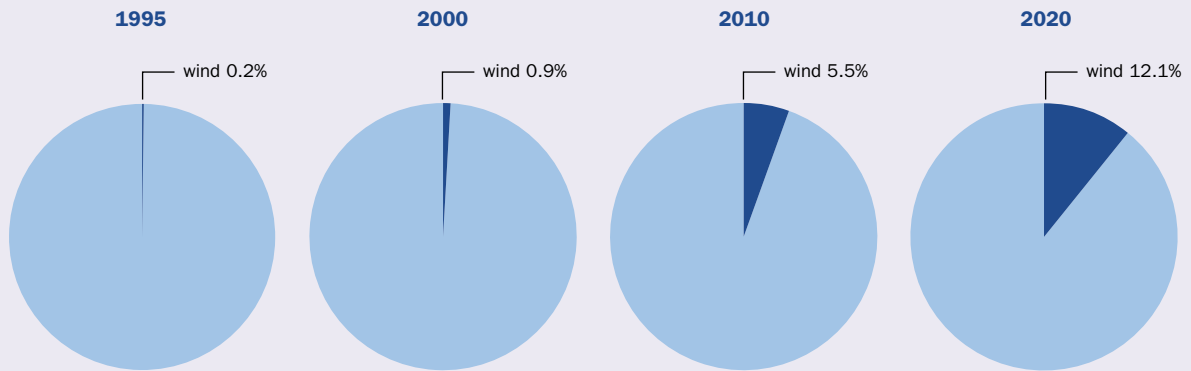
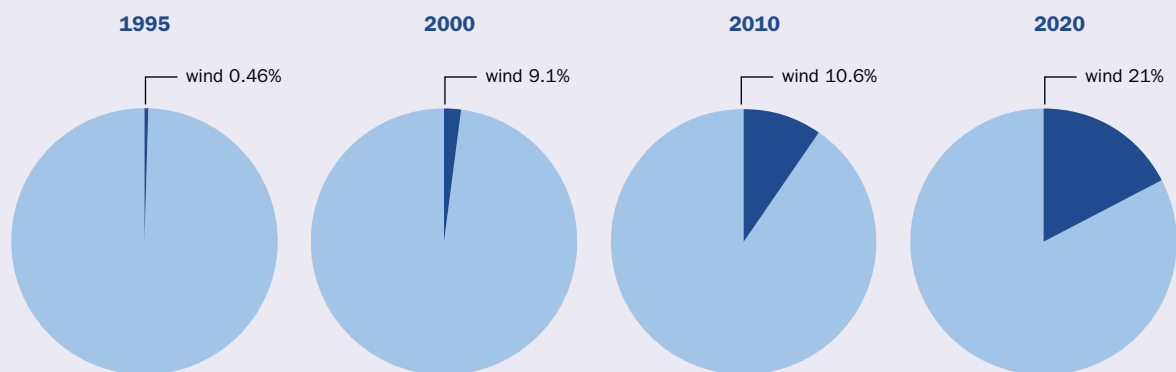


FIGURE 12: CONTRIBUTION OF WIND POWER (TWh) TO ELECTRICITY GENERATION 1995 – 2020, EU



	1995	2000	2010	2020
Total Electricity Generation (TWh)	2,327	2,572	3,064	3,511
Wind Electricity Generation (TWh)	4.1	22.4	168	425
Share of Wind (%)	0.2%	0.9%	5.5%	12.1%

FIGURE 13: CONTRIBUTION OF WIND POWER (GW) TO ELECTRICITY GENERATION CAPACITY 1995 – 2020, EU



	1995	2000	2010	2020
Total Generation Capacity (GW)	538.8	580.7	706	855.4
Total Wind Generation Capacity (GW)	2.5	12.3	75	180
Share of Wind (%)	0.46%	2.1%	10.6%	21%

THE ROLE OF WIND POWER IN NEW ELECTRICITY GENERATION

The leading role that wind power will play in the power generating system of the EU in the coming two decades is even more evident when considering its share of new generating capacity expected to be installed in Europe in the first two decades of this century.

In the period 1995-2000, wind power accounted for 23.4% of net increase in generating capacity across the EU. During the

period 2001-2010 wind power will account for 50% of net increase installed generating capacity and 70.3% during the period 2011-2020 (Figure 14).

Of total new construction of electricity generating capacity, including capacity replacement of decommissioned plants, wind power will represent 27.8% during the period 2001-2010 and 36.9% during the period 2011-2020.

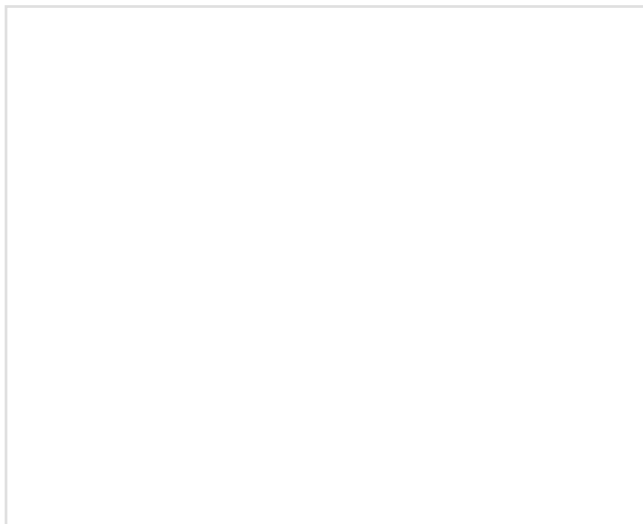
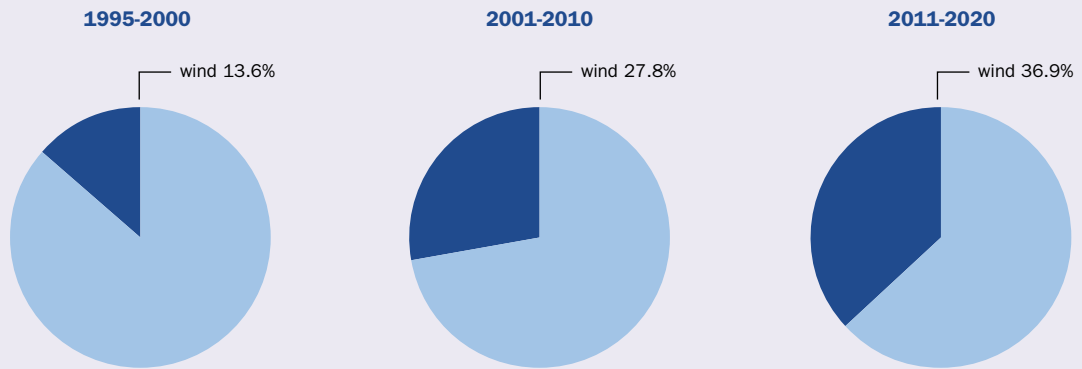


FIGURE 14: CONTRIBUTION OF WIND POWER TO NEW EU GENERATION CAPACITY: GW



	1995-2000	2001-2010	2011-2020
Additional Generation Capacity (GW)	41.9	125.3	149.4
New Wind Capacity (GW)	9.8	62.7	105
Share of Wind (%)	23.4%	50%	70.3%
Capacity Retirement (GW)	30	100	135
Total New Capacity Construction (GW)	71.9	225.3	284
Share of Wind (%)	13.6%	27.8%	36.9%

GREENHOUSE GAS EMISSIONS IN EUROPE

In 1997 in Kyoto the EU made a commitment to reduce its emissions of greenhouse gases (GHG) by 8% by 2008-2012 compared to its 1990 level of emissions. A 'burden sharing approach' sets targets for each of the 15 Member States within the overall commitment made by the EU in Kyoto.

CO₂ is by far the most important greenhouse gas in the EU, accounting for 82% of total GHG emissions in 2000. In 2000, overall greenhouse gas emissions in the EU was 3.5% below the 1990-level and CO₂ emissions were 0.5% below 1990 levels. Thus, the EU achieved its goal of stabilising CO₂ emissions by 2000 at 1990 levels, mainly due to the switch to gas in the UK and the restructuring of the former East German industry and economy. However, in 2002 the European Commission published a report which suggests that with existing measures the EU will not reach its Kyoto target.

EU GHG emissions are projected to decrease by 4.7%, leaving a gap of 3.3% points (161.6 Mt CO₂). CO₂ emissions are projected to decrease only by 2%. In Table 6 the Greenhouse gas emissions are presented for each Member State. The real figures for 1990 and 2000 are shown together with the projections for 2010. The commitment implied for each Member State is also presented as well as the gap between projection and commitment. It is clear that the over-delivery of Germany saves the overall picture. Without the positive contribution of Germany the gap between commitments and projections would double. Besides Germany, only Sweden and the United Kingdom are on track to reach their target (Table 3).

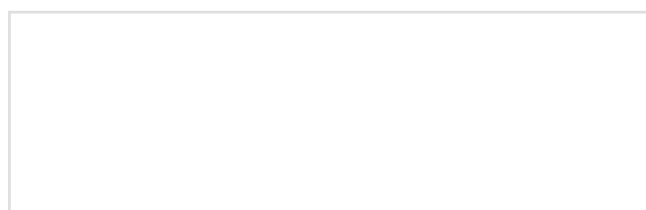


TABLE 3: GREENHOUSE GAS EMISSIONS (Million tonnes of CO₂ equivalent)

	1990	2000	EC Burden Sharing	Commitment Implied by Burden sharing	Projections 2010	Gap
Austria	77.4	79.8	-13.0%	-10.0	8.9	-18.9
Belgium	143.1	151.9	-7.5%	-10.9	22.4	-33.3
Denmark	69.4	68.5	-21.0%	-16.0	-13.4	-2.6
Finland	77.1	74.0	0.0%	0.0	12.8	-12.8
France	551.8	542.3	0.0%	0.0	49.3	-49.3
Germany	1,222.8	991.4	21.0%	-257.2	-412.9	+155.6
Greece	104.8	129.7	25.0%	24.8	28.7	-3.9
Ireland	53.4	66.3	-13.0%	7.0	21.4	-14.4
Italy	522.1	543.5	-6.5%	-35.3	44.0	-79.3
Luxembourg	10.8	5.9	-28.0%	-3.5	-2.8	-0.6
Netherlands	210.3	216.9	-6.0%	-12.7	13.0	-25.7
Portugal	65.1	89.7	27.0%	17.5	37.6	-20.1
Spain	286.4	386.0	15.0%	31.1	100.0	-69.0
Sweden	70.6	69.4	-4.0%	2.8	0.5	+2.3
United Kingdom	742.5	649.1	-12.5%	-93.1	-103.8	+10.7
European Union	4,207.6	4,059.3	-8.0%	-355.8	-194.2	-161.6

TABLE 4: CO₂ EMISSIONS BY COUNTRY (Million tonnes of CO₂)

	1990	2000	Change 1990-2000	Projection Change 1990 - 2010	
Austria	62.3	66.1	6.1%	10.4	17%
Belgium	118.0	127.0	7.7%	21.7	18%
Denmark	52.6	52.9	0.4%	-10.7	-18%
Finland	62.5	62.3	-0.3%	13.9	22%
France	394.1	401.9	2.0%	59.2	15%
Germany	1,014.5	857.9	-15.4%	-320.5	-32%
Greece	84.3	103.7	23.0%	28.7	29%
Ireland	31.5	43.8	39.1%	19.8	63%
Italy	441.1	461.8	4.7%	10.4	2%
Luxembourg	10.2	5.4	-46.8%	-3.0	-26%
Netherlands	159.6	173.5	8.7%	32.0	20%
Portugal	44.1	63.2	43.2%	31.1	71%
Spain	227.2	306.6	34.9%	80.9	36%
Sweden	56.1	55.9	-0.4%	1.8	3%
United Kingdom	583.7	542.7	-7.0%	-40.3	-7%
European Union	3,341.8	3,324.8	-0.5%	-64.6	-2%

CO₂ EMISSION REDUCTIONS FROM WIND POWER

There are different ways of defining the CO₂ emissions avoidance for electricity production from wind. It depends on the assumptions made on which fuels are displaced when wind electricity is produced. The energy mix differs, of course, from Member State to Member State. The basic assumption here is that wind power is displacing intermediate loads. The base loads are different for every Member State. Nuclear, where it is present, is always used as base load. For the European Union as a whole it is assumed, then, that each kWh produced by wind power is displacing a kWh defined by the energy mix of gas, oil and coal at the time of production. During the period 2000-2010 the energy mix will be changing.

According to the 2000 IEA data fossil fuels generated 1,315 TWh in the EU and emitted 981 million tonnes of CO₂. As a consequence, one TWh produced by wind power saved 0.75 million tonnes of CO₂ in 2000. The IEA projects that in 2010 fossil fuels will generate 1,671 TWh and emit 1,084 million tonnes of CO₂. As a consequence, one TWh produced by wind power will save 0.65 million tonnes of

CO₂ in 2010. A linear variation between the two values is assumed for the intermediate years 2001-2009.

In Figure 15 the estimated CO₂ emission reductions from wind power are presented on a yearly basis for the period 2001-2010. The CO₂ reduction due to the wind power development during this period will be almost 100 Mt/year in 2010. Adding the production from wind installations before 2001 gives a total CO₂ reduction of 109 Mt/year in 2010.

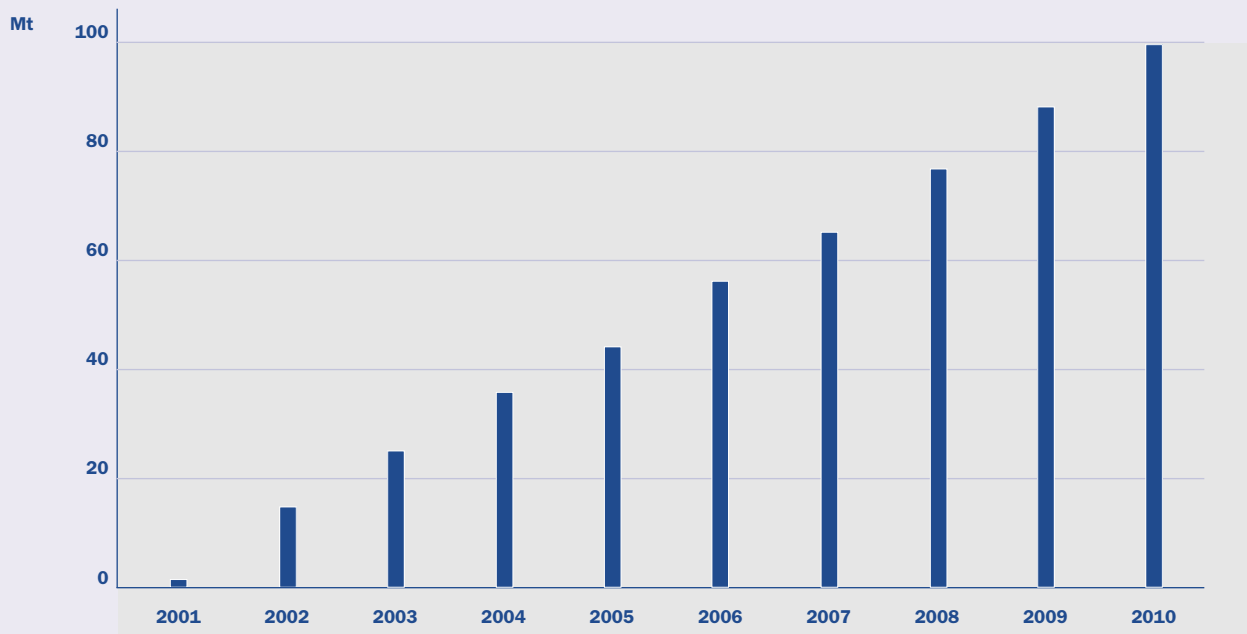
The EU Kyoto commitment of reducing greenhouse gases by 8% is equal to a reduction of 355.8 Mt CO₂ equivalents between 1990 and 2010. By 2010 wind power will meet more than 30% of the EU Kyoto obligation.

Table 5 provides a breakdown for each country.

As mentioned, the European Commission estimates that the Community will be 161.6 Mt CO₂ short of meeting its Kyoto commitment. CO₂ abatement from wind power by 2010 will equal two thirds (67%) of that gap.



FIGURE 15: ANNUAL CO₂ EMISSION REDUCTIONS FROM WIND POWER



CO₂ Reduction Mt/year	7.4	16.5	26.7	36.2	45.8	57.4	67.2	76.8	89.5	99.2
Cumulative CO₂ Reduction Mt/year	7.4	23.9	50.6	86.8	132.6	190	257	334	423	523

TABLE 5: CO₂ EMISSION REDUCTIONS DUE TO WIND POWER BY MEMBER STATE

	Installed Capacity 2001-2010 (MW)	Energy Produced 2001-2010 (TWh)	CO₂ Reduction in 2010 (Mt/year)
Austria	423	0.99	0.49
Belgium	237	0.55	0.29
Denmark	2,583	6.06	4.42
Finland	461	1.07	0.70
France	5,934	13.83	8.99
Germany	21,887	51.03	38.27
Greece	1,811	4.22	3.80
Ireland	1,382	3.23	2.26
Italy	3,273	7.64	4.20
Luxemburg	40	0.09	0.04
Netherlands	2,054	4.80	2.40
Portugal	1,400	3.26	2.71
Spain	12,765	29.83	20.80
Sweden	2,269	5.29	2.64
United Kingdom	5,594	13.05	7.18
EU Total	62,113	144.9	99.2

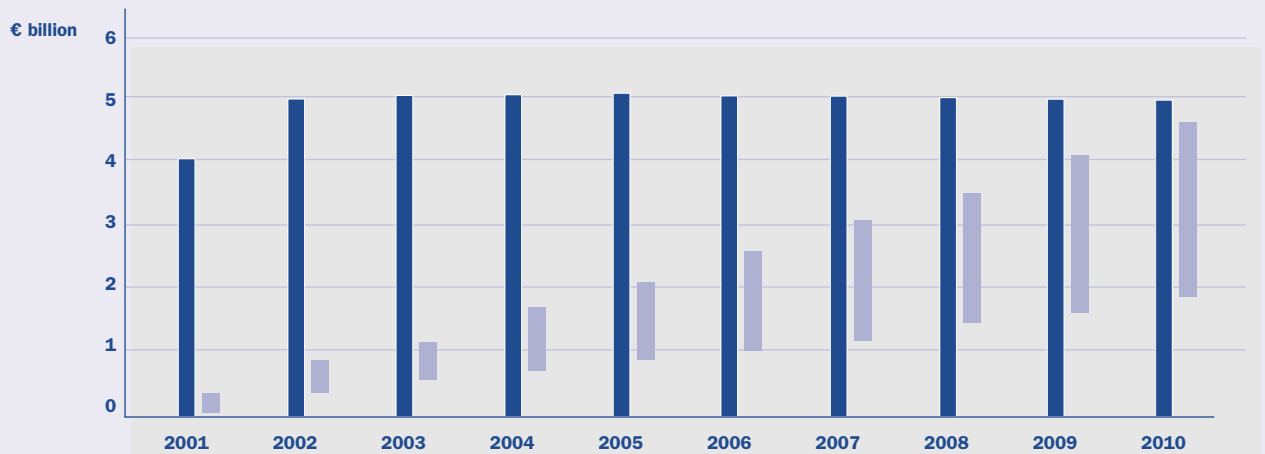
INVESTMENTS AND EXTERNAL COSTS SAVINGS

The 'external costs' to society derived from burning fossil fuels or from nuclear generation are not fully included in electricity prices. These costs have both a local and a global component, the latter mainly related to the eventual consequences of climate change.

There is a lot of uncertainty, however, about the magnitude of such costs, and they are difficult to identify and quantify.

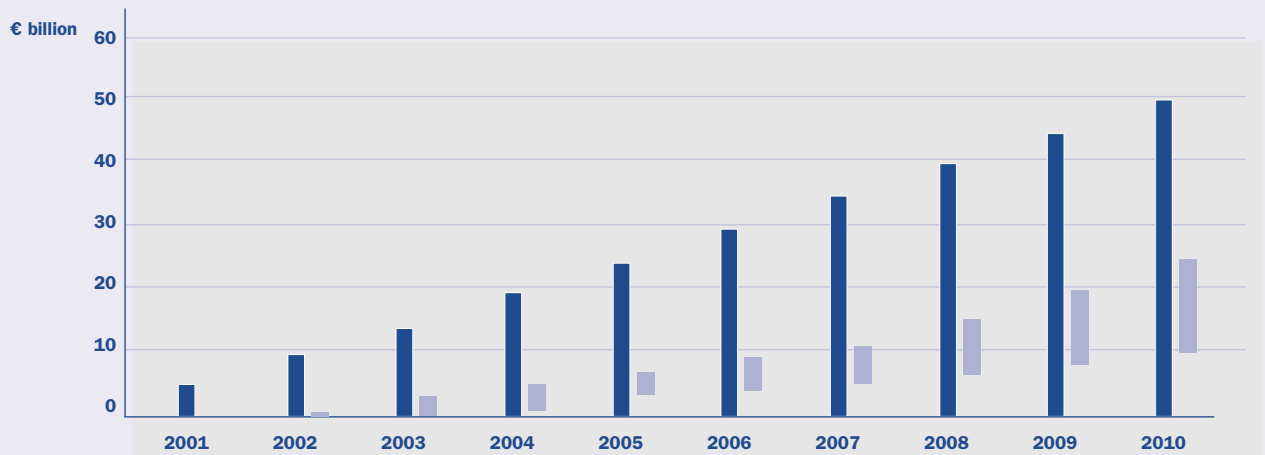
A European Commission project – the 'Extern E' project has – assessed these costs for fossil fuels at three levels: a low level with €3.8/ tonne CO₂, a medium level with a range €18 –46/ tonne CO₂ and a high level with €139/ tonne CO₂. By contrast, very low values are attached to the externalities related to wind power. In order to estimate the external costs avoided by wind power we use the medium level considering it as an estimation of the European average.

FIGURE 16: ANNUAL INVESTMENTS AND YEARLY AVOIDED EXTERNAL COSTS - 2001 - 2010



Investment (€ billion)	4.05	4.99	5.02	5.03	5.04	5.03	5.02	5	4.97	4.9
Yearly Avoided External Costs (€ billion)	0.1-0.3	0.3-0.8	0.5-1.2	0.7-1.7	0.8-2.1	1.0-2.6	1.2-3.1	1.4-3.5	1.6-4.1	1.8-4.6
New Capacity (MW)	4,500	5,700	5,900	6,100	6,300	6,450	6,600	6,750	6,900	7,000

FIGURE 17: CUMULATIVE INVESTMENTS AND YEARLY AVOIDED EXTERNAL COSTS - PERIOD 2001 - 2010



Cumulative Investment (€ billion)	4.1	9	14.1	19.1	24.1	29.2	34.2	39.2	44.1	49
Cumulative Yearly Avoided External Costs (€ billion)	0.1-0.3	0.4-1.1	0.9-2.3	1.6-4.0	2.4-6.1	3.4-8.7	4.6-11.8	6.0-15.4	7.6-19.5	9.4-24.0
Cumulative Capacity (MW)	17,300	23,000	28,900	35,000	41,300	47,750	54,350	61,100	68,000	75,000

In Figure 15 to 18 the investments in wind power and the corresponding avoided external costs are presented for the period 2001-2010 together with a projection of the unit cost of wind power capacity (€/kW).

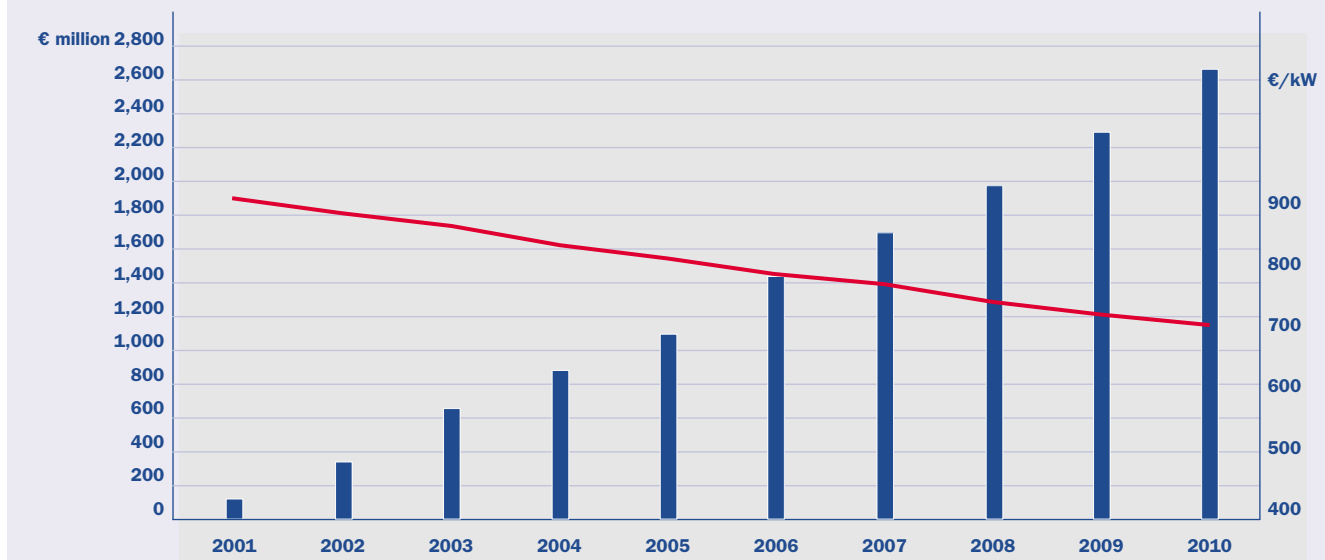
It shows that a total investment in wind power capacity of €49 billion can reduce CO₂ emissions by 99.2 million tonnes/year in 2010, have a cumulative CO₂ reduction of 523 million tonnes during this period and avoid external costs which range from €9.4 to €24 billion.

The investment of €49 billion in capacity over the period

2001-2010 will continue to avoid external costs during the 20 year lifetime of the wind turbines, ie beyond 2010. Taking into account the entire avoided external costs over 20 years, for the target of 62GW gives a total of €188-480 billion of avoided external costs.

Wind power has zero fuel input and costs as the resource is free and supply is endless. Additional wind power capacity eliminates direct fuel costs for the lifetime of the operating plant, typically 20 years. Over time, wind power as it achieves large installations, avoids a significant amount of avoided direct fuel costs of gas, oil or coal.

FIGURE 18: YEARLY AVOIDED FUEL COSTS 2001 - 2010



Yearly Avoided Fuel Cost (€ million)	169	384	631	870	1,116	1,422	1,690	1,965	2,328	2,624
Cumulative Avoided Fuel Cost (€ million)	169	554	1,184	2,054	3,170	4,592	6,282	8,246	10,575	13,198
Unit Cost (€/kW)	900	875	850	825	800	780	760	740	720	700
Cumulative Capacity (MW)	4,500	10,200	16,100	22,200	28,500	34,950	41,550	48,300	55,200	62,200

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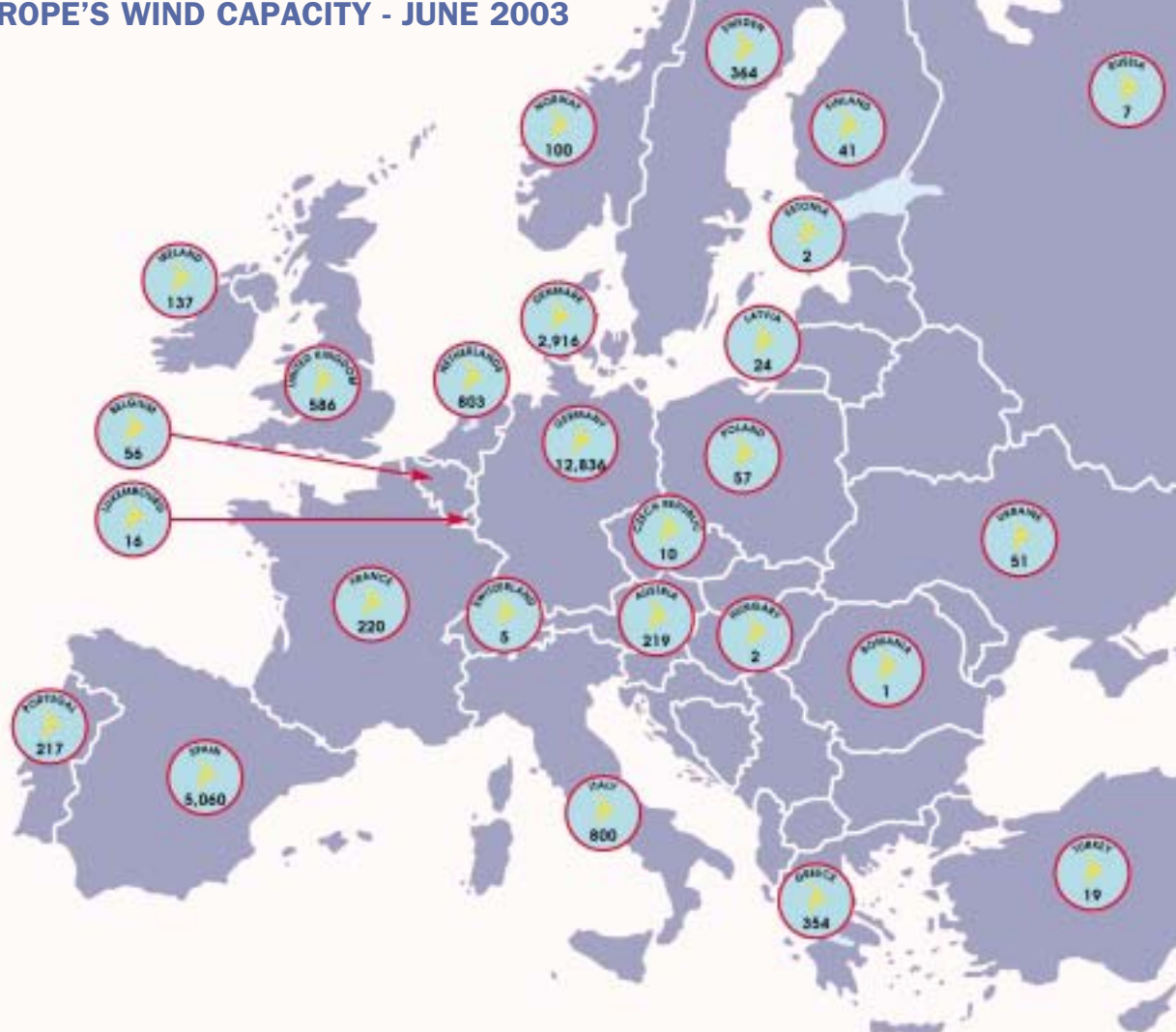
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Data from Eurostat and Eurelectric

EUROPE'S WIND CAPACITY - JUNE 2003



CAPACITY INSTALLED (MW)

	Total at end 2002	Installed Jan-June 2003	Total by June 2003
Germany	12,001	835	12,836
Spain	4,830	230	5,060
Denmark	2,881	36	2,916
Netherlands	678	125	803
Italy	788	12	800
United Kingdom	552	34	586
Sweden	328	36	364
Greece	297	57	354
France	148	72	220
Austria	139	80	219
Portugal	196	21	217
Ireland	137	0	137
Belgium	44	12	56
Finland	41	0	41
Luxembourg	16	0	16
European Union	23,076	1,550	24,626

IN OTHER EUROPEAN COUNTRIES (MW)

	Total at end 2002	Installed Jan-June 2003	Total by June 2003
Norway	97	3	100
Poland	27	30	57
Ukraine	46	5	51
Latvia	24	0	24
Turkey	19	0	19
Czech Republic	7	3	10
Russia	7	0	7
Switzerland	5	0	5
Hungary	2	0	2
Estonia	2	0	2
Romania	1	0	1
Total	237	41	278

Notes: Figures take into account capacity decommissioned. Some country totals for end 2002 have been revised since provisional figures were published in 'Wind Directions', March 2003.



About EWEA

EWEA is the voice of the wind industry - actively promoting the utilisation of wind power in Europe and worldwide.

EWEA members from over 40 countries include 200 companies, organisations, and research institutions. EWEA members include manufacturers covering 98% of the world wind power market, component suppliers, research institutes, national wind and renewables associations, developers, electricity providers, finance and insurance companies and consultants. This combined strength makes EWEA the world's largest renewable energy association.

The EWEA Secretariat is located in Brussels at the Renewable Energy House. The Secretariat co-ordinates international policy, communications, research, and analysis. It manages various European projects, hosts events and supports the needs of its members.

EWEA is a founding member of the European Renewable Energy Council (EREC) which groups the 6 key renewables industry and research associations under one roof.



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