GLOBAL WIND 2005 REPORT

GWEC
GLOBAL WIND ENERGY COUNCIL

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FOREWORD

Today, wind energy is a global business, growing at a faster rate than any other energy source. In 2005, the global wind markets grew by 40.5 %, generating some 12 billion euro, or 14 billion USD, in new generating equipment. While Europe remains the biggest market, other regions such as Asia and North and Latin America are quickly catching up.

As a response to these developments, the Global Wind Energy Council (GWEC) was founded in March 2005 with the aim to provide a credible and representative forum for the entire wind energy industry at international level. GWEC's mission is to ensure that wind power establishes itself as one of the world's leading energy sources, providing substantial environmental and economic benefits.

In the first year since its inception, GWEC has focused on engaging external stakeholders to assist the creation of efficient policy frameworks for wind power development. GWEC works with emerging markets to transfer know-how and strengthen the development of wind energy. In addition, it serves as a platform for providing quality information, expertise, analysis and data about wind energy.

The Global Wind 2005 Report is the first in a series of annual reports by GWEC on the status of the global wind energy markets. The report outlines the industry's perspective on the development of wind energy around the world. Besides stressing the importance of wind power for tackling global energy and environmental challenges, it presents the regional and national statistics on installed capacity and contains GWEC's projections for the industry up to 2010. In addition, the report provides an account of developments in individual countries in which wind energy has become a mainstream power source or is expected to do so in the near future. The Global Wind Report will be updated on a yearly basis.

The data and country reports for the 2005 report have been collected through GWEC's member associations around the world and additional industry contacts. The Council wishes to thank the contributors and is looking forward to an equally fruitful cooperation for future editions.

The message from the Global Wind 2005 Report is clear: Wind energy has become a global market and it is rapidly developing into a mainstream power source in many countries of the world. It can and must play a central role in responding to the key energy challenges of our time: security of supply, climate change, increasing energy demand and volatile fossil fuel prices.

Arthouros Zervos
Chairman, Global Wind Energy Council

Tackling the global energy challenge

Middelgrunden wind farm, Denmark

The world is on the verge of an energy crisis. The global energy challenge requires urgent action in three areas: tackling the threat of climate change, meeting the rising demand for energy and safeguarding the security of energy supply.

Wind energy is a significant and powerful resource. It is safe, clean and abundant. Wind energy can and must be part of the solution to the global energy challenge.

WORLDWIDE ENERGY SECURITY FROM WIND POWER

World energy demand is expected to grow at a staggering rate in the next 30 years. The International Energy Agency (IEA) predicts that the world's energy needs will be almost 60 % higher in 2030 than they are now. Two-thirds of this increase will arise in China, India and other rapidly developing economies, which will account for almost half the energy consumption by 2030.

Already now, these developments are beginning to put strong pressure, mainly on developing countries. Sharp increases in world energy demand will trigger important investments in generating capacity and grid infrastructure. According to the IEA, the global power sector will need to build some 4,800 GW of new capacity between now and 2030. Two trillion USD (1.7 trillion euro) will be needed in power generation and 1.8 trillion dollars in transmission and distribution networks.

The majority of industrialised countries has historically had overcapacities for electricity production. This situation, however, is changing rapidly. The countries of the OECD see their demand for electricity increasing, while many power plants will soon reach the end of their lifespan. The IEA predicts that by 2030, over 2,000 GW of power generation capacity will need to be built in the OECD, including the replacement of decommissioned plants.

In the EU alone, according to the European Commission, electricity demand is expected to increase by 51 % between 2000 and 2030, requiring investments in power generation in the order of around 625 billion euro (760 billion USD). About half of this expenditure is needed for the replacement of existing power plants.

Security of energy supply is one of the main driving forces behind the development and deployment of renewable energy sources. Increasingly, governments around the world are realising the threats that the current shaky supply situation is posing to their economic growth. Over-reliance on energy imports from few, mostly politically unstable countries and volatile oil and gas prices are already now inflicting a multi-billion euro drain on the global economies. In addition, authoritative energy experts are predicting the end of cheap oil to arrive earlier than big oil companies would have us believe.

Unlike conventional fuels, wind energy is a massive indigenous power source, which is permanently available in virtually every country in the world. There are no fuel costs, no geo-political risk and no supply dependence that come with relying on imported fuels from politically unstable regions.

THE IMPERATIVE OF COMBATING CLIMATE CHANGE

The impetus behind wind power expansion has come increasingly from the urgent need to combat global climate change, which is one of the greatest threats the world is facing. The UN's Intergovernmental Panel on Climate Change projects that average temperatures around the world will increase by up to 5.8°C over the next century, resulting in flooding, droughts and violent climate swings.

There is a broad consensus now that greenhouse gas emissions must be cut drastically to limit the wide-reaching environmental consequences. The use of fossil fuels is responsible for 70 % of global greenhouse gas emissions. A shift in the way we produce and consume energy is thus essential. Wind power is one of the few energy supply technologies that possess the maturity, clout and global muscle to deliver deep cuts in CO_2.

OECD countries in particular are striving to meet their national targets set under the Kyoto Protocol in 1997, which calls for a global cut of CO_2 emissions of 5.2 % from 1990 levels by 2012. Policy makers are anxious to achieve greenhouse gas reductions at the lowest possible cost to society. As a result, there is a strong incentive to choose the seemingly cheapest solutions to the problem, such as shifts to natural gas, improving energy efficiency and launching emissions trading systems. However, such short-term solutions could fundamentally jeopardise the technological development of renewable energy sources that will be so urgently needed as a cost effective way to combat climate change in the long run. Therefore, short-term measures must not substitute policies to promote renewable energy.

Dabancheng wind farm, Xinjiang, China

Combating climate change is only a secondary driver for wind energy in the developing world. However, other more immediate environmental benefits such as the reduction of air pollution from coal combustion in countries like India and China do play an important role in turning to renewable energies.

A STATE OF THE ART TECHNOLOGY READY FOR DEPLOYMENT AT A LARGE SCALE

Thanks to twenty years of technological progress, wind turbines have come a long way since they were first deployed in the 1980, and size, efficiency and ease of use have increased considerably. A wind farm today acts much more like a conventional power station, and modern turbines are modular and quick to install. This is of particular importance for countries in need of a rapid increase in electricity production.

Wind turbines have grown larger and taller. The generators in the largest modern turbines are 100 times the size of those in 1980. In the same period, the rotor diameters have increased 8-fold.

Windy Hill wind farm, Australia

Turbine efficiency has also increased, thanks to size, improved components and more sophistication in the selection of sites for wind farms. At a given site, a single modern machine today can produce 180 times more electricity at less than half the cost per kWh than twenty years ago.

THE ECONOMIC IMPACT OF WIND POWER

Due to improved technology, wind power generation is increasingly competitive with conventional fossil fuel sources. At the best sites, the costs for wind power production are already on a par with new coal or gas fired power plants. If the environmental and social costs of power generation were included in electricity prices, wind power would already be cheaper than any other electricity generating technology.

Wind power also eliminates the economic impacts and risks associated with volatile and increasing fuel prices. Since the costs of wind power are fixed and known, there is no uncertainty over the future price for electricity. Financial analysts have found that if this avoided market risk is taken into account, wind power is cheaper than conventional fuels already today.

For a long time, the cost of wind power has been measured against the cost of running existing conventional power stations, which at the time of their construction received massive subsidies and have been depreciated long since. Increasingly, however, both in the developed and in the developing world, wind energy will have to compete with the much higher cost of building new thermal or nuclear power stations, as additional capacity is needed and old plants are being retired.

GLOBAL WIND DEVELOPMENT: A VAST UNTAPPED POTENTIAL

Already now, wind is the fastest growing energy source in the world with an average annual growth rate of more than 26 % since 1990. The world's wind energy generating capacity at the close of 2005 stood at over 59 gigawatts (GW).

However, the global potential for wind energy remains largely untapped. Historically, the market has mainly been driven by five countries: Germany, Spain, United States, India and Denmark. If other countries were to match the efforts of these forerunners, the impact for the industry would be far-reaching. It is likely that the next twenty years will see a broadening of the global wind market and involve new countries across all continents.

Several countries outside of Europe and the US are now taking the first steps to develop large-scale commercial wind markets. Policy targets for renewable energy now exist in at least 45 countries worldwide, including 10 developing countries. China alone has recently set its target at 30 GW from wind power from 2020, but the potential is estimated to be much higher.

The IEA predicts wind energy to be the second largest source of renewable electricity by 2030 after large hydro. In its "Wind Force 12" forecasts, GWEC estimates that the wind industry is capable of becoming a dynamic and innovative 80 billion euro (67 billion USD) annual business by 2020. Wind power installed worldwide could be increased from 59 GW in 2005 to 1,000 GW by 2020 and could supply 12 % of the electricity worldwide.

The growth potential for wind energy in new markets is thus enormous. However, this impressive growth can only be sustained and expanded if energy policies are further implemented and adopted in more countries. As with any other energy source, the wind power market is largely driven by policy and markets only exist where policy support is enacted.

The Status of the Global Wind Markets

The global wind energy sector experienced another record year in 2005, with the installation of 11,531 megawatts (MW). This represents a 40.5 % increase in annual additions to the global market, up from 8,207 MW in the previous year. The total value of new generating equipment installed was over 12 billion euro, or 14 billion USD.

The total installed wind power capacity now stands at 59,084 MW worldwide, an increase of 24 % compared to 2004.

The countries with the highest total installed capacity are Germany (18,428 MW), Spain (10,027 MW), the USA (9,149 MW), India (4,430 MW) and Denmark (3,122 MW). India has thereby overtaken Denmark as the fourth largest wind market in the world. A number of other countries, including Italy, the UK, the Netherlands, China, Japan and Portugal have reached the 1,000 MW mark of installed capacity.

In terms of new installed capacity in 2005, the US was clearly leading with 2,431 MW, followed by Germany (1,808 MW), Spain (1,764 MW), India (1,430 MW), Portugal (500 MW) and China (498 MW). This development shows that new players such as Portugal and China are gaining ground.

GLOBAL MARKETS

Europe

The EU is still leading the market with over 40,500 MW of installed capacity at the end of 2005, representing 69 % of the global total. In 2005, the European wind capacity grew by 18 % (see also page 16 for an EU overview, and pages 18, 20, 22 and 24 for country reports on Germany, Italy, Spain and the UK).

The EU market has already reached the 2010 target set by the European Commission of 40,000 MW five years ahead of time. Moreover, growth is now happening in a greater number of countries, including new markets such as Portugal and France. The European Wind Energy Association (EWEA) predicts that by 2010, wind energy alone will save enough greenhouse gas emissions to meet one third of the European Union's Kyoto obligation.

The general trend shows that the EU sector is gradually becoming less reliant on a few key markets, and other regions are starting to catch up with Europe. The growth in the EU market in 2005 only accounted for about half of the total global new capacity, down from nearly three quarters in 2004.

In the EFTA countries (mainly in Norway), 110 MW were installed during the year 2005, taking the total up to 279 MW. The EU accession countries now have 28 MW of installed capacity, 20 MW of which in Turkey.

GROWTH RATES IN TOP 10 MARKETS

	2001	2002	2003	2004	2005	Growth rate 2004-2005	4 years average growth
Germany	8,754	11,994	14,609	16,629	**18,428**	10.8 %	20.9 %
Spain	3,337	4,825	6,203	8,263	**10,027**	21.3 %	31.9 %
US	4,275	4,685	6,374	6,725	**9,149**	36.0 %	21.8 %
India	1,502	1,702	2,125	3,000	**4,430**	47.7 %	31.8 %
Denmark	2,489	2,889	3,116	3,118	**3,122**	0.1 %	6.0 %
Italy	682	788	905	1,265	**1,717**	35.7 %	26.5 %
UK	474	552	667	907	**1,353**	49.2 %	30.6 %
China	400	468	567	764	**1,260**	64.9 %	34.4 %
NL	486	693	910	1,079	**1,219**	13.0 %	26.4 %
Japan	274	414	687	936	**1,078**	15.2 %	42.1 %
Total top 10	22,673	29,010	36,163	42,686	**51,783**	21.3 %	23.0 %

North America

The year 2005 has seen major activity in non-European markets, mainly in North America, where nearly a quarter of new capacity was installed. The total capacity increased by 37 % in 2005, gaining momentum in both the US and Canada. The wind energy industry in the US broke earlier annual records of installed capacity with installing nearly 2,500 MW, which makes it the country with the most new wind power (see also page 26 for a report on the US market).

The US growth is largely due to the current three-year window of stability in the federal incentive for wind energy, the production tax credit (PCT). For the first time in the credit's history, the US Congress extended the wind energy production credit before it expired. As a result, the wind industry is looking forward to several record-breaking years in a row, according to the American Wind Energy Association (AWEA). Previous years had seen a constant up and down of the market, depending on whether the PTC had been renewed in time to create investor confidence.

Thanks to a mixture of federal incentives and initiatives by individual provinces to increase the contribution from wind or renewable energy, the Canadian wind capacity increased by a staggering 54 % and now stands at 683 MW. According to the Canadian Wind Energy Association (CanWea), wind energy now produces enough electricity in Canada to power more than 200,000 homes (see also page 30 for a report on the Canadian market).

Canada

Asia

The Asian continent is developing into one of the main drivers for wind energy development and accounted for 19 % of new installations in 2005. Asia experienced a growth of over 46 % of installed capacity, bringing the continent up to a total of nearly 7,000 MW.

The strongest Asian market remains India with over 1,430 MW of new installed capacity, which takes its total figure up to 4,430 MW. The Indian government envisages a capacity addition of around 5,000 MW by 2012. However, the Indian Wind Turbine Manufacturers Association (IWTMA) is expecting an average of 1,500 MW to 1,800 MW of new installations every year for the next three years for wind alone (see also page 36 for a report on the Indian market).

The Chinese market has been boosted in anticipation of the country's new Renewable Energy Law, which entered into force on 1 January 2006. As a result, nearly 500 MW of new capacity was installed in 2005, more than double the 2004 figure. This brings China up to 1,260 MW of capacity, thereby passing the 1,000 MW mark which is often deemed critical for sustained market growth (see also page 38 for a report on China).

According to the list of approved projects and those under construction, 2,000 MW of wind capacity could be installed by the end of 2006. The goal for wind power in China by the end of 2010 is 5,000 MW, requiring an annual increase from 2006 onwards of 800 MW, according to the Chinese Renewable Energy Industry Association (CREIA).

Japan's wind energy industry has also surged forward in recent years, spurred by government set quotas for renewables and by the introduction of market incentives. In the fiscal year of 2005, Japan installed 142 MW of new capacity, bringing the total up to 1,078 MW by the end of March 2006 (see also page 40 for more details on the Japanese market).

Greece

Latin America

While to date, there has been little activity in Latin America, various governments are in the process of implementing renewable energy laws or programmes, and wind energy is expected to develop at a strong rate in the coming years.

In Brazil, the government passed a programme called PROINFA to stimulate the development of biomass generation, wind and small hydro generators. In a first stage (up to 2007), the programme aims to implement 3,300 MW of projects using these technologies. The Brazilian government is planning to increase the installed wind capacity to 1,451 MW by 2007, up from the current 29 MW (see p. 32 for a country report on Brazil).

Mexico has an excellent potential for wind energy. Although currently, Mexico only has a total installed capacity of 3.2 MW in two small wind farms, the Mexican Wind Energy Association (AMDEE) currently estimates the development of at least 3,000 MW in the 2006-2014 period, as 2005 was characterized by some positive initiatives for renewable energy development in Mexico (see p. 34 for a country report on Mexico).

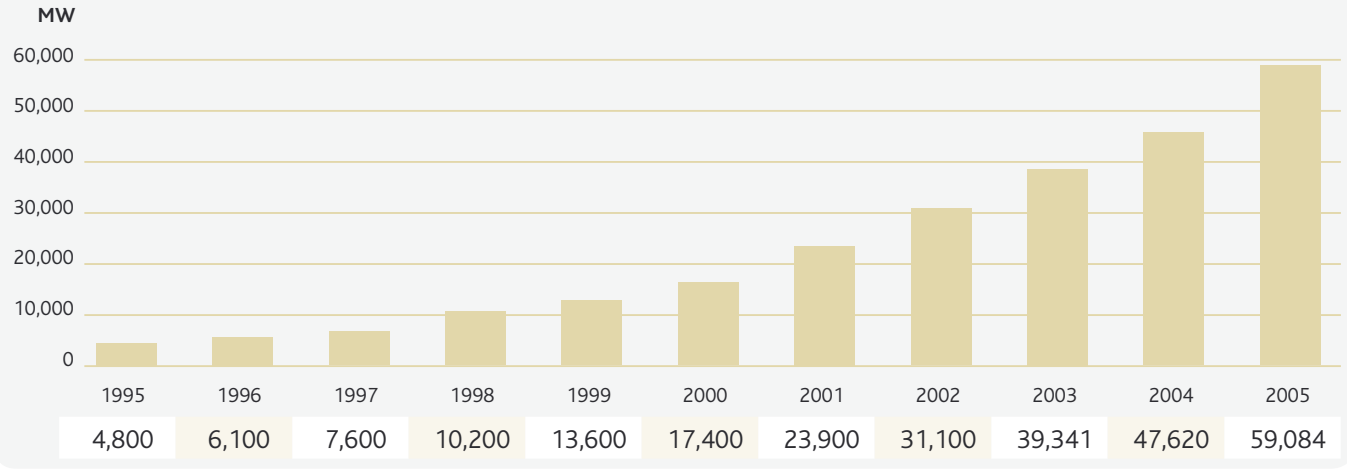
Australia

The Australian market nearly doubled in 2005 with 328 MW of new installed capacity, bringing the total up to 708 MW. According to the Australian Wind Energy Association (Auswind), the 2007 implementation of a state based market mechanism and a commitment by state governments to establish an emissions trading scheme will provide financial incentives to continue this growth (see also page 44 for more details on the Australian market).

Africa

The relatively young African market saw slow growth in 2005, but is showing promising signs for future developments. The main countries experiencing growth are Morocco (64 MW, up from 54 MW) and Egypt, which is planning to install 850 MW of wind power by 2010 (see also p. 46 for a country report on Egypt).

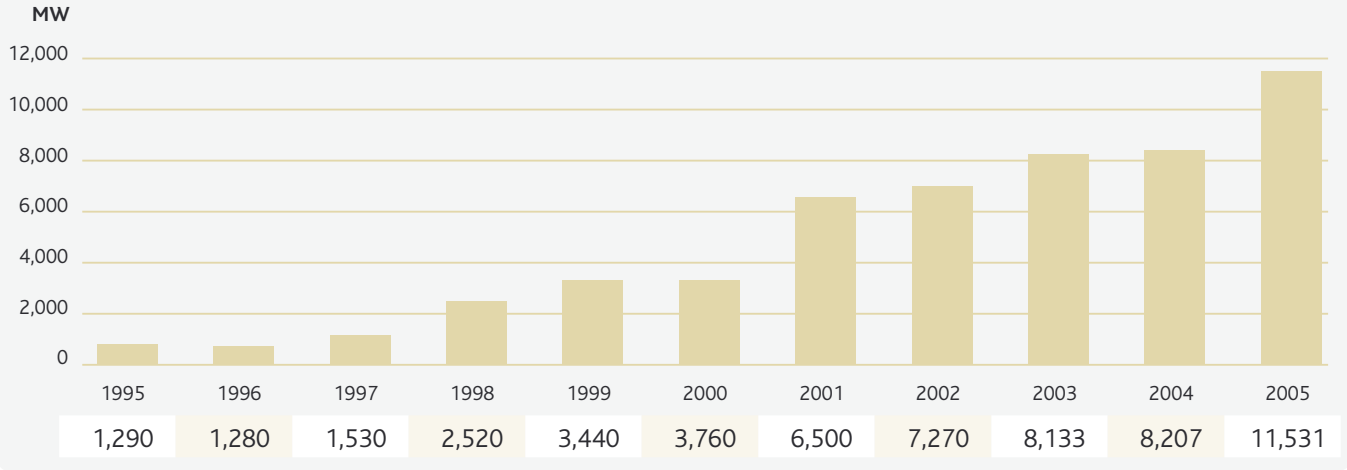
GLOBAL CUMULATIVE INSTALLED CAPACITY 1995-2005



1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
4,800	6,100	7,600	10,200	13,600	17,400	23,900	31,100	39,341	47,620	59,084

Source: GWEC

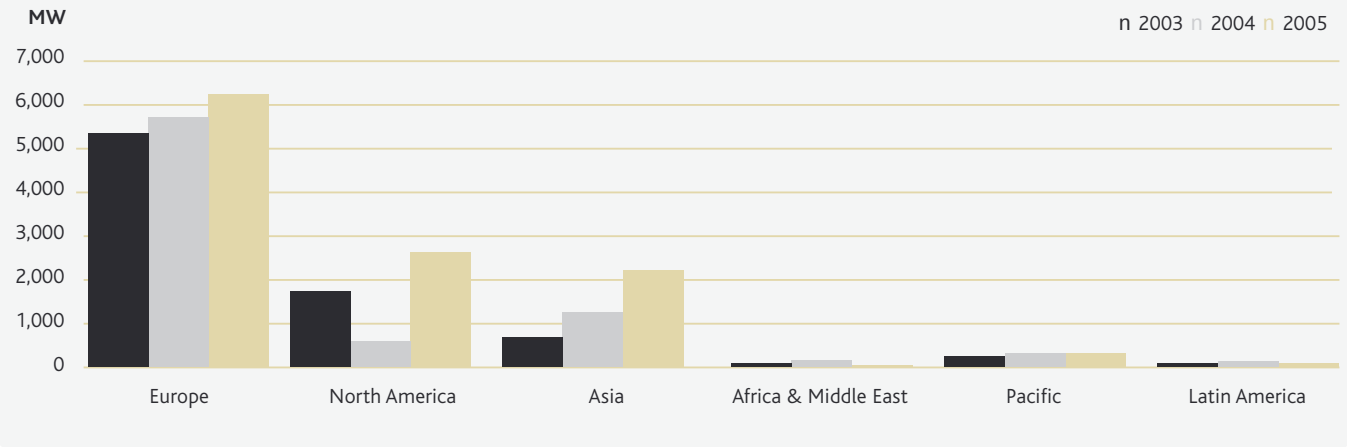
GLOBAL ANNUAL INSTALLED CAPACITY 1995-2005



1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
1,290	1,280	1,530	2,520	3,440	3,760	6,500	7,270	8,133	8,207	11,531

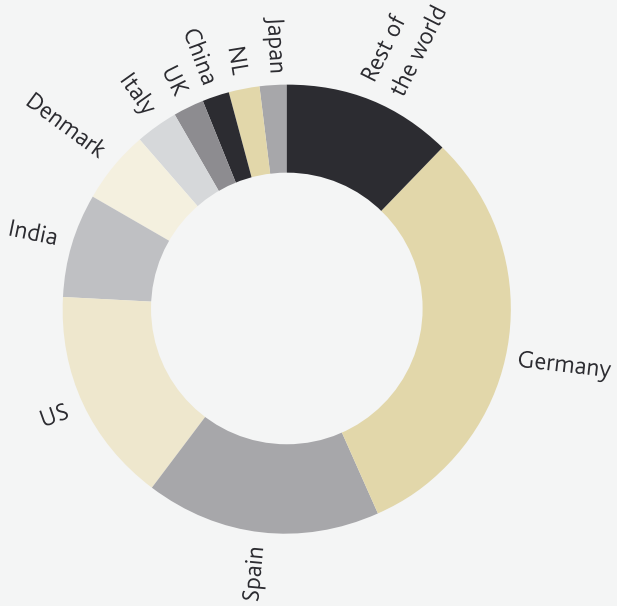
Source: GWEC

ANNUAL INSTALLED CAPACITY BY REGION



Source: GWEC

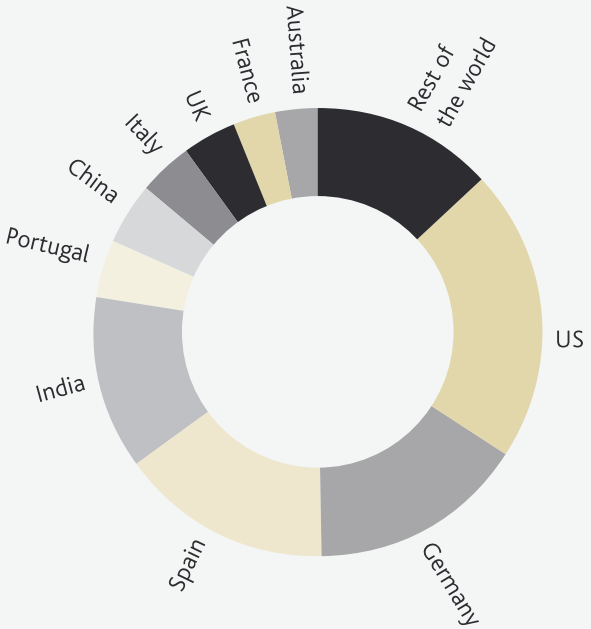
TOP 10 CUMULATIVE INSTALLED CAPACITY (DEC. 2005)



Total capacity	MW	%
Germany	18,428	31.2
Spain	10,027	17.0
US	9,149	15.5
India	4,430	7.5
Denmark	3,122	5.3
Italy	1,717	2.9
UK	1,353	2.3
China	1,260	2.1
NL	1,219	2.1
Japan	1,078	1.8
Top 10 – Total	**51,783**	**87.6**
Rest of the world	**7,301**	**12.4**
World total	**59,084**	**100**

Source: GWEC

TOP 10 NEW INSTALLED CAPACITY (JAN.-DEC. 2005)



New capacity	MW	%
US	2,431	21.1
Germany	1,808	15.7
Spain	1,764	15.3
India	1,430	12.4
Portugal	500	4.3
China	498	4.3
Italy	452	3.9
UK	446	3.9
France	367	3.2
Australia	328	2.8
Top 10 – Total	**10,024**	**86.9**
Rest of the world	**1,507**	**13.1**
World total	**11,531**	**100.0**

Source: GWEC

GLOBAL INSTALLED WIND POWER CAPACITY (MW) – REGIONAL DISTRIBUTION

		Total end 2004	During 2005	Total end 2005
AFRICA & MIDDLE EAST	Egypt	145	0	**145**
	Morocco	54	10	**64**
	Tunisia	20	0	**20**
	Other [1]	33	2	**35**
	Total	252	12	**264**
ASIA	India	3,000	1,430	**4,430**
	China	764	498	**1,260**
	Japan	936	142	**1,078**
	South Korea	69	29	**98**
	Taiwan	13	74	**87**
	Philippines	0	25	**25**
	Other [2]	3	2	**5**
	Total	4,785	2,199	**6,982**
EUROPE	EU-25 [3]	34,371	6,183	**40,504**
	EFTA [4]	169	110	**279**
	Ukraine	72	10	**81**
	EU Accession Countries [5]	28	0	**28**
	Other [6]	7	5	**12**
	Total	34,647	6,316	**40,904**
LATIN AMERICA & CARIBBEAN	Costa Rica	71	0	**71**
	Caribbean	55	0	**55**
	Brazil	29	0	**29**
	Argentina	26	1	**27**
	Colombia	20	0	**20**
	Other [7]	6	5	**11**
	Total	207	6	**213**
NORTH AMERICA	USA	6,725	2,431	**9,149**
	Canada	444	239	**683**
	Total	7,169	2,670	**9,832**
PACIFIC REGION	Australia	380	328	**708**
	New Zealand	169	0	**169**
	Pacific Islands	12	0	**12**
	Total	561	328	**889**
WORLD	Total	47,621	11,531	**59,084**

Source: GWEC

[1] Cape Verde, Iran, Israel, Jordan, Nigeria, South Africa;
[2] Bangladesh, Indonesia, Sri Lanka;
[3] Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, United Kingdom;
[4] Iceland, Liechtenstein, Norway, Switzerland;
[5] Bulgaria, Croatia, Romania, Turkey;
[6] Faroe Islands, Russia;
[7] Chile, Cuba, Mexico.
Please note: project decommissioning of 69 MW and rounding affect the final sums.

Market forecast for 2006-2010

Until the end of the current decade, the cumulative capacity of wind energy installations is predicted to reach 134.8 GW, more than double of the present installed capacity. The average annual cumulative growth rate during the period 2005-2010 will be 18 %, compared with 28 % during the period 2000-2005. The annual installed capacity is predicted to reach 17.8 GW in 2010, an increase of 55 % from the11.5 GW installed in 2005. This implies an average annual growth rate of 9.1 % for the global wind energy market. The growth could be much bigger but, at least in the near future, is limited by the production capacities of the manufacturers. In most markets, the current delivery time for machines is at least two years.

Europe will continue to be the most important market, but with a smaller share than in the past. The trend which appeared for the first time in 2005, where Europe represented 55 % of the market compared with 72 % in 2004, will continue and will be accentuated. With a predicted annual average growth rate of 13.5 % for the period 2006-2010, the installed capacity in Europe will represent 48 % of the global installed capacity. The total installed capacity should reach 77.6 GW by 2010, representing 57 % of the total global installed capacity, compared to 69 % in 2005. Delays in the offshore market have pushed large scale offshore development towards the end of the decade. However, offshore development will give a new momentum to the European market during the next decade.

The structure and the share of the different European markets will also be transformed. Although Spain and Germany will remain the most important markets on the continent, their relative importance will decrease as other national markets will become stronger. Spain should continue to grow with a more or less stable pace of 2,000 MW per year, adding 10,000 MW during the period 2006-2010 and reaching its 20,000 MW target by 2010. Although the German market will continue to decrease, it will remain the second strongest market for the period 2006-2010 with 6,600 MW added and the biggest one in terms of the total installed capacity (~25,000 MW in 2010). The United Kingdom, France and Portugal are predicted to be the other most important European markets, each increasing by approximately 4,000 MW during the period 2006-2010.

The North American market is predicted to have the highest growth rate. From 9.8 GW installed at the end of 2005, it is estimated to reach 29.1 GW by the end

Zhangbin wind farm, Taiwan, China

of 2010, with an annual average growth rate of 24.3 %. The US market will be the most important national market in the world during the period 2006-2010 with a predicted average of 3,000 MW per year. There is an uncertainty with the PTC ending by the end of 2007, but all the elements indicate that it will be extended. High level engagement of an increasing number of States assures that the market will grow stronger. The predicted 15,000 MW could also be easily surpassed. By 2010, the US will be on par with Germany in cumulative installed capacity. Canada also is predicted to be one of the countries with extraordinary growth rates. It is estimated that by 2010, the cumulative installed capacity in Canada will have reached 5,000 MW. This means that 4,300 MW will be introduced during the period 2006-2010 listing Canada in the top five countries for that period.

The Asian market will also gain considerable market share with the development of a predicted average annual growth rate of 23.5 % during the period under consideration. The total installed capacity in the Asian continent should reach 20.1 GW by 2010, up from 7.0 GW of 2005. With a predicted installed capacity of 6,000 MW during the period 2006-2010, India will continue to be the continental leaders and the fourth country globally. China will emerge as the second country of the continent with the highest growth rate and a predicted installed capacity of 3,800 MW during the period. Japan will continue its development with lower growth rates and an installed capacity of 1,500 MW, keeping the third position. South Korea and Taiwan will be the emerging markets of the continent.

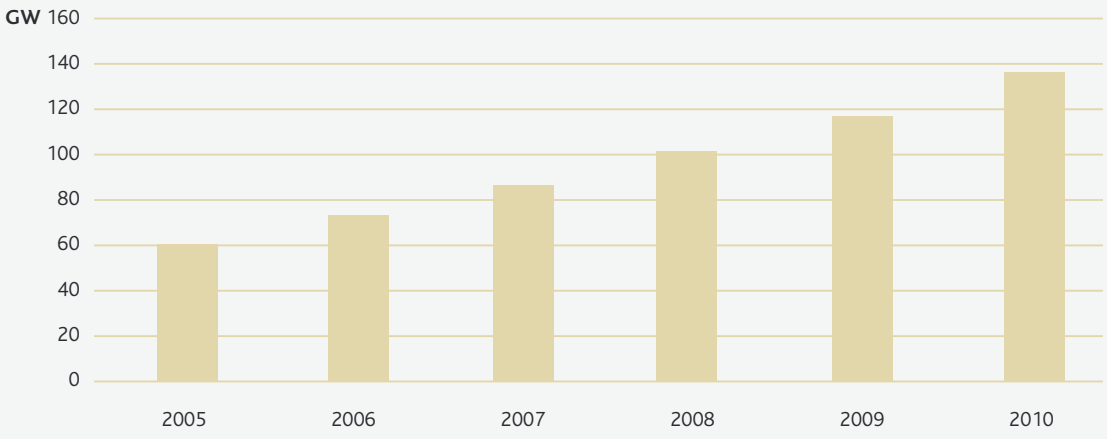
The market in Latin America has not yet taken off. The year 2005 has only seen marginal installations. During the period 2006-2010, it is predicted that the market will

take off starting with Brazil and followed to a lesser extent by Mexico. Smaller developments will also take place in some countries of Central America as well as in Argentina and Chile. Despite its large potential, Latin America will remain a small market until the end of this decade, progressing towards a more significant development in the next decade.

In the Pacific region, wind energy development has started in Australia and New Zealand. With 370 MW installed in 2005, Australia is for the first time in the top ten list. Despite some uncertainties regarding the political framework, the development is predicted to continue in the country with 1,500 MW to be installed in the period 2006-2010, keeping it in the top ten list for that period. Although no new capacity was added in New Zealand in 2005, there are a lot of projects in different phases of development giving a signal that 800 MW could be added by 2010.

Africa remains the continent with the smallest wind development. Two countries have emerged as leaders of

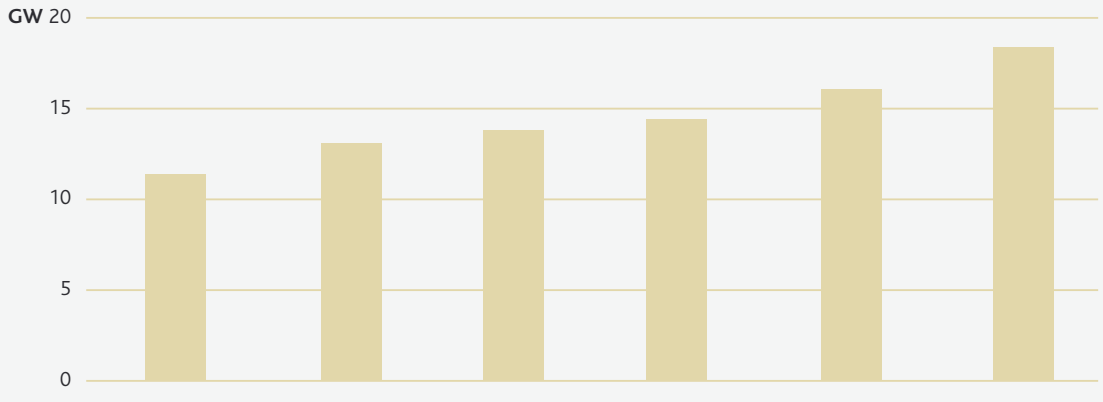
GLOBAL FORECAST 2005-2010: CUMULATIVE CAPACITY



	2005	2006	2007	2008	2009	2010
Cumulative capacity (GW)	59.1	72.2	86.3	101	117	134.8
Growth rate	24.1 %	22.1 %	19.5 %	17.0 %	15.8 %	15.2 %

Source: GWEC

GLOBAL FORECAST 2005-2010: ANNUAL INSTALLED CAPACITY



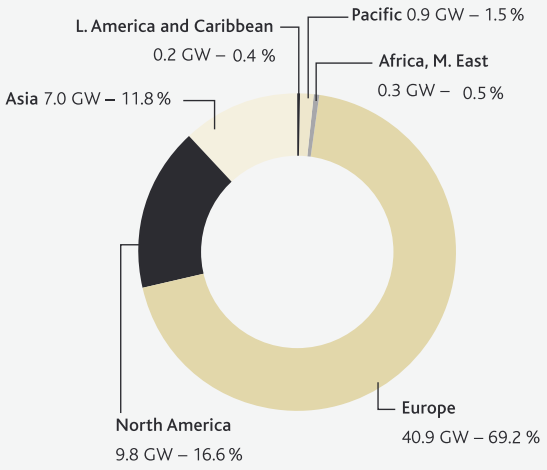
	2005	2006	2007	2008	2009	2010
Annual installed capacity (GW)	11.5	13.1	14.1	14.7	16	17.8
Growth rate	40.5 %	11.4 %	7.6 %	5.8 %	8.8 %	11.3 %

Source: GWEC

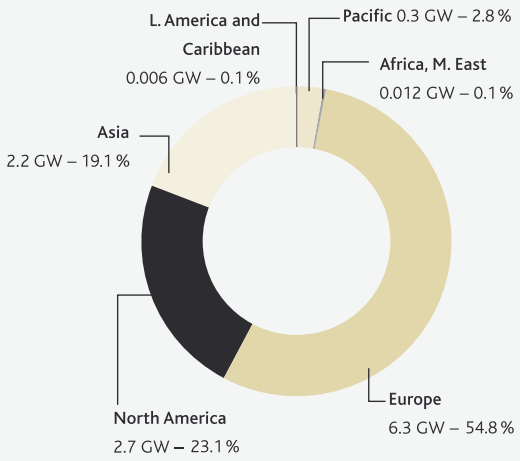
the continent: Egypt and Morocco. The development is expected to continue in these two countries at a more rapid rate than in the past and some development is predicted in other North African and Middle East countries adding a total of 1,000 MW during the period 2006-2010 for the whole continent.

Little development is expected in the Former Soviet Union countries.

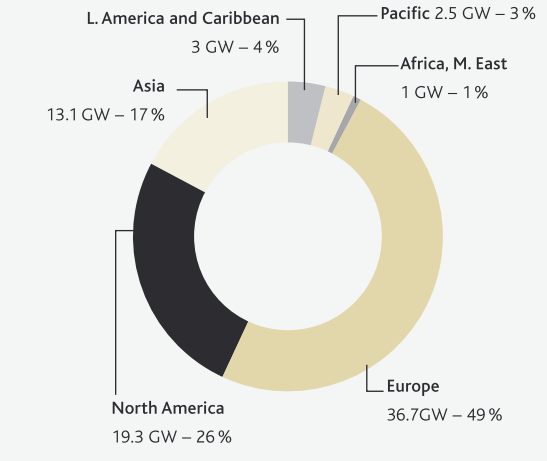
TOTAL CAPACITY END 2005 (GW)



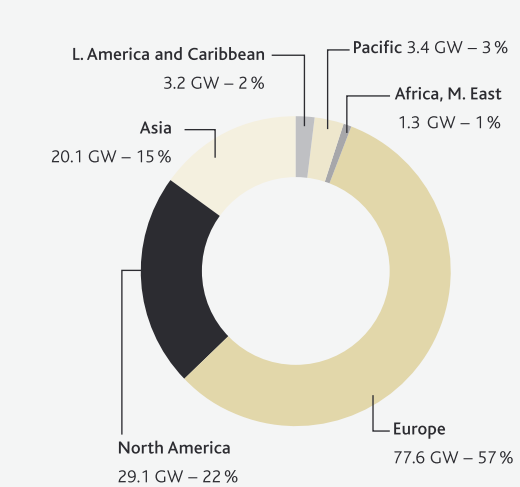
INSTALLED CAPACITY IN 2005 (GW)



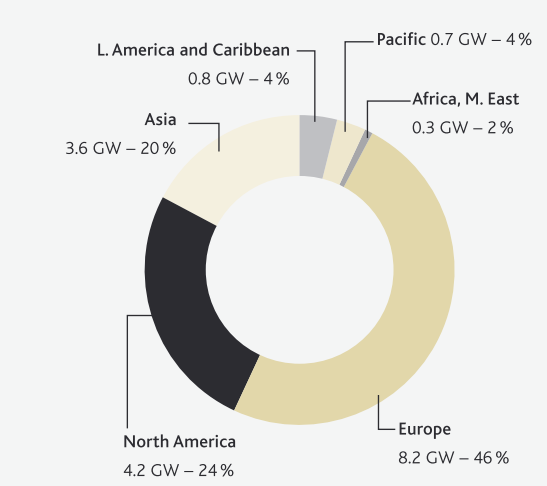
PROJECTED CAPACITY 2006-2010 (GW)



TOTAL CAPACITY END 2010 (GW)



INSTALLED CAPACITY IN 2010 (GW)



European Union

THE WORLD'S LEADING MARKET

Europe has historically been the strongest market for wind energy development. In 2005, the European Union has seen another record year with installations above 6,000 MW, thereby reaffirming its undisputed status as the world's biggest wind market.

Industry statistics released by the European Wind Energy Association (EWEA) show that cumulative wind power capacity increased by 18 % to 40,504 MW at the end of 2005, up from 34,372 MW at the end of 2004. 6,183 MW of wind power capacity were installed in 2005, representing a wind turbine manufacturing turnover of some € 6 billion.

Over the last ten years, cumulative wind power capacity in the EU has increased by an average 32 % per year. In terms of annual installations, the European market has grown by an average 22 % over the same period.

Although there are still many barriers to wind energy development in most EU countries, the figures demonstrate a healthy underlying trend in the market. The European wind sector is gradually becoming less reliant on a few key markets in Europe, and other countries such as France, Portugal, Italy, the Netherlands and the UK have recently demonstrated strong growth.

The top five European wind energy markets in 2005 were Germany (1,808 MW), Spain (1,764 MW), Portugal (500 MW), Italy (452 MW) and the UK (446 MW). In cumulative installed capacity, two countries have more than 10 GW (Germany 18,428 MW and Spain 10,027 MW) and seven countries have more than 1GW (Denmark 3,122 MW, Italy 1,717 MW, UK 1,353 MW, Netherlands 1,219 MW and Portugal 1,022 MW, as well as Germany and Spain).

The 40,504 MW installed in the EU by the end of 2005 will, in an average wind year, produce some 83 TWh of electricity, equal to 2.8 % of EU electricity consumption in 2004.

The EU's target for wind energy is 40,000 MW by 2010. Thanks to strong market growth mainly in Germany, Spain and Denmark, this target has already been met in 2005, five years ahead of time.

THE EU RENEWABLES DIRECTIVE

An important factor behind the growth of the European wind market has been strong policy support both at EU and at national level. The EU's Renewables Directive has been in place since 2001. It aims to increase the share of electricity produced from renewable energy sources (RES) in the EU to 21 % by 2010 (up from 15.2 % in 2001), thus helping the Union reach the RES target of overall energy consumption of 12 % by 2010.

According to the directive, each member state is obliged to generate a specified proportion of its electricity from renewable sources by 2010. For the time being, these targets are indicative, and it is up to the member states to take appropriate measures to promote renewable electricity production and consumption. The national targets vary between 78 % (Austria) to 6 % (Belgium), depending on the current share of renewables in the national energy production.

Germany

POLITICAL SUPPORT MECHANISMS

In Europe, a number of main types of regulatory policies have been used to support renewables:

Feed-in tariffs exist in most member states, including Germany: Electric utilities are obliged to enable renewable energy plants to connect to the electric grid, and they must purchase any electricity generated with renewable resources at fixed minimum prices. These prices are generally set higher than the regular market price, and payments are usually guaranteed over a specified period of time. The additional costs of these schemes are paid by suppliers and are passed through to the power consumers. These schemes have the advantages of investment security, the possibility of fine tuning and the promotion of mid- and long-term technologies.

A variant of the feed-in tariff scheme is the fixed-premium mechanism currently implemented in Denmark and partially in Spain. Under this system, the government sets a fixed premium or an environmental bonus, paid above the normal or spot electricity price to RES generators.

Under the **green certificate** system, which currently exists in Sweden, the UK, Italy, Belgium and Poland, electricity produced by RES is sold at conventional power-market prices, but the quota for this is set by the government: Consumers (or suppliers) are obliged to purchase a certain number of green certificates from producers according to a fixed percentage of their total electricity consumption (supply). There are penalties for non-compliance.

Since consumers wish to buy these certificates as cheaply as possible, a secondary market of certificates develops where producers compete with one another to sell green certificates. However, green certificates may pose a higher risk for investors and make it less attractive to invest in developing high cost technologies for the long-term future.

Pure **tendering** procedures existed in two Member States (Ireland and France). However, France has recently changed its system to a feed-in tariff combined with tendering system in some cases and Ireland has just announced a similar move. Under a tendering procedure, the state places a series of tenders for the supply of renewable power, which is then supplied on a contract basis at the price resulting from the tender. The additional costs generated by the purchase of RES are passed on to the end consumer. While tendering systems theoretically make optimum use of market forces, they have a stop-and-go nature not conductive to stable conditions. This type of scheme also involves the risk that low bids may result in projects not being implemented.

In December 2005, the European Commission published a report on the functioning of the Renewables Directive and on a potential harmonization of the various support schemes in the different countries. However, the Commission suggested not to harmonise the support mechanisms at this stage, saying that it was too early to compare the advantages and disadvantages of well-established support mechanisms with systems with a rather short history. However, the Commission's analysis shows that for wind energy, systems using feed-in tariffs currently have the best performance for wind energy.

EWEA also believes that a hasty move towards a harmonized EU-wide payment mechanism for renewable electricity would have a profound negative effect on the markets for wind power and put European leadership in wind power technology and other renewables at risk. It is also of the opinion that real competition in the conventional power market must precede a harmonized market for renewable electricity.

The European Parliament, environmental NGOs and the renewables industry have long called for ambitious and mandatory RES targets to be set at European level for the period up to 2020. So far, EU Member States have been reluctant to adopt such long-term targets.

EU: TOTAL INSTALLED CAPACITY

Year	MW
2000*	12,887
2001*	17,315
2002	23,159
2003	28,598
2004	34,371
2005	**40,504**

*until 2001: EU-15

Germany

CURRENT MARKET SITUATION

17,574 wind turbines with a total capacity of 18,428 MW were installed in Germany by the end of 2005. This corresponds to an 11 % increase compared to the previous year. 1,049 new wind turbines with a total capacity of 1,808 MW were installed in during the year 2005, down from 2,037 MW in 2004.

However, exports from manufacturers and suppliers in 2005 clearly overcompensated for the decline in the domestic market. This is due to the rapidly expanding global market. In the longer run it is also expected that the industry will profit from the developing offshore business.

The total share of wind energy in the total electricity consumption in Germany now stands at approximately 5.5 %.

LEGISLATIVE FRAMEWORK

The amended version of the *Renewable Energy Sources* Act (Erneuerbare-Energien-Gesetz / EEG) came into force in 2004. Since 2000, under EEG regulations electricity produced from renewable energy sources is given priority for connection to the grid, the priority of purchase, of transmission, and for payments. These include hydropower, wind, solar, and biomass energy, geothermal energy as well as landfill, pit and sewage gas. Grid operators are obliged to feed in electricity produced from renewable energy and buy it at a minimum price within their supply area. The regulation also introduced at German-wide scheme to equalise costs incurred by grid operators, as the amount of energy from renewables being fed into the system differs in the various regions. The next amendment of the law is scheduled for 2007/2008.

In order to allow for technological progress and continuous cost reduction, the compensation rates are subject to nominal annual degression. In the case of wind energy, this is set at an annual 2 % for new wind energy turbines.

As of 1 January 2006, the initial tariff for onshore wind energy is set at 8.36 euro cent for at least five years. After this, depending on the site, the tariff can drop to the basic rate of 5.28 euro cent. The tariff is fixed for 20 years. Depending on the reference revenue, the initial tariff is

granted between 5 and 20 years. No compensation is granted for plants with a reference revenue of less than 60 %. There are additional incentives (prolonged initial tariff) for the repowering of plants.

For offshore wind energy, the initial tariff is set at 9.10 euro cent, with the basic tariff at 6.19 euro cent, for a period of 20 years. The initial tariff is granted for capacity put into operation before the end of 2010 for 12 to 20 years, depending on the site. There is an additional prolongation for deeper waters and a growing distance from the coast.

Another important regulation is the German Federal Building Code which treats wind energy plants as privileged projects. Local authorities are supposed to designate specific priority- or preferential zones for wind energy utilisation. However, this means that they can also restrict construction to specific areas (exclusion zones).

REPOWERING TRENDS

Germany will continue to face a slight decline in the market over the next two to three years. For onshore wind farm development, the amount of sites commissioned is decreasing while repowering is proceeding at a slow pace. Germany has been the dominant market in the global wind industry for over a decade, and a slower rate of growth is therefore regarded as natural. Experts anticipate that around 1,500 MW of new capacity will be installed in 2006.

Already now, repowering could play a stronger role in Germany today. However, this is not the case mainly due to increasing building restrictions. A number of Federal States (Länder) have issued recommendations concerning

Fuhrlaender wind farm, Germany

vicinity and height restrictions, which are then being adopted by the responsible local authorities. In practice this means that a large number of suitable sites can no longer be used for the installation of modern turbines. The height restrictions also inhibit the production of units yielding the maximum energy. If these framework conditions remain in place, a lot of onshore potential will not be realised.

OFFSHORE POTENTIAL

A recent study published by the Ministry of the Environment (BMU) includes a projection for 1,100 MW offshore wind capacity by 2010, and as much as 12,000 -15,000 MW by 2020. The tariff for offshore installations is currently higher than that for onshore plants. However, at the moment, no offshore projects are in operation or under construction.

Mainly for nature conservation reasons, the German offshore parks will be erected up to 40-60 km away from the coastline and 20-40 meters deep. So far, experience of building such wind farms is very limited, hence higher risk attached make financing from banks more complicated. More than 60,000 MW of projects have been proposed by various companies and consortia. Eleven projects were licensed by the end of 2005 in the North and the Baltic Seas by the national maritime authority.

The first pilot projects are expected to come into operation no earlier than 2008. To support the development, an Offshore Foundation with membership from manufacturers, government, associations and grid operators started activities in summer 2005.

FUTURE DEVELOPMENTS

An improved framework for wind energy was a topic that was also addressed in the coalition agreement between the newly elected government parties, Christian Democrats (CDU/CSU) and Social Democrats (SPD). This includes specific support for repowering and offshore and a rapid grid expansion.

The domestic market will consolidate at a high level once the administrative hurdles such as general distance regulations and height limits can be overcome and construction can continue. This is mainly a political issue. In principle there is still a potential for new turbine capacity of about 11,000 MW that could be erected on already commissioned sites onshore. Additional capacity will come from repowering: new studies clearly state that repowering has the potential to double the amount of wind energy capacity onshore in Germany (currently over 18,000 MW) with significantly fewer turbines and can triple the energy yield.

GERMANY: TOTAL INSTALLED CAPACITY

Year	MW
2000	6,113
2001	8,754
2002	11,994
2003	14,609
2004	16,629
2005	**18,428**

Spain

FRAMEWORK & POLICY

The year 2005 saw the consolidation of a reliable support system in Spain's electricity market, which gave a strong impetus to wind energy development. The system is now firmly based on a predictable feed-in tariff in combination with an optional pool price plus premium mechanism.

One major step for renewable energy was the approval of the "*Plan de Energías Renovables en España, 2005-2010*," (PER) in the Council of Ministers in August 2005, by which the Spanish government updated the renewable energy targets that had been set in 1999.

The PER sets new targets for installed power and electricity production for each technology, as well as for biofuel production. The purpose is to achieve the 12 % target of primary energy consumption of in Spain from renewable sources, established by the electricity sector act 57/1997.

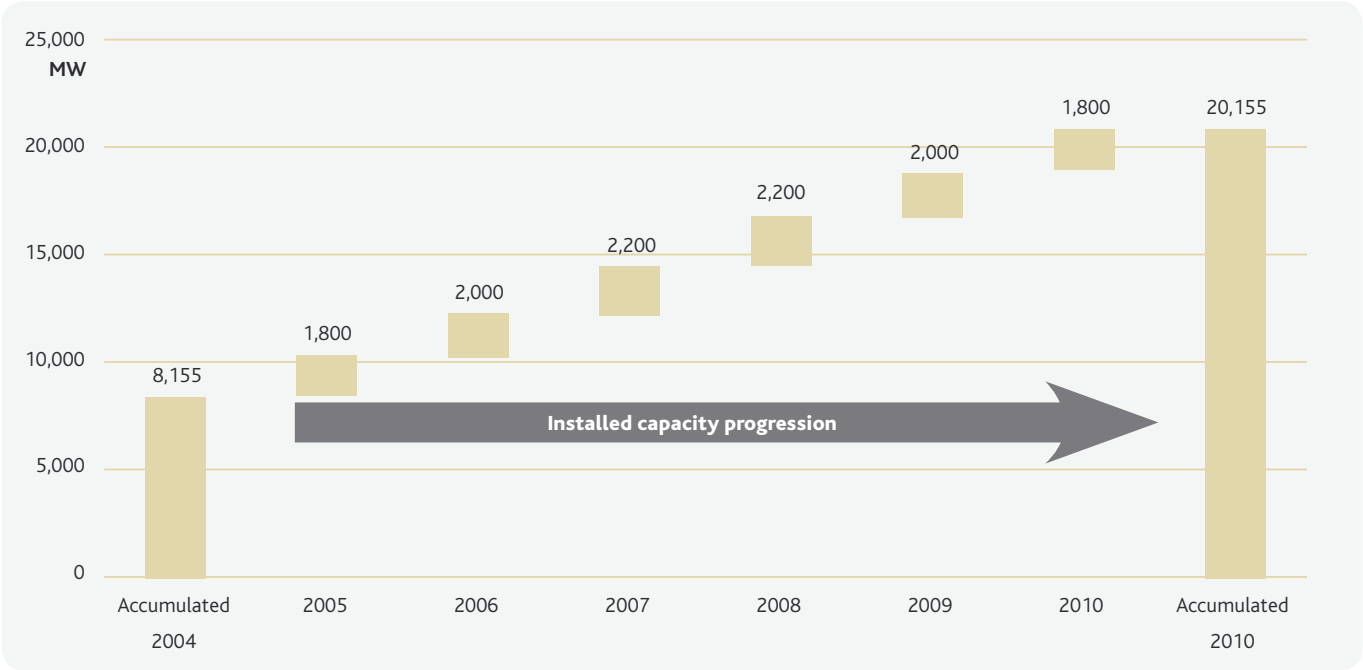
Following the adoption of the first renewable energy plan in Spain in 1999, renewable energy has grown at a much higher rate than originally expected, with growth as high as 4,3 % since 2001. As a result, there was a need to review the plan to adapt it to the real conditions.

The new Spanish Renewable Energy Plan also aims to steadily combat increasing CO_2 emissions, which are now 30 % higher than previously forecasted in order for Spain

to fulfil its Kyoto commitments. The new renewable energy targets have also been allocated to better deal with issues of security and diversification of energy supply, which were particularly dominated this year by high volatility of oil prices, and for the vulnerability resulting from the procurement of natural gas from unstable regions.

In the determination of the specific new targets, the wind energy potential in Spain is clearly recognised with 20,155 MW.

The Spanish PER takes into account the fact that the rapid progression of wind energy has led to Spain meeting its targets for 2010 five years ahead of time. It also accounts for the Spanish turbine manufacturing industry, which can provide up to 2,500 MW/year, and will help the country reach its 20,155 MW target for 2010.



WIND POWER IN THE SPANISH POWER SYSTEM

Wind power installed capacity rose to 10,028 MW in 2005, with 1,764 MW of new installed capacity, consisting of turbines between 660 MW and 2,000 MW in size.

Overall, more than 20,000 GWh have been produced in Spanish wind farms. For the first time, this figure exceeded the outputs of large hydroelectric power plants with 16,658 MW of installed capacity which were previously in the forefront. New figures confirm wind energy as the primary renewable energy resource that is now firmly embedded in the Spanish mainstream power generation portfolio.

Debates about large scale wind energy supply in 2005 focused on specific technical issues and brought about substantial improvements in prediction tools through the "Spanish prediction exercise". This programme involves the Asociación Empresarial Eólica (AEE), the Spanish R&D Ministry, the National Meteorological Institute as well as several prestigious institutes.

Moreover, the Spanish TSO Red Eléctrica de España has designed new specific grid codes for wind energy, which will trigger increased R&D efforts to improve turbine technology. This will help address security of supply and system inadequacy issues, especially in the field of active power control and wind farm protection.

Grid stability is one of the main issues arising from the large scale wind power connected directly to the transmission net. This requires new technical guidelines on the operation of the turbines, and also new operative demands in order to increase the communication between wind farm operators and the TSO.

Therefore, new codes are needed to address the issues related to the large contribution of wind power in congestion management, providing signals to enable the proper operation of the power system and making it possible to connect and disconnect the wind turbines through an intermediate control centre. These new codes are expected to come into force in 2006.

Leitza-Beruete, Navarra, Spain

WIND POWER AND THE WHOLESALE ELECTRICITY MARKET

At the end of 2005, 93 % of wind power was supplied through the wholesale electricity market, and there has been a strong trend towards migration between the different revenue schemes. This shows the capability of wind power operators to participate in electricity trading.

Globally, Spain holds the second position for installed wind power capacity with 10,028 MW, after Germany with a capacity of 18,428 MW.

Iberdrola Group, Spain's largest renewable utility with 3,259 MW of installed wind power capacity, was the world leader in wind energy in 2005, representing 32,5 % of the Spanish market.

Gamesa, with more than 62 % of the Spanish turbines market is leading Spain to be the third largest manufacturer in the world.

SPAIN: TOTAL INSTALLED CAPACITY

Year	MW
2000	2,235
2001	3,337
2002	4,825
2003	6,203
2004	8,263
2005	**10,027**

Italy

In its Renewable Energy Directive, the European Commission in 2001 set what seemed like an ambitious target at the time for Italy: at least 22 % of electricity supply should come from renewable sources by 2010. While at the time, the availability of financial incentives was uncertain, the introduction of a Green Certificate based system (linked to an obligation on power producers to source an increasing percentage of their supply from renewables) has since created more stability. This combination, coupled with the support given by the Italian government through ratification of the European Directive (through national decree 387/03), has reinforced backing for renewable energy.

Both geothermal and hydroelectric energy is widespread in Italy but they have reached their saturation levels and have limited possibilities of further development. The photovoltaic market is slowly emerging thanks to a good feed-in tariff system but the target defined for photovoltaic installations is limited to only 300 MW by 2010. Wind and biomass energy are the only renewable energy sources which can be exploited to reach the EU targets in a reasonable timescale and at competitive cost. The confidence that the market is currently showing towards wind energy is reflected in the latest statistics. By the end of 2005, Italy had reached a level of more than 1,700 MW, taking it to fourth position on the European league charts.

LEGISLATIVE FRAMEWORK

The 1999 Italian White Book defined all the renewables targets by the year 2010, including a target of 2,500 MW for wind installations. The first important opening for renewable energy in Italy came with the introduction of national regulation CIP 6/92, which established a fixed feed-in tariff for the first eight years of a plant's production, enabling investors to see a predictable return on their investment.

In 1999, however, the Bersani decree (79/99) restructured the Italian electricity market to be in line with the European Union's liberalisation directive. Since 2002, the support system has therefore been changed from a feed-in price mechanism to a renewable energy quota system based on green certificates. This new system fixed the proportion of energy to be produced from renewable sources at 2 %, with the condition that it must come from new or repowered

plants which came into operation after 1 April 1999.

In 2002, the Italian Government also confirmed its commitment towards the Kyoto Protocol by setting a target for the reduction of CO_2 emissions by 6.5 % by 2010. The 22 % target of the EU's RES Directive further helped the process.

Another fundamental step took place in December 2003 with the adoption of the national decree 387/03 implementing EU directive 2001/77/EC for the promotion of renewables:

- Increase of the quota of renewables by 0.35 % per year in the period 2004-2006, with the Italian Government defining the increase for the years after 2006.
- Establishment of the Italian Energy Observatory to monitor the application of national and European directives for the promotion of the renewables and to evaluate the status of the renewables development.
- Definition of the methodology for calculation of the price for the power from renewables.

DEVELOPMENT TRENDS

The growing Italian market has brought about the arrival of several new domestic players as well as growing interest from foreign developers, even if the wind resource is rather limited. The involvement of these new investors and an increase in competition has in turn led to the search for potential sites outside the traditional areas in the Southern Italian mainland.

In 1998, just two regions represented 78 % of the total market in Italy; today all the Southern Italian regions are involved in wind development. The acceptance of wind farms by the local population has been further encouraged

Florinas (SS) Sardinia wind farm, Italy

in some areas by using the local workforce for both on site construction and maintenance activities.

The Italian wind industry today employs about 3000 people (including indirect employment), with Vestas being the only turbine manufacturer present in Italy, located in Taranto (Puglia). The types of turbines installed in the Italian market are mainly medium size with capacities ranging between 500 and 850 KW. The trend is now moving towards larger MW turbines, despite the fact that installations of this size can be difficult to construct. Many sites are located in complex and hilly terrain, where transportation and access are both difficult.

In 2005, more than 50 % of the total installed capacity in Italy came from large size turbines. The increased use of MW turbines has met with some local opposition from people who consider their visual impact to be esthetically displeasing. In the region of Sardinia and Puglia, for example, the authorities recently called a halt to the installations. Both the Italian National Wind Energy Association and the government have responded critically to this type of radical exclusion of wind energy.

Despite these problems, the year 2005 fulfilled the wind energy industry's expectations, with a growth rate of 35 %. The prospects for 2006 are even higher and if the present trend continues in the next years, the target of 2,500 MW by 2010 will be met by 2007. Studies show a potential of at least 5,000 MW in Italy.

Wind energy will be fundamental to reach the target under the European Union's Renewable Energy Directive: ANEV (Italian National Wind Energy Association) estimates that the wind capacity required to reach the target of 22 % of renewable energy by 2010 would be in the range of 8,000 MW.

The main barriers to the development of the wind sector remain the regional authorization hurdles (i.e. in Sardinia and Puglia), local acceptance and grid connection difficulties. To further the development of the wind sector in the next years and in order to promote renewables it is necessary to clarify and reinforce some aspects of the national decree 387/03: to implement the wind sector guide lines, to better coordinate between government and the Italian regions, to increase compulsory renewable energy quota and to define the grid connection rules.

ITALY: TOTAL INSTALLED CAPACITY

Year	MW
2000	427
2001	682
2002	788
2003	904
2004	1,265
2005	**1,717**

United Kingdom

The UK government has a target for 10 % of the country's electricity supply to be provided by renewable sources in 2010, and wind energy is expected to be the main contributor. Projections by the British Wind Energy Association (BWEA) show that a total of up to 8,000 MW of capacity could be installed by the end of the decade. This would meet more than three-quarters of the national target.

Britain has the best wind regime of any country in Europe, but the growth of its market has been hampered in the past by a mixture of opposition to development at a local level and lack of clear government policy. Both those elements have improved over the last few years, encouraged by clearer guidelines to local authorities, a strong campaign by the BWEA to promote the benefits of wind power, and the introduction of a green certificate-based market incentive providing greater security to investors.

The result is that 2005 was the best year ever for construction of wind farms in the UK. A total capacity of 446 MW was commissioned, more than a fourfold increase on 2003, taking the total to almost 1,337 MW. A further 797 MW is already under construction, and should be completed during 2006, with the largest project being a 120 MW wind farm in South Ayrshire, Scotland. But as importantly, a long list of further projects either already have permission to go ahead or are waiting for a decision from the relevant authorities, providing confidence that the UK's ambitious target is achievable.

PLANNING SUCCESS

According to the BWEA's latest annual survey, roughly 2,098 MW of capacity had gained consent, but has not yet gone forward to construction, and even more is awaiting determination. In Scotland alone, a total of 5,387 MW is waiting for a decision to be made, most of that under a separate procedure for handling projects of more than 50 MW installed capacity. Evidence of increased developer confidence is that even in England, where gaining planning consent has historically proved more difficult, a record number of applications – over 2,700 MW of capacity on and offshore – were submitted during 2005.

What these figures show is that, despite the perennial UK problem of determined local opposition to specific projects, substantial progress is now being made. Scottish wind farms still accounted for the largest installed capacity

Carno wind farm, Wales, UK

Novar wind farm, Scotland, UK

in 2005. However, the approval rate for wind farms in England was better by comparison, and it appears that new planning guidance in England – PPS22 – has begun to have an effect.

The level of activity around the UK is also evidence that the Renewables Obligation, the green certificate based support system introduced in 2001, is creating sufficient confidence in the market. A review of the RO is scheduled to take place in 2006, but the government has indicated that it does not intend to change the basic parameters.

OFFSHORE DEVELOPMENT

If the 2010 target is to be achieved, however, an important contribution is expected to be made by wind farms built around the UK's coastline. These have been encouraged by two successive rounds of sea bed lease allocation, both organised by the Crown Estate, which controls activity in coastal waters.

In the first round, projects with the potential for more than 1,500 MW of capacity were allocated leases. Three of these have already been built – at North Hoyle (60 MW) off the west coast, Scroby Sands (60 MW) off the east and Kentish Flats (90 MW) in the Thames Estuary. The Barrow project off the coast of Cumbria is now under construction and will be complete in early 2006. These have provided valuable experience of how to handle the demands of marine installation. However, they have also shown how difficult and risky such projects are. Progress will be slow for the next two years, while a number of issues are resolved.

Once these technical and commercial issues are settled however, the potential from the second offshore round is enormous. Leases have been granted by the Crown Estate on 15 sites in three strategic areas, all further out to sea than in the first round, and with the projects proposed ranging in size up to 1,200 MW. When built, these would have a total capacity of up to 7,200 MW, equivalent to 7 % of the UK's electricity supply.

Whilst the Round 1 projects have benefited from capital grants provided by the UK government, however, these will not be available for the second round. In order to make the much larger Round 2 projects viable, BWEA is calling for additional measures to allow offshore to be viable until costs can be brought down through innovation.

Meanwhile, starting with the 1,000 MW London Array scheme, up to four Round 2 projects totaling over 2,500 MW applied for construction consent during 2005, a process that could take up to a year to complete. When the first of these dips its foundations in the sea, it will place the UK firmly in the vanguard of the European offshore league.

UNITED KINGDOM: TOTAL INSTALLED CAPACITY

Year	MW
2000	406
2001	474
2002	552
2003	648
2004	888
2005	**1,353**


EUROPE
Total capacity end of 2004 34,647 MW
New installed capacity in 2005 6,316 MW
Total capacity end of 2005 40,904 MW
NORTH AMERICA
Total capacity end of 2004 7,169 MW
New installed capacity in 2005 2,670 MW
Total capacity end of 2005 9,832 MW
LATIN AMERICA & CARIBBEAN
Total capacity end of 2004 207 MW
New installed capacity in 2005 6 MW
Total capacity end of 2005 213 MW

ASIA

Total capacity end of 2004	4,785 MW
New installed capacity in 2005	2,199 MW
Total capacity end of 2005	6,982 MW

AFRICA & MIDDLE EAST

Total capacity end of 2004	252 MW
New installed capacity in 2005	12 MW
Total capacity end of 2005	264 MW

PACIFIC

Total capacity end of 2004	561 MW
New installed capacity in 2005	328 MW
Total capacity end of 2005	889 MW

United States

2005: A RECORD-BREAKING YEAR

The U.S. wind energy industry shattered all previous annual installation records in 2005, adding more than 2,400 megawatts (MW) of new generation capacity. The industry is expected to turn in an even bigger performance in 2006, with installations likely to top 3,000 MW, according to the American Wind Energy Association (AWEA).

The record addition of 2,431 MW boosted cumulative U.S. capacity by over 35 %, and brought the country's total wind power generating capacity to 9,149 MW as of December 31, 2005. There are now utility-scale installations in 31 states.

U.S. wind energy facilities will produce an estimated 25 billion kWh in 2006 – about 0.6 % of the country's electricity generation, enough to power the equivalent of 2.3 million average American households. The current U.S. electricity mix consists of about 50 % coal, 20 % nuclear, 18 % natural gas, 6.5 % hydropower, with the rest generated from other sources like oil and non-hydro renewables, according to the U.S. Energy Information Administration. With stable, supportive policies, wind energy could provide at least 6 % of U.S. electricity by 2020 – a share similar to that of hydropower today – and more over time.

The new wind farms completed in 2005 include twelve projects of 100-MW capacity or more, ranging geographically from the 140-MW Maple Ridge project in upstate New York, to the150-MW Hopkins Ridge project in Washington state, in the Pacific Northwest. The largest single project completed this year was the 210-MW Horse Hollow wind energy center in Texas. Texas added some 700 MW of wind in 2005 – the largest amount installed in any state – which brings it close to long-time national leader California.

Nine Canyon wind farm, Washington State, USA

THREE-YEAR WINDOW OF STABILITY IN PRODUCTION TAX CREDIT PLAYS KEY ROLE

The wind energy industry is delivering this record-breaking growth thanks to a three-year window of stability in the federal incentive for wind energy, the production tax credit (PTC). The credit was extended in mid-2005, before its scheduled expiration in December 2005, thus providing the U.S. wind energy sector with the first "seamless" extension ever and with a stable planning horizon through December 2007. Following the past six years of boom-and-bust cycles caused by successive expirations of the PTC, this relative stability allows companies to ramp up production and plan for growth.

The PTC provides a 1.9 cent-per-kilowatt-hour (kWh) tax credit for electricity generated with wind turbines over the first ten years of a project's operations, and is a critical factor in financing new wind farms. In order to qualify, a wind farm must be completed and start generating power while the credit is in place. The credit helps to level the playing field for wind in the energy sector, which is one of the most heavily subsidized in the U.S. economy.

RENEWABLE PORTFOLIO STANDARDS PROGRESS IN STATES

While the U.S. federal government has failed to endorse strong renewable energy policies, a growing number of states are enacting policies of their own, including minimum renewable energy requirements for utilities (a policy often referred to as the Renewables Portfolio Standard, or Renewable Energy Standard). Twenty states and the District of Columbia have now adopted some form of RPS. In 2005, Texas increased its original 1999 RPS from 2,000 MW of electricity from renewables by 2009 to 5,580 MW by 2015.

TRANSMISSION HURDLES STILL LOOM

To further tap the country's vast wind energy potential and bring wind energy to market, changes will be needed in electric industry practices. The wind energy industry and other organizations that support renewable energy development are advocating electric market rules that do not unfairly penalize new technologies like wind. They are also working to seek upgrades and expansion of transmission lines in wind-rich areas. Given the complex and decentralized nature of the country's electric market, the challenge for the U.S. wind energy industry and its allies is to make such changes happen, in a timely fashion, in the multiple arenas where such decisions are made.

ECONOMICS POINT TO WIND

Simple economics is also driving wind power growth. The rising cost of fuel, and in particular that of natural gas, is prompting utilities to look more closely at wind: because it is a fuel-free source of energy, investing in wind allows utilities to lock in stable-priced electricity for as long as twenty years. Wind energy development can also help cut consumers' heating and electric bills by lowering demand for natural gas and extending its supply. And while a massive wave of new coal plants is currently proposed in the U.S. in response to high natural gas prices, it remains to be seen how many of these coal plants will in fact be built over time (or older plants retired), given the carbon question mark looming over all power generation in the years ahead.

UNITED STATES: TOTAL INSTALLED CAPACITY

Year	MW
2000	2,578
2001	4,275
2002	4,685
2003	6,372
2004	6,725
2005	**9,149**

Canada

The Canadian wind market has grown by an average of more than 30 % over each of the last six years as a result of a mixture of federal incentives and initiatives by individual provinces to increase the contribution from wind or renewable energy. In 2005, the industry installed 239 MW of new wind energy capacity, shattering the previous annual installation record of 122 MW established in 2004. As a result, Canada's total installed wind energy capacity grew by 54 % in 2005 and now stands at 683 MW. This means that wind energy now produces enough electricity in Canada to power more than 200,000 homes.

In 2005, Canada's largest project, the 150 MW Centennial wind farm in Saskatchewan, commissioned its first 90 MW, with the remainder to be commissioned in early 2006. The province of Manitoba installed its first wind farm and the largest wind farm in Atlantic Canada (31 MW) was commissioned in the province of Nova Scotia. Quebec also saw the installation of the Mont Miller wind farm.

Castle River wind farm, Alberta, Canada

ECONOMIC IMPACT

With the rapid growth of the industry in Canada, the economic benefits of wind energy are becoming more apparent. Projects installed in 2005 represented more than $400 million (289 million euro or 344 million USD) worth of investment and investment could be seen in five new Canadian manufacturing facilities to produce wind turbine towers, blades and nacelles. With the vast majority of wind energy development taking place in rural areas, wind energy projects are also providing real and ongoing economic benefits to both rural landowners through lease payments and rural municipalities through increased tax revenues.

A study commissioned by the Canadian Wind Energy Association (CanWEA) estimates that the wind industry provides the equivalent of 720 full-time direct jobs, with an annual payroll of just under $500 million (362 million euro or 430 million USD). Including indirect impacts, 1370 jobs result from the presence of the wind industry in Canada. Two-thirds of the $400 million (289 million euro or 344 million USD) industry is spent on goods and services from Canadian suppliers.

POLICY

In 2005, Canadian federal and provincial governments both put in place policy measures to boost the deployment of wind energy technology.

An important contributor to Canada's vibrant market has been the federal government's Wind Power Production Incentive (WPPI). In 2005, the Federal Government extended the WPPI program to 2010 and quadrupled the funds available such that it can now support the development of 4,000 MW of wind energy development in Canada. It also improved the tax treatment of investments in wind energy by allowing for accelerated depreciation of such investments.

Several provinces also implemented policies that will underpin the growth of wind power in Canada. These were the most important developments:

- The province of Alberta agreed to proceed with construction of a major new transmission line (funded by ratepayers) solely to expand the potential to bring wind energy on-line in the SW corner of the province

Castle River wind farm, Alberta, Canada

- The province of Manitoba announced its intention to procure 1,000 MW of wind energy by 2014.
- The province of Ontario announced a 1,000 MW request for proposals for renewable energy and subsequently awarded 955 MW of power purchase agreements to wind energy developers
- The province of Quebec issued a request for proposals for 2,000 MW of wind
- The province of New Brunswick announced its intention to procure 400 MW of wind energy by 2016
- The province of Prince Edward Island announced its intention to procure 200 MW of wind energy by 2010 (PEI's peak load is 210 MW)
- The Government of Prince Edward Island put in place a system of Standard Offer Contracts for wind energy development and the province of Ontario announced its intention to create a Standard Offer Contract system for small wind energy projects

As a result of these policy measures, experts predict much more dramatic growth in the years to come. The year 2006 will see at least 500 MW of wind energy projects commissioned with construction taking place in Alberta, Saskatchewan, Manitoba, Ontario, Quebec, New Brunswick, Nova Scotia and Prince Edward Island. CanWEA estimates that the recent implementation of policy measures could facilitate the installation of a minimum of 8,000 MW of wind energy in Canada by 2015. This would make wind energy responsible for 16 % of all electricity to be produced by new generating facilities to be constructed in Canada over the next decade.

CANADA: TOTAL INSTALLED CAPACITY

Year	MW
2000	137
2001	198
2002	236
2003	322
2004	444
2005	**683**

Brazil

The energy mix in Brazil is already made up of 44 % of renewables (mainly hydropower), and renewables will continue to play an important role in the country's electrification plans. As high oil prices, electrical shortages and air pollution problems are putting pressure on the authorities to provide sustainable solutions, ethanol, biomass, hydroelectricity, wind and solar power generation are in a strong position to be the main sources for rural electrification projects.

As a result of the highly cost effective electricity production of hydroelectric power plants, any alternative energy source in Brazil needs to be competitive. Studies of the CBEE have shown that wind power can now be generated at costs comparable to thermoelectric, nuclear and even new hydroelectric pants. Almost 70 % of the potential future hydro plants would require higher investments that those for wind farm projects. Especially potential new hydro plants in the Amazon region would be considerably more expensive than the existing plants.

Horizonte wind farm, Brazil

However, at this stage, wind still plays a secondary role in Brazil. According to a wind atlas published by the Brazilian Wind Energy Centre (CBEE), the total wind potential for Brazil is estimated at 29GW. One of the most promising regions is the Northeast, which has poor water but strong wind resources.

A stronger use of wind energy would have the advantage of preserving water for much needed irrigation in the São Francisco River in the Northeast of the country. Big planned irrigation projects could have a detrimental impact on the water volume of the hydroelectric plants reservoir, which would affect the electricity production and supply in the entire region. Interestingly, the highest wind speeds in this region occur during seasons in which the water level in the river is at its minimum. Wind farms could thus counteract this problem and save river water when it is most needed.

Brazil is also one of the pilot countries under the UNEP's Solar and Wind Energy Resource Assessment (SWERA), which aims to help countries assess their wind and solar potential.

THE PROINFA PROGRAMME FOR ALTERNATIVE ELECTRICITY SOURCES

In 2002, the Brazilian government passed a programme called PROINFA to stimulate the development of biomass generation, wind and small hydro generators. This law was revised in November 2003.

In a first stage (up to 2007), the programme guarantees power sale contracts to 3,300 MW of projects using these technologies. The Brazilian state-controlled electricity utility Electrobás will buy power produced by RES under

Murcuripe wind farm, Brazil

power purchase agreements (PPAs) of 20 years at pre-set preferential prices. These prices will have a reference value floor of 70 % of the national average supply tariff. The incremental costs of the RES power will be passed on to the end-use consumers through an increase on energy bills. The Brazilian National Development Bank (BNDES) will make special financing programmes available for renewables projects that are eligible for PROINFA.

PROINFA stipulates that a minimum of 60 % of construction costs have to be spent domestically. As a result, the programme is expected to generate 150,000 jobs and to attract private investments worth some 2.6 billion USD.

In a second stage, once the 3,300 MW objective has been met, PROINFA aims to increase the share of the three renewable sources to 10 % of annual electricity consumption within 20 years. In this stage, renewable energy generators will be required to issue a number of Renewable Energy Certificates proportional to the amount of clean energy produced.

Despite the high expectations raised by the PROINFA programme, the scheme has, to date, failed to deliver the great number of wind projects the government had aimed for. Only 29 MW had been installed by the end of the year 2005, falling short of the initial target to increase the installed capacity to 1,000 MW by then. The installed wind capacity by 2007 is now estimated at 1,451 MW.

BRAZIL: TOTAL INSTALLED CAPACITY

Year	MW
2003	23
2004	24
2005	**29**

Mexico

Among Latin American nations, Mexico is one of the most promising areas for wind energy development. Its abundant wind resource has an estimated energy potential of 30,000 MW located in the region of the Isthmus of Tehuantepec, State of Oaxaca. The Mexican Wind Energy Association (AMDEE) currently estimates the development of at least 3,000 MW in the 2006-2014 period, with transmission availability representing the major obstacle. Currently, Mexico has a total installed capacity of 3.2 MW in two small wind farms, both of which have been in operation since the mid-nineties. No additional wind energy capacity has been installed since.

Mexico's incipient wind energy development is largely due to the historical inexistence of government incentives for the use of renewable energy, as well as the lack of a clear regulatory framework, that would allow for private sector participation in the development of wind facilities. The latter aspect is a consequence of the existing government monopoly in the electricity sector.

However, 2005 was characterized by some positive initiatives for renewable energy development in Mexico. A new provision was added to Federal Tax Laws that allows for 100 % depreciation on capital in the first year for all investments made toward the development of renewable energy.

Moreover, in December 2005, the Low Chamber of the Mexican Congress approved the initiative for the Renewable Energy Utilization Law (LAFRE), which aims at establishing a Renewable Energy Utilization Programme and set a target of 8 % of the national power production to come from renewable energy by 2012 (excluding large hydro). The law also enforces the creation of a Trust to support RE projects, rural electrification, biofuels and technological R&D.

Besides this Trust, there are other means such as the GEF (Global Environmental Fund), the UNDP (United Nations Development Program) and the World Bank and others to support large-scale power production from renewable energy, specially wind power and R&D.

E. La Venta wind farm, Mexico

E. La Venta wind farm, Mexico

In August 2005, a bid for an 83.3 MW wind facility, La Venta II, in the state of Oaxaca, by the National Electricity Commission was granted to the Spanish consortium Iberdrola-Gamesa.

The Federal government also announced provisions in the 2006 budget for the construction of another wind farm in Oaxaca. Finally, modifications to the existing interconnection contract between private renewable energy facilities and the national grid were passed by the Mexican Energy Regulatory Commission establishing clear methodologies for capacity recognition from renewable sources.

Furthermore, the large-scale RE Project PERGE received a GEF donation, through the World Bank, of 70 million USD (59 million euro). The objective of this project is to boost grid connected renewable energy in Mexico and reduce pollutant emissions. This project will be divided into two phases; in the first phase, a 101 MW wind power IPP will be supported. For this IPP, the national utility (CFE) will be paying for the avoided costs of power and a Green Fund will pay the producer an incentive on his production. This IPP will be tendered in 2006 to begin operation in 2008. For the second phase, the Fund will support five additional 101 MW wind power IPP's.

Private wind development in Mexico is characterized by the participation of a number of companies, including major players such as Gamesa, Iberdrola, EDF-EN, Unión Fenosa, GE Wind, Clipper Windpower and Endesa. The combined development portfolio in private wind energy facilities reaches 3,000 MW for the 2006-2014 period. Given high electricity prices and volatility, increasing interest from large industrial and municipal consumers is driving private development under the self-supply modality allowed by law.

However, the Mexican Wind Energy Association AMDEE has called for a more solid commitment by the Mexican Government to foster and protect private investment in this sector to match the increasing investment in wind development.

India

India's wind energy sector registered impressive growth and expansion during 2005. Total installed capacity stood at 4,430 MW at the end of December 2005, an increase of more than 1,430 MW over the previous year (2004), which makes India the fourth largest producer in the world. The growth witnessed during 2005 was also the highest ever in a single year, a massive 47.6 % increase over the previous year. Even so, given the country's vast potential, progress could be further accelerated.

Bidrekere wind farm, Karnataka, India

WIND POTENTIAL

The original impetus to develop wind energy in India came in the early 1980s from the then Department of Non-Conventional Energy Sources, now known as the Ministry of Non-Conventional Energy Sources (MNES). Its purpose was to encourage a diversification of fuel sources away from the growing demand for coal, oil and gas required to feed the country's rapid economic growth. MNES undertook an extensive study of the wind regime, establishing a countrywide network of wind speed measurement stations. These have made it possible to assess the national wind potential and identify suitable areas for harnessing wind power for commercial use. The total potential for wind power in India was first estimated by The Energy and Resources Institute (TERI) in 1990 as 45,000 MW and this figure was also adopted by the MNES as the official estimate of the wind power potential in the country. However, since 1990, a massive exercise of wind monitoring and wind resource assessment carried out by government agencies and private sector has identified many more resource areas and currently the Indian Wind Turbine Manufacturers Association (IWTMA) estimates the potential to be of the order of 65,000 MW.

INCENTIVES

The fiscal incentives extended by the Indian government to the wind energy sector include:

- Direct taxes – 80 % depreciation in the first year of installation of a project.
- Tax holiday for 10 years.
- No income tax to be paid on power sales to utilities.
- FDI investments are cleared very fast .

MNES has also issued guidelines to all state governments to create an attractive environment for the export, purchase, wheeling and banking of electricity generated

GR Halli wind farm, Karnataka, India

by wind power projects. After the Electricity Act 2003, State Electricity Regulatory Commissions (SERC) were set up in most of the states in the country. SERCs have the mandate of promoting renewables including wind energy through preferential tariffs and a minimum obligation on distribution companies to source a certain share of electricity from renewable energy. Different states have different tariffs for grid connected wind farms.

One result of these incentives and tariffs has been to encourage energy intensive and profit making industries and businesses to invest in wind power. An important attraction is that owning a wind turbine assures a profitable power supply compared to the tariff of the high voltage sector. Wind farms in India therefore often consist of clusters of individually owned generators. More than 97 % of investment in the wind sector in India has come from the private sector. In recent times wind farms have also come up as Independent Power Producers (IPPs).

Chitradurg wind farm, Karnataka, India

MANUFACTURING BASE

Over the past few years, both the government and the wind power industry have succeeded in injecting greater stability into the Indian market. This has encouraged larger private and public sector enterprises to invest. It has also stimulated a stronger domestic manufacturing sector; some companies now source more than 80 % of the components for their turbines in India. This has resulted both in more cost effective production and in creating additional local employment. Most recently, some Indian manufacturers have started to export their products.

Andhiyur wind farm, Tamilnadu, India

About nine wind turbine manufacturers are currently offering their products on the Indian market. The major players are Suzlon, Enercon, NEG Micon, Vestas RRB and Pioneer Asia Wind Turbines. It can be said that India is now emerging as a manufacturing and knowledge hub for wind power development.

The geographical spread of Indian wind power has so far been concentrated in a few regions, especially the southern state of Tamil Nadu, which accounts for more than half of all installations. This is beginning to change, with other states, including Maharashtra, Gujarat, Rajasthan and Andhra Pradesh, starting to catch up. The result is that wind farms can be seen under construction right across the country, from the coastal plains to the hilly hinterland and sandy deserts.

The Indian government envisaged a capacity addition of around 5,000 MW by 2012. However, the IWTMA is expecting an average of 1,500 MW to 1,800 MW of new installations every year for the next three years for wind alone.

INDIA: TOTAL INSTALLED CAPACITY

Year	MW
2000	1,220
2001	1,456
2002	1,702
2003	2,125
2004	3,000
2005	**4,430**

China

With its large land mass and long coastline, China is rich in wind energy potential. Estimates by the Chinese Meteorology Research Institute show the land-based exploitable wind resource with a potential power generation capacity of 253 GW (based on the relatively low height of ten metres above ground). Areas with rich wind resources are located mainly along the south-east coast and nearby islands and in Inner Mongolia, Xinjiang, Gansu Province's Hexi Corridor, and in some parts of Northeast China, Northwest China, North China and the Qinghai-Tibetan Plateau. The ocean-based wind resource is capable of supporting a further 750 GW of capacity.

The first Chinese wind farm went on line in 1986 as a demonstration project. With finance from foreign grants or soft loans, more grid connected turbines were installed. Then in 1994 the former Ministry of Electric Power made a decision to develop wind farms as a new clean power source. Regulations were issued to cover grid connection and the payment for electricity generated, making wind power commercially viable. By the end of 2005, total installations in mainland China had reached 1260 MW, with an annual growth of 60 %.

Tongyu wind farm, Jilin, China

Although satisfying electricity demand and reducing air pollution are the usual driving forces behind wind power, this has been made more difficult in China, where coal-fired generation is much cheaper than wind. Wind power development must therefore focus on cost reduction through large scale projects and the local manufacture of wind turbines.

The localisation of wind turbine manufacturing has the advantage of lower costs and benefits for the local economy. It is estimated that costs can be up to 15 % lower, a figure that will increase with the use of advanced technologies. Since most good wind sites are located in remote and poor rural areas, wind farm construction will benefit the local economy through the annual income tax paid to county governments, which represents a significant proportion of their budget. Other benefits include power grid extension for rural electrification and employment in wind farm construction and maintenance.

CONCESSION PROJECTS

To create a stable market it is crucial to establish a wind turbine manufacturing industry. The National Development and Reform Commission (NRDC) is therefore promoting "Wind Power Concessions" for large scale commercial development. The basic concept is that local authorities invite investors, both international and domestic, to develop 100 MW size wind farms at potential sites, with a tendering procedure aimed at bringing down the generating cost and increasing the proportion of locally made components.

The major elements of a wind power concession projects are:

- Each project should be 100 MW and the wind turbines no smaller than 600 kW.
- 70 % of the wind turbine components should be made in China.
- Local authorities are responsible for building access roads to the wind farm sub-station, and the grid company for transmission lines to the sub-station.
- Project investors are selected by public bidding, with the lowest feed-in tariff (price per kWh) obtaining the contract. The length of the contract is 25 years.
- After the first 30,000 full load hours of operation for a turbine, the feed-in tariff is reduced to the average for the power market at that time.
- All electricity produced by the project must be purchased by the provincial power grid company, which covers the extra cost of wind power generation.

By the end of 2005, the total installed capacity of wind power concession projects had reached 1,200 MW. A further 800 MW are planned in 2006. Although the aim of the concession scheme has been to encourage a reduction in the price of wind power within China's reformed electricity industry, where operation of power generation and the power grid are now separated, the negative aspect has been that the feed-in tariffs offered by

Huitengxile wind farm, China

winning concessions have been extremely low, providing little incentive for further investment.

On the manufacturing side, imported turbines have so far dominated the Chinese market. To increase the domestic capability, several government agencies have sponsored national initiatives, including "Ride The Wind" and the "National Debt Funded Wind Power" programmes. By the end of 2004, the market share of domestic made turbines had already reached 18 %. Even so, there is only one Chinese wind turbine manufacturer to have achieved a volume production capability.

RENEWABLE ENERGY LAW & REGULATIONS FOR RENEWABLE ENERGY POWER

In order to promote the development of renewable energy technologies, a renewable energy law was published in February 2005, and it entered into force on the 1st of January of 2006.

The key points of the new law are as follows:

1. Set up a national target for renewable development
2. Adopt feed-in tariffs system for renewable energy power
3. Set up a national wide cost sharing system
4. Set up a national fund and other incentives for promoting renewable energy development

In January 2006, Price Department and Energy Bureau of National Development & Reform Commission (NDRC), issued two documents to define the pricing and cost sharing of renewable energy power (Regulation 7) and to promote renewable power grid connection (Regulation 13).

The key points of these regulations are the following:

1. In principle, the renewable energy power price will be set by the national government. However, for wind, there will also be a bidding procedure to determine the price, which will then have to be approved by the government. A regulation outlining the details of this procedure is expected to be adopted in May 2006;
2. The extra cost of renewable energy for power will be shared by all electricity users;
3. The cost of renewable power grid connection will also be shared by the electricity end users;
4. The grid must buy the renewable energy power at a government approved price.

FUTURE PROSPECTS

According to the list of approved projects and those under construction, 2,000 MW of wind capacity could be installed by the end of 2006. Based on the "learning curve" theory of cost reduction, however, it will take a market of 3,000 MW in order to bring the cost of wind power down closer to that of coal. The goal for wind power in China by the end of 2010 is 5,000 MW, requiring an annual increase from 2006 onwards of 800 MW.

Looking further ahead, 30 GW of wind power has been proposed by the Chinese government in its long term planning for 2020; this would mean an annual installation level of 2,500 MW over the decade from 2011 onwards. By the end of 2020 it is estimated that, in order to satisfy growing demand, the total power capacity in China will reach 1,000 GW. In this scenario wind generated electricity would by then represent 1.5 % of total power production.

CHINA: TOTAL INSTALLED CAPACITY

Year	MW
2000	346
2001	402
2002	469
2003	567
2004	764
2005	**1,260**

Japan

Japan's wind energy industry has surged forward in recent years, partly spurred by a government requirement for electricity companies to source an increasing percentage of their supply from renewables. Development has also been encouraged by the introduction of market incentives, both in terms of the price paid for the output from renewable plants and in the form of capital grants towards clean energy projects. Power purchase agreements for renewables also have a relatively long lifespan of 17 years, which helps to encourage investor confidence. The result has been an increase in Japan's installed capacity from 461 MW at the end of 2002 (fiscal year) to more than 1,000 MW by March 2006.

In pursuit of the Kyoto Protocol objectives, Japan has a target to reduce the level of its greenhouse gas emissions by 6 % (compared to their 1990 level) by 2008-12. To help achieve this goal, the Japanese government introduced a Renewable Portfolio Standard (RPS) law in April 2003 with the aim of stimulating renewable energy to provide 1.35 % of total electricity supply in 2010. However, the law has a number of weaknesses, including

Costal wind farm, Japan

a very low target (almost one tenth of Germany's), the inclusion of electricity generated by waste incineration as "renewable" and insufficient market incentives. Apart from the RPS, the Japanese wind industry also benefits from the government's Field Test and New Energy Business Support Programmes.

The wind power capacity has increased very fast in the past ten yeas. However, the sector has experienced a slowdown over the last few years, mainly due to Japan's severe weather conditions. The country has a history of typhoon attacks that flew down turbines, coupled with lightning incidents, strong gusts and high turbulence, mostly in the mountainous regions.

Another issue which has created challenges for Japanese wind developers concerns grid infrastructure. The leading regions for wind power development in Japan are Tohoku and Hokkaido in the north of the country and Kyushu in the south. However, as the strongest electricity demand is concentrated in the centre of Japan, while most potential wind power sites are located in remote areas where grid capacity is relatively small, limited grid connection has hampered the development of wind generation.

Both the Japanese Wind Energy Association and the Japanese Wind Power Association have therefore been supporting further R&D activity in the areas of grid stability, technical safety, lightning protection and generation output prediction.

The official government target for wind power in Japan by 2010 is 3,000 MW. Achieving this figure could face unnecessary difficulties, however, due to the current RPS law and the above mentioned external conditions. Therefore, the Ministry of Economic, Trade, and Industry (METI) and New Energy and Industrial Technology

Beach wind farm, Japan

Development Organization (NEDO) have recently set up various committees, such as the committee of Wind Turbine Availability Improvement, the committee of Numerical Wind Power Prediction, the committee of Design Methods against Extreme Winds, the committee of Lightning Protection and the technical committee of Grid Connection to investigate these problems.

Improving the integration between the International Electrotechnical Commission (IEC) standards and Japanese Industrial Standards (JIS) is an important task, because the aforementioned Japanese external conditions differ from those in IEC Standards. Japan Electrical Manufacturers' Association (JEMA) supports this task under METI's initiative in order to develop 'J(=Japanese)-class wind models' with which any manufacturer can design a turbine at any place in Japan. To derive models, wind measurements with high sampling speed are undertaken.

Japan has huge offshore wind energy potential. However, no big project or research program has been initiated to develop Japanese offshore technology. The main hurdle to the development of offshore wind farms is the depth of the water even close to the shores.

JAPAN: TOTAL INSTALLED CAPACITY

Fiscal Year*	MW
2000	139
2001	308
2002	461
2003	678
2004	936
2005	**1,078**

*The fiscal year runs from 1 April – 31 March.

Philippines

The year 2005 was a big milestone in terms of wind energy development in the Philippines. The first wind farm in Southeast Asia was commissioned in the northern tip of Luzon island. This 24.75 MW facility was developed by Northwind Power Development Corp. in a 40 % Danish, 60 % Filipino partnership.

Following suit, the San Carlos Wind Farm Project is scheduled to come online in 2007, a 30 MW project in the Province of Negros Occidental, where in 2002, for the first time, a community successfully rejected a proposed coal fired power plant. Today, Negros stands on the verge of another historic first, a province committed to a 100 % renewable energy development. Carlos Wind Power Corporation is owned by a joint partnership between Smith Bell Wind Technologies and Global Renewable Energy Partners (GREP), a Sydney based Danish development company.

Within the next decade, the Philippines hope to become the leading wind power producer in Southeast Asia. The country's goal is to double its renewable energy capacity by 2013. The government's vision is to install at least 417 MW of wind-based power projects within ten years.

BARRIERS TO WIND ENERGY DEVELOPMENT

The Philippines have, by far, the highest wind energy potential among Southeast Asian countries. According to a study by the US-based National Renewable Energy Laboratory, using a conservative assumption of 7 MW per km^2, the country's land area could support over 70,000 MW of installed capacity, delivering more than 195 billion kWh per year. This is seven times the current peak demand of almost 10,000 MW.

Despite this enormous potential, the current installed capacity remains at 24.75 MW. There is no new wind farm development coming online this year. The main reason for slow growth in the Philippines is the absence of established national policies that would allow a massive uptake of wind energy. It has yet to institute renewable energy uptake targets along with a market deployment mechanism that would allow for large scale commercial development.

However, the Philippines government has started working on a newer version of a bill to promote the development of renewable energies in the Philippines. The original bill sat in congress for several years and has gone through several versions. The latest version hopefully will not suffer the same fate as its predecessors.

In late 2004, the state-run Development Bank of the Philippines (DBP) earmarked 50 billion PhP (950 million USD, 800 million euro) in loans. The money will be used specifically to assist interested investors in developing the country's renewable energy resources. However, in a presentation by the DBP in the December 2004 Wind Power Summit in Manila, the DBP stated that wind power projects are not financially viable if funded substantially by commercial loans. An ideal funding mix for such investments would be 70 % official development assistance loans, 20 % grants and 10 % equity.

There is currently no provision for a defined and stable return for investors where the price for renewable power must allow for risk return profiles that are competitive with other investment options and where the duration of a project must allow investors to recoup their investments. Until such market based systems are in place and until the Philippine government electricity sector barriers and remove market distortions to renewables, only wind projects that rely heavily on ODAs and grants will commercially succeed in the Philippines.

The project financing for the Northwind project, for instance, was enabled through support from DANIDA, which provided 11.2 million USD (9.3 million euro) in seed capital to the project and another 8 million USD (6.7 million euro) in grants for its completion. An export credit facility of 29.35 million USD (24.46 million euro) was also arranged under a loan agreement between the Northwind Power Development Corp., the Trade and Investment Development Corp. of the Philippines, ABN-

Luzon island wind farm, Philippines

AMRO Bank NV and the Danish Export Credit Agency, payable in 10 years without interest. The Philippine Export-Import Agency has agreed to guarantee up to 28.8 million USD (24 million euro) of the total project cost.

Despite the challenges at the policy level, a good number of monitoring stations are currently gathering wind data in Luzon, Cebu, Panay and Negros islands, initiated by local companies and in some cases by non-government organizations working with the private sector. In Negros alone, three wind monitoring stations are currently in place.

Australia

Australia enjoys one of the best wind resources in the world, resulting in phenomenal capacity factors in many regions on predominately cleared open farmland. Together with good access to grid infrastructure and well organized financial and legal services, Australia continues to be an exciting country in which to develop wind energy projects.

CURRENT INDUSTRY GROWTH

The exponential growth in Australia's wind energy projects continued throughout 2005, with the addition of 328 MW, bringing total installed capacity to 708 MW at the close of the calendar year. This will provide 2,170 GWh of electricity annually and meet the household energy needs of over 400,000 homes. Approximately 6,000 MW of projects are in various stages of pre-construction development (such as planning approval and financial feasibility analysis).

The installed wind farm projects represent in excess of $ 1.4 billion (862 million Euro or 1.02 billion USD) in capital expenditure (estimated). Current policy initiatives will see construction of several wind farm projects in 2006 with future growth beyond this level dependent upon the implementation of government policy initiatives that build on the success of the Mandatory Renewable Energy Target.

2005 saw a significant realignment of a number of Australian wind energy companies, signaling international confidence in the long term health of the industry in the region. Energy company Australian Gas Light and Power purchased New Zealand subsidiary Southern Hydro for $1.425 billion (877 million euro or 1.04 billion USD). Industry Funds Management, a superannuation giant with considerable international investments won a bidding war with Acciona for the ownership of Pacific Hydro. China Light and Power strengthened its interest in wind energy with a joint venture with Hydro Tasmania to form Roaring 40s. Wind farm investment vehicles Babcock and Brown Wind Partners and the Viridus Clean Energy Group were also successfully listed on the Australian Stock Exchange.

MANUFACTURING – RECENT AND POTENTIAL

While domestic renewable energy policy reticence raises concern for the immediate growth of the wind energy manufacturing sector, the qualities that make Australia an attractive place to build manufacturing facilities remain: a skilled and educated workforce, ideally situated in the Asia Pacific region, well developed infrastructure and a stable political environment.

The growth in manufacturing that was experienced in 2004 and the preceding years was somewhat quieter in 2005, reflecting the fact that the Australian renewable energy market has all but met the demand created by the MRET scheme.

Inspite of this prudent approach, the opening of the Vestas Blade factory in mid 2005 exemplified the commitment that key manufacturing companies have to the Asia Pacific region. The formal opening of a head office for Suzlon and its successful bid for the turn key operation of AGLs largest wind farm in the Southern Hemisphere, also underlines the importance of the Australian market as a platform to the Asia Pacific region.

Very recently Hayward Engineering was awarded a significant contract to deliver wind towers to the domestic market.

Strong demand for renewable energy in New Zealand has provided an opportunity for Australian manufacturers to supply into this market. Clearly, stimulation of the domestic market via the introduction of appropriate policy market mechanisms will provide incentives for the manufacturing sector to retain its presence and also a more stable platform upon which to build a robust Australian manufacturing sector.

THE POLICY ENVIRONMENT

Recognizing the critical relationship between the implementation of industry development mechanisms and the continued expansions of the Australian wind energy industry, the Federal Government has formally requested advice on, and are now considering policy proposals that will act to stimulate the deployment of wind and other renewable technologies.

The Asia Pacific Clean Development and Climate Pact (AP6) has established the Renewable and Distributed Energy Taskforce which is specifically concerned with addressing impediments to the uptake of wind and other renewable technologies. The key message to be delivered to the taskforce is that wind energy is a mature technology which requires specific policy mechanisms to address the price gap between it and that of conventional fossil fuel energy generation. How such a finding will affect Australia's domestic energy policy will be a critical question over this next year.

The Council of Australian Government (COAG) very recently launched its Plan for Collaborative Action on Climate Change. This is an exciting development and further demonstrates the commitment both Federal and State Governments have to addressing climate change challenges. The COAG agreement "reassess the Australian Agenda with a view to extending agreement on policy principles, planning faster more ambitions transition to sustainable low emissions and lifestyles and setting and agenda for action."

COAG has specifically asked for:

- the completion by end 2006 of a national framework for the take up of renewable and low emission technologies,

- the completion by mid 2006 of an acceleration of existing work by Ministerial Councils on emissions reporting and development options for strengthened reporting approaches.

The Victorian State Government has also committed to the implementation of the development of a market based mechanism to support the achievement of its goal to see 1,000 MW of wind installed in the Victoria. The detail of the scheme is currently being developed and it is recognized that an immediate start date will be essential to ensuring that the industry's future in the state.

Other State Governments (and indeed the Federal Government) are watching the Victorian Government's efforts with interest to assess the scheme's success.

In the lead up to the election in March, the South Australian State Government has committed to a renewable energy target of 20 % and is promoting wind energy as part of the Government statement of success. The South Australian Opposition's policy has included a commitment to reducing greenhouse gas emissions by 40 % by the 2050.

ADDRESSING COMMUNITY CONCERNS AND GRID INFRASTRUCTURE CHALLENGES

The Australian wind energy industry is also working to address other hurdles to wind energy uptake. Influencing how the management of the power system is redesigned so that greater amounts of wind energy can be incorporated is an important priority, as is supporting the initiatives in wind forecasting currently being undertaken. Proactively addressing issues of community concern such as landscape impact assessment, assessment of risks to bird species associated with wind farm development and demonstrating measurable compliance with the Auswind Best Practice Guidelines are other high level projects being progressed

AUSTRALIA: TOTAL INSTALLED CAPACITY

Year	MW
2000	32
2001	73
2002	105
2003	198
2004	380
2005	**708**

Egypt

SECURING ENERGY SUPPLY

Egypt is an oil and gas producing country and its electrical power supply is well developed, with over 98 % of households connected to the national grid. Although currently, the country's total installed capacity can meet even peak demand, the rapid growth rate of domestic power consumption of 7 % annually and dwindling oil reserves are starting to put pressure on the system. It is estimated that around 1,000 MW would have to be added every year to meet the increasing energy demand underpinning the rapid economical development.

Security of energy supply as well as environmental concerns led the Egyptian government to take up the use of renewable energies in its national energy planning as early as the 1980s. In 1982, the government adopted a programme for researching and harnessing the country's renewable energy resources.

The New and Renewable Energy Authority (NREA) was founded in 1986, with the aim to boost solar, biomass and wind power production. NREA's target is to increase the share of renewable energy sources (RES) to 3 % by 2010. 850 MW of wind energy are scheduled to be installed by the end of 2010.

At the Conference on Renewable Energies in Bonn in June 2004, Egypt affirmed its commitment to increase this share to 14 % of the country's installed capacity with renewable energy by 2020-2025, the nominated value will be divided into two portions 7 % from hydro, 7 % by wind and solar energies. The targets include the installation of 3,000 MW of hydropower, 2,750 MW of wind power and 750 MW of solar-thermal generation capacity.

STRONG WIND RESOURCES

Egypt enjoys an excellent wind regime, particularly in the Suez Gulf, where wind speeds reach over 10 m/sec. A wind atlas for the Suez Gulf Coast was issued in 1996 in cooperation with Risø National Laboratory, Denmark, while a detailed wind atlas for the same region was published in March 2003, concluding that the region can host about 20,000 MW of wind farms. The Wind Atlas for Egypt, covering the whole country, has been finalised in December 2005 in cooperation with Risø National Laboratory.

WIND PROJECTS IN EGYPT

Pilot projects & Hurghada wind farm

In 1988 the first wind farm with a capacity of 400 kW was installed in Ras Ghared on the Red Sea Coast, consisting of four 100 kW units, which have now been transferred to Hurghada and connected to the national grid.

In 1992, a second wind farm consisting of four 100 kW machines was established at Hurghada, also on the Red Sea Coast, and connected to the national grid in 1998.

Also at Hurghada, a 42 turbine wind farm has been operational since 1993 as part of the local grid.

Zafarana wind farm

With the Zafarana project, Egypt has moved on from limited experimental projects to the phase of large scale grid connected wind farms. A presidential decree allocated an area of 80 km^2 on the Gulf of Suez at Zafarana for NREA, showing institutional support and governmental commitment to the wind energy programme.

1. In March 2001 and November 2003, two parts of a 60 MW wind farm was connected to the national grid in cooperation with the Danish International Development Agency (DANIDA). This 60 MW wind farm is connected to the national grid. The annual energy production is about 210 GWh at capacity factor 40 %. An additional phase of 120MW is in the tendering preparation.

Zafarana wind farm, Egypt

2. In March 2001 and June 2004, a 33 MW and a 47 MW capacity were installed in cooperation with the German Government through the Kreditanstalt für Wiederaufbau (KfW), consisting of 55 and 71 turbines respectively. This 80 MW wind farm is connected to the national grid. The expected annual energy production from this wind farm is about 305 GWh at a capacity factor of 43.5 %. An additional phase of about 80 MW is in the tendering process.

3. An 85 MW wind farm in Zafarana in cooperation with the Spanish government is under implementation and expected to connect to the national grid in 2006. The expected energy generated here is about 320 GWh per year, leading to some 71000 TOE annually in fuel savings and a CO_2 abatement of about 195,000 tons per year.

4. An additional 120 MW wind farm, which will be set up in cooperation with Japan, is in the tendering process.

Gabal El-Zayt

Recently, an area of 700 km^2 has been earmarked to host a 3,000 MW wind farm at Gabal El-Zayt on the Suez Gulf coast. This site enjoys a wind regime of 10.5 min/sec.

At Gabal El-Zayt, 80 MW are in the phase of a feasibility study and are likely to be implemented in operation with the German government. A Memorandum of Understanding to this effect was signed at the Renewables Conference in Bonn in June 2004.

Moreover, the feasibility study for 220 MW in cooperation with the Japanese government has been completed.

EGYPT: TOTAL INSTALLED CAPACITY

Year	MW
2000	5
2001	5
2002	68
2003	98
2004	145
2005	**145**

Conclusions: The need for solid political frameworks

This report has shown that wind energy is fast becoming a mainstream energy source in an increasingly globalized market place. However, after decades of massive financial, political and structural support to conventional technologies, wind power remains at a competitive disadvantage. As a result, political support both at national and at international level is key to the global success of wind energy. Political action is needed to overcome these distortions and create a level playing field.

Combating climate change, securing energy supply and meeting increasing global energy demand are the main challenges our world is facing in the 21 century. Decision makers around the world are now putting energy policy at the centre of international meetings and initiatives, such as the 14th session of the UN Commission on Sustainable Development (CSD) in May 2006 in New York, the G8 Summit in July in St. Petersburg and the Asia-Pacific Partnership on Clean Development and Climate (AP6). Renewable energies are able to provide solutions to the manifold energy challenges the world is facing, and their promotion should form the basis of both national and international energy policy.

In addition, there is an urgent need to start negotiations on a new round of emission reduction targets for the second commitment period of the Kyoto Protocol after 2012, as agreed at the Meeting of the Parties (MOP1) in Montreal in December 2005. New targets are needed as soon as possible to allow governments to put emission reduction measures in place, including renewable energy policies. Setting legally binding targets is crucial as a driving force behind successful political frameworks for wind power and other renewables. While targets themselves do not guarantee development, they act as important catalysts for the development of the necessary framework conditions for renewable energy, creating investor confidence and enhancing planning certainty for industrial stakeholders and consumers.

Alaiz wind farm, Navarra, Spain

In recent years, a number of countries have established targets and policies for renewable energy to diversify their energy supply and as part of their efforts to reduce greenhouse gas emissions. However, for wind energy to realise its great potential to become a major contributor to global energy supply, more countries around the world need to take action, set targets and develop the necessary regulatory frameworks in terms of financial incentives, grid access regulation and planning and administrative procedures. Industrialising economies such as China, India and Brazil should be especially encouraged to accelerate the dissemination and use of low-carbon technologies and renewable energies which can underpin their aspirations for economic growth and higher standards of living.

Experience has shown that a successful policy framework for renewable energy must include the political will to develop appropriate measures in each of the four vital fields:

- Well designed payment mechanism
- Grid access and strategic development of the grids
- Good governance and appropriate administrative procedures
- Public acceptance

If one or more of these key components are missing from an overall framework, little progress will take place. Historically, no country has ever managed to develop a market for renewable electricity through the application of just one policy, but success has been the result of combinations of policies adapted to the local, regional or national context.

Wind energy is clean, free and abundant. It can provide solutions to the main energy challenges of our time, such as climate change, security of energy supply, growing energy demand and uncertainty over fossil fuel prices. A mature technology ready to be deployed on a large scale, wind power can fuel the development of emerging economies around the world. The time to act on this knowledge is now.

Prainha wind farm, Brazil

THE BENEFITS OF WIND ENERGY

WIND POWER...

- is clean, free and indigenous
- combats climate change
- reduces air pollution
- provides energy security
- diversifies energy supply
- eliminates imported fuels
- prevents conflict over natural resources
- improves rural electrification and reduces poverty
- creates jobs, regional growth and innovation
- hedges prices volatility of fossil fuels
- delivers power on a large scale
- is modular and quick to install

ABOUT GWEC

GLOBAL REPRESENTATION FOR THE WIND ENERGY SECTOR

GWEC is the voice of the global wind energy sector.

As the market has expanded, the leading wind power associations around the world have become increasingly linked through overlapping membership and bilateral activities. Global institutions and agreements – from the United Nations Kyoto Protocol to the World Bank's funding for project initiatives – require a united response from the industry and associations.

GWEC brings together the major national, regional and continental associations representing the wind power sector, and the leading international wind energy companies and institutions.

With a combined membership of over 1,500 organisations involved in hardware manufacture, project development, power generation, finance and consultancy, as well as researchers, academics and associations, GWEC's member associations represent the entire wind energy community.

The members of GWEC represent:

- Over 1,500 companies, organisations and institutions in more than 50 countries
- All the world's major wind turbine manufacturers
- 99 % of the world's nearly 60,000 MW of installed wind power capacity

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