GLOBAL WIND **2006** REPORT

GWEC

GLOBAL WIND ENERGY COUNCIL

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Foreword

2006 was another booming year for the wind industry, with growth in annual installed capacity of 32 % globally, well ahead of our own projections. The market continued to broaden, further establishing wind power as the leading renewable energy technology – in the vanguard of the 21st century energy industry transformation. Globally, the value of new generating plant installed in 2006 reached €18 billion, or US$24 billion.

Against the backdrop of a growing acknowledgement of the twin crises of global climate change and energy security, wind power is the most effective means available now to tackle both issues. At the same, wind energy development strengthens local economies and insulates countries from the macro-economic shocks of global commodities markets. Wind energy provides a clear solution for policymakers and a general public increasingly concerned with volatility in the gas market, discussions of 'peak' oil, and growing realization of the true cost of coal.

Energy policy is now at the heart of high-level international meetings, such as the UN Commission on Sustainable Development (CSD) in May 2007 in New York and the G8 Summit in June in the German city of Heiligendamm. Climate and energy policy were the subject of a recent debate in the UN Security Council and a General Assembly debate is planned for later in the year.

Renewable energies, and especially wind energy, 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.

The Global Wind Report 2006 is the second annual report by GWEC on the status of global wind energy markets, and it clearly shows that wind energy today is a global business, with installations in over 70 countries.

While Europe continues to lead the way, with 65 % of the global market, the United States was the leader in new installed capacity for the second year running, bringing about 2,500 MW capacity of new plant on line in 2006.

The Asian market is also growing at a breathtaking rate, by 53 % in 2006. China's booming industry more than doubled its capacity; India, the world's 4th largest market, continued its strong growth.

The broadening of the global market is clearly illustrated by the list of markets which more than doubled their installed capacity in 2006: Iran, Brazil, Mexico, Taiwan and South Korea; while Poland, Morocco and Egypt nearly doubled.

The data and country reports for 2006 have been collected through GWEC's member associations around the world as well as other industry sources. The Council thanks the contributors and looks forward to further cooperation for future editions.

The central message from the Global Wind 2006 Report is clear: wind power is becoming an established, mainstream power source in a rapidly growing number of countries, and that growth will, and must, continue as we seek to stave off the threat of global climate change and create true energy security while at the same time growing new industries, creating new jobs and a new paradigm for a truly sustainable 21st century energy economy.

Arthouros Zervos
Chairman
Global Wind Energy Council

Steve Sawyer
Secretary General
Global Wind Energy Council

Booming wind markets put temporary strain on supply chains

The global wind energy industry is facing a challenge that many other sectors would qualify as a 'luxury problem', that of supply chain difficulties due to booming demand.

The global wind energy industry has been growing at the staggering rate of nearly 30 % per year for the last 10 years, and experts predict that there is no end in sight for this boom. While a large proportion of this development is happening in Europe, other markets, especially Asia and North America are catching up fast.

The success of wind energy worldwide and its tremendous growth has put unprecedented pressure on the manufacturers of the components of wind turbines, such as towers, rotor blades, gearboxes, bearings, generators, etc., and the industry has been struggling to keep up with the demand. At the moment, developers of wind farms have to wait for 12 months for the turbines required, and the trend shows that this may increase to 18 or even 24 months.

Construction site Vestas, Porep, Germany

2006 ANOTHER RECORD YEAR DESPITE SUPPLY CHAIN DIFFICULTIES

Despite these constraints facing supply chains for turbines, the annual market for wind energy continued to increase at a rate of 32 % in 2006, with over 15,000 MW of new capacity installed worldwide. This follows a record year in 2005, where the growth rate topped 40 %. To keep up this pace, the sector has had to rapidly mature into a streamlined, efficient mass producer of high quality technical equipment. Nevertheless, there are still a number of bottlenecks in the supply chain, and many developers continue to have difficulties in sourcing turbines for their projects.

For 2007, experts predict a rise in demand to nearly 20,000 MW, stretching the industry beyond its manufacturing capabilities. However, all players are working to resolve supply chain difficulties and to counteract existing bottlenecks, and it is expected that the current challenges will be overcome by 2009 the latest.

FACTORS LEADING TO BOTTLENECKS OFTEN OUTSIDE OF INDUSTRY'S CONTROL

Overcoming supply chain difficulties is not simply a matter of ramping up the production of wind turbine components to meet the increased levels of demand. The real picture is more complicated that that, since large scale investment decisions must be based on a sound long-term outlook for the industry; but in most markets, both the projections and actual demand for wind energy depend on a number of factors, some of which are outside of the control of the industry.

In particular, the political frameworks for wind energy in various countries play a crucial role in fostering the growth of the industry. The future of national incentive programmes is not always easy to predict for the long-term, making it

Construction site Vestas, Porep, Germany

difficult for manufacturers to commit to big investments. One of the most striking examples of the impact that national programmes can have on wind energy development is the Production Tax Credit (PTC) in the United States, which in the past was often not renewed in a timely fashion.

At the end of 2003, the PTC period expired without an extension, leaving the market in a very insecure position. This resulted in new installations of only 389 MW in the US in 2004, while market participants waited for the credit to get extended. This happened at the end of 2004, spurring renewed investment and turning 2005 and 2006 into record years with over 2,400 MW of new capacity built in each year. This boom is still continuing and has resulted in a massive increase in demand for turbines. However, the limited timescale of the PTC and the danger of it expiring again at the end of 2008 have prompted manufacturers to prioritise the US market, which as a result has diverted turbines from European suppliers that were originally destined for other markets around the world.

There are various other reasons that have led to the current difficulties. One factor is the steady growth of the size of turbines, increasing from less than 1 MW to 2 MW and larger in a short period of time. Only a few component suppliers, especially in the area of gearboxes, but also blades, bearings and towers, can satisfy the demand for such big machines. This has important implications for the supply chain.

Other broader developments have also affected the wind industry, such as the price and availability of certain raw materials used in the manufacturing of wind turbines. Prices have increased substantially for steel, copper and carbon, all of which are essential in this industry. Growing economies such as China and India have boosted global demand for raw materials more than expected, and global steel prices have more than doubled since 2001, putting additional strain on manufacturers.

PRODUCTION CAPACITY BEING EXPANDED, MAINLY IN US, INDIA AND CHINA

While the industry is doing its best to keep up with the strong demand, this cannot be done overnight. For component suppliers, ramping up their manufacturing requires a major investment in machinery with up to two years lead-time. At a time when the entire machine tools business is struggling to meet demand, this is not an easy proposition.

However, despite the uncertain investment environment, the massive up-front investment required and long lead times involved, most turbine and components manufacturers have already taken the plunge to respond to the boom in demand by substantially expanding their production capacity. This expansion is continuing in Europe, but there is an increasing focus on new production facilities in the US, China and India. The challenge will be to make the whole supply chain follow this trend in order to secure long-term supply of all necessary components.

EXPERTS PREDICT CONTINUING STRONG GROWTH – PROBLEMS TO BE RESOLVED BY 2009

With these ambitious plans for expansion and a continuous influx of new players emerging on the stage, experts predict that the current tight situation for turbine manufacturers should be overcome by 2009 at the latest. In the meantime, it is expected that the industry will continue to see very healthy growth rates of 25-30 % per year. In 2006, all expectations for growth were exceeded by far, and there is good reason to be optimistic about the future.

The Status of the Global Wind Energy Markets

THE BOOM CONTINUES DESPITE SUPPLY CHAIN DIFFICULTIES: 2006 ANOTHER RECORD YEAR

The booming wind energy markets around the world exceeded expectations in 2006, with the sector experiencing yet another record year with installations of 15,197 megawatts (MW). This takes the total installed wind energy capacity to 74,223 MW, up from 59,091 MW in 2005.

Despite constraints facing supply chains for wind turbines, the annual market for wind continued to increase at the staggering rate of 32 % following the 2005 record year, in which the market grew by 41 %. This development shows that the global wind energy industry is responding fast to the challenge of manufacturing at the required level, and manages to deliver sustained growth.

In terms of economic value, the wind energy sector has now become firmly installed as one of the important players in the energy markets, with the total value of new generating equipment installed in 2006 reaching €18 billion, or US$23 billion.

Barrow wind farm, UK

The countries with the highest total installed capacity are Germany (20,622 MW), Spain (11,615 MW), the USA (11,603 MW), India (6,270 MW) and Denmark (3,136 MW). Thirteen countries around the world can now be counted among those with over 1,000 MW of wind capacity, with France and Canada reaching this threshold in 2006.

In terms of new installed capacity in 2006, the US continued to lead with 2,454 MW, followed by Germany (2,233 MW), India (1,840 MW), Spain (1,587 MW), China (1,347 MW) and France (810 MW). This development shows that new players such as France and China are gaining ground.

EUROPE REMAINS MARKET LEADER

Europe continues to lead the market with 48,545 MW of installed capacity at the end of 2006, representing 65 % of the global total. In 2006, the European wind capacity grew by 19 %, producing approximately 100 TWh of electricity, equal to 3.3 % of total EU electricity consumption in an average wind year.

Despite the continuing growth in Europe, the general trend shows that the 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 European market in 2006 accounted for about half of the total new capacity, down from nearly three quarters in 2004.

While Germany and Spain still represent 50 % of the EU market, we are seeing a healthy trend towards less reliance on these two countries. In the EU, 3,755 MW were installed outside of Germany, Spain and Denmark in 2006. In 2002, this figure still stood at only 680 MW. The figures clearly confirm that a second wave of European countries is investing in wind power (see also page 16 for an EU overview, and pages 20, 22, 24, 26 and 28 for country reports on Germany, Italy, Poland, Spain and the UK).

With 2,233 MW installed during 2006, a 23 % increase compared to 2005, Germany passed the 20,000 MW mark.

KGW plant, Germany

Spain was the second largest market in 2006, with 1,587 MW. France moved up to third place in 2006 (from sixth place in 2005), with 810 MW installed during the year – more capacity than has previously been commissioned in the entire history of the French market. This reflects increasing success by developers in getting their projects off the ground.

Once again, Portugal performed well, with 694 MW of new capacity, more than in any previous year. With a further 1,063 MW already under construction, according to the research institute INEGI, the Portuguese market should be well on the way to meeting the government target of more than 3,750 MW by 2010.

With 634 MW installed in 2006, the UK also had another record year. Total installed capacity increased by 47 %, taking one of Europe's windiest countries close to 2,000 MW. The Italian market continued to perform well, with a further 417 MW installed, whilst Ireland set a new record with 250 MW, increasing its total capacity by 50 %.

New wind power installations in the EU-10 tripled from 60 MW in 2005 to 183 MW in 2006, mainly driven by Poland, Lithuania and Hungary. Bulgaria installed 22 MW, while Romania connected 1.3 MW. Eight EU countries now have more than 1,000 MW of wind power capacity installed.

ASIA NOW IN SECOND PLACE FOR NEW INSTALLATIONS

Asia has experienced the strongest increase in installed capacity outside of Europe, with an addition of 3,679 MW, taking the continent over 10,600 MW. In 2006, the continent grew by 53 % and accounted for 24 % of new installations.

The strongest market in Asia remains India with 1,840 MW of new installed capacity, which takes its total figure up to 6,270 MW. While the Indian government has envisaged a capacity addition of around 10,000 MW by 2010, 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 (see also page 38 for a report on the Indian market).

China more than doubled its total installed capacity by installing 1,347 MW of wind energy in 2006, a 70 % increase

Shan Tou Dan Nan wind farm, China

from last year's figure. This brings China up to 2,604 MW of capacity, making it the sixth largest market world wide. The Chinese market was boosted by the country's new Renewable Energy Law, which entered into force on 1 January 2006 (see also page 40 for a report on China).

Thanks to the Renewable Energy law, the Chinese market has grown substantially in 2006, and this growth is expected to continue and speed up. According to the list of approved projects and those under construction, more than 1,500 MW will be installed in 2007. The goal for wind power in China by the end of 2010 is 5,000 MW, which will already be reached well ahead of time, according to experts' estimations.

NORTH AMERICAN MARKET CONTINUES TO BOOM

Some 22 % of the world's new wind capacity was installed in North America, where the annual market increased by a third in 2005, gaining momentum in both the US and Canada.

For the second year running, the US wind energy industry installed nearly 2,500 MW, making it the country with the most new wind power. These strong growth figures show that wind is now a mainstream option for new power generation in the US, reflecting nation's increasing demand for clean, safe and domestic energy. Wind also continues to attract both private and public sources of capital, with new generating capacity worth US$4 billion installed in 2006. This made wind one of the largest sources of new power generation in the country – second only to natural gas – for the second year in a row (see also page x for a report on the US market).

Canada also had a record year, with the installed capacity more than doubling from 683 MW in 2005 to 1,459 MW at the end of 2006. CanWEA estimates that Canada is on the edge of a wind energy boom as provincial governments are now targeting to have a minimum of 10,000 MW of installed wind energy capacity in place by 2015 (see also page 32 for a report on Canada).

LATIN AMERICAN MARKETS SHOWING SIGNS OF EXPANSION

The Latin American market is starting to show signs of healthy growth, mainly in Brazil and Mexico. Overall, Latin America saw 296 MW of new installations in 2006, compared to only 6 MW in the previous year.

In Brazil, the government's PROINFA programme is showing first signs of success, with new installations of 208 MW, which brings the total capacity up to 237 MW, while the infrastructure for another 220 MW is still being constructed. The Federal Government is also expected to announce a 5,000 MW wind energy program to be realized between 2009 and 2015 (see page 34 for a country report on Brazil).

In Mexico, which also has an excellent potential for wind energy, 85 MW of new capacity were installed in 2006, bringing the total up to 88 MW. The Mexican Wind Energy Association (AMDEE) estimates the development of at least 3,000 MW by 2014 (see page 36 for more information on Mexico).

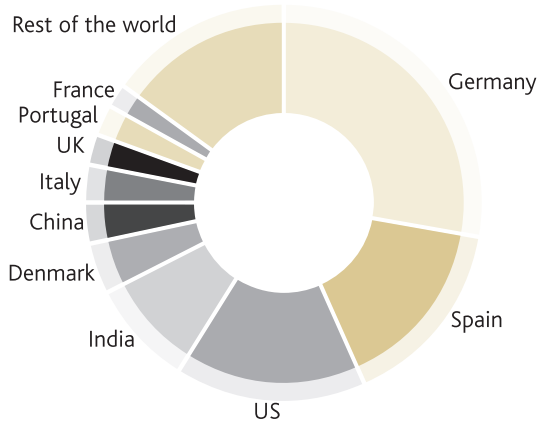
PROMISING GROWTH IN AFRICA AND THE MIDDLE EAST

Growth in the relatively young African and Middle Eastern market picked up considerably in 2006, with 172 MW of new installed capacity, bringing the total up to 441 MW. This represents a 63 % growth, and should be seen as a promising sign for future developments. The main countries experiencing growth are Egypt (230 MW, up from 145 MW), Morocco (124 MW, up from 64 MW) and Iran (48 MW, up from 23 MW), (see pages 48, 52 and 50 for reports on these countries).

AUSTRALIAN MARKET STALLING, BUT IMPROVEMENTS EXPECTED IN 2007

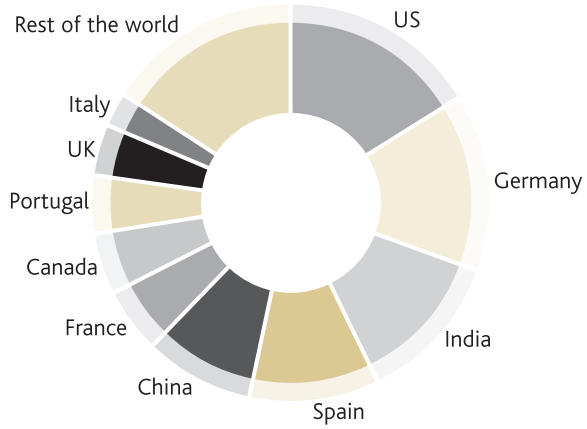
Compared to previous years, the Australian market only experienced slow growth in 2006, which saw only 109 MW installed, bringing the total capacity to 817 MW. However, the Australian market has been given a new lease of life with the introduction of state based renewable energy targets providing a more positive outlook for 2007 (see page 46 for a country report on Australia).

TOP 10 TOTAL INSTALLED CAPACITY



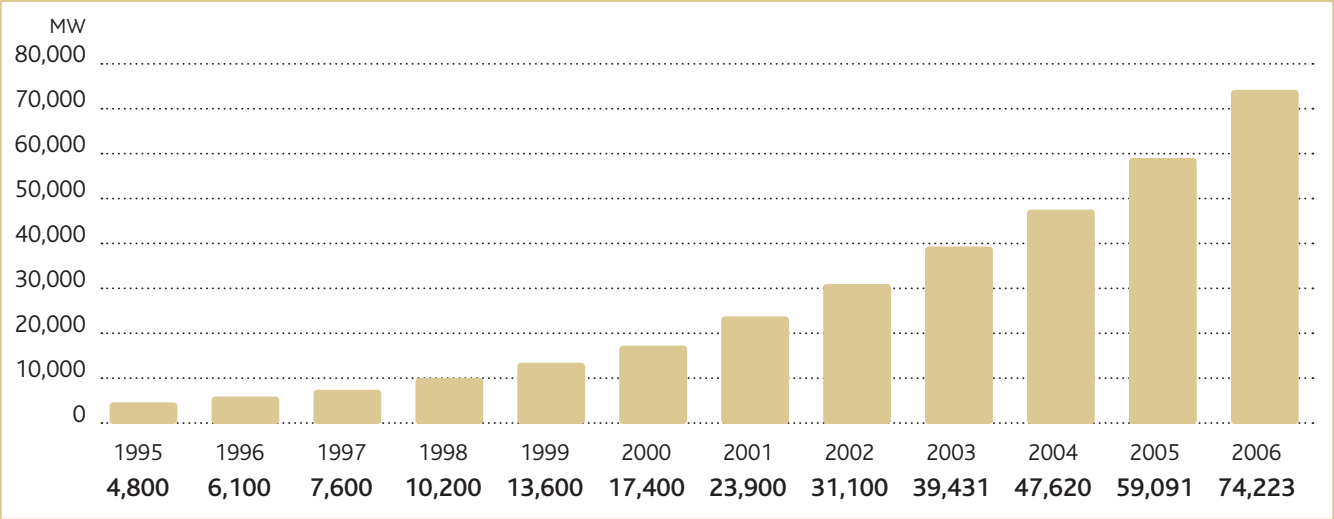
	MW	%
Germany	20,622	27.8
Spain	11,615	15.6
US	11,603	15.6
India	6,270	8.4
Denmark	3,136	4.2
China	2,604	3.5
Italy	2,123	2.9
UK	1,963	2.6
Portugal	1,716	2.3
France	1,567	2.1
Rest of the world	11,005	14.8
Total top 10	**63,218**	**85.2**
Total	**74,223**	

TOP 10 NEW CAPACITY

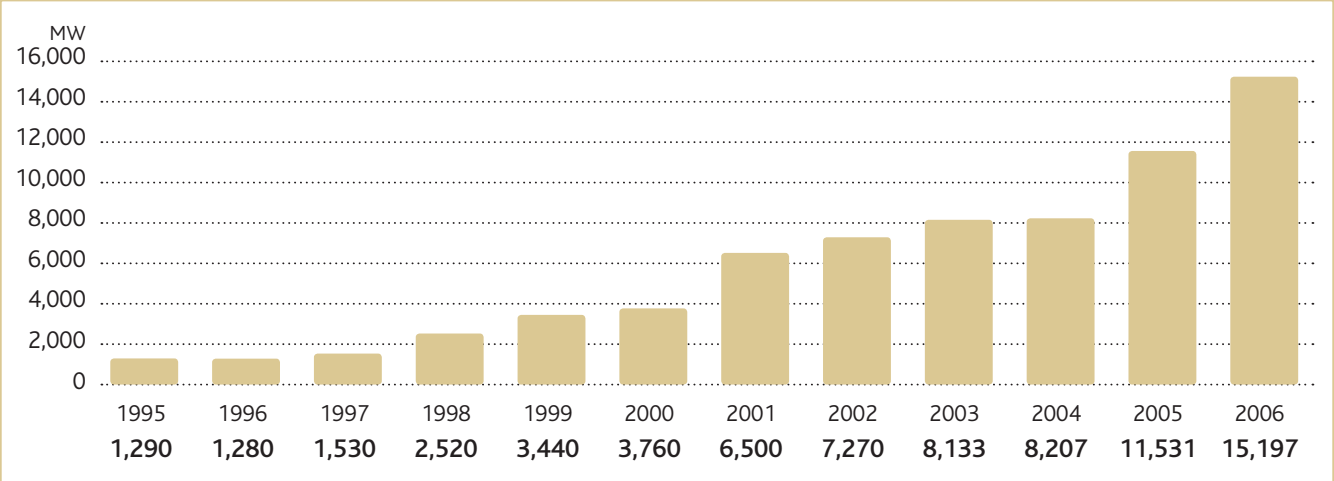


	MW	%
US	2,454	16.1
Germany	2,233	14.7
India	1,840	12.1
Spain	1,587	10.4
China	1,347	8.9
France	810	5.3
Canada	776	5.1
Portugal	694	4.6
UK	634	4.2
Italy	417	2.7
Rest of the world	2,405	15.8
Total top 10	**12,792**	**84.2**
Total	**15,197**	

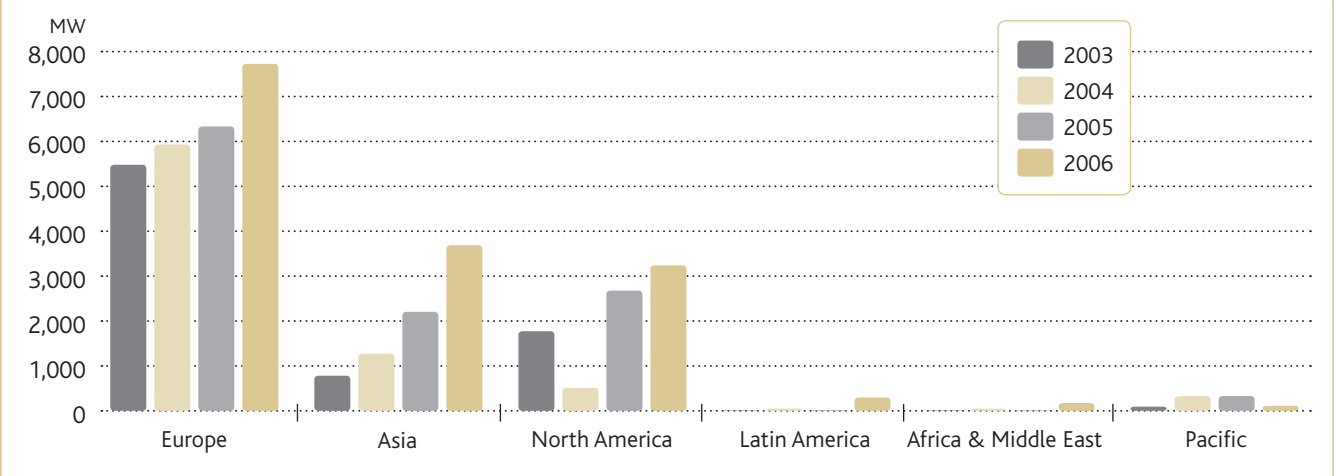
GLOBAL CUMULATIVE INSTALLED CAPACITY 1995-2006



GLOBAL ANNUAL INSTALLED CAPACITY 1995-2006



ANNUAL INSTALLED CAPACITY BY REGION 2005-2006



GLOBAL INSTALLED WIND POWER CAPACITY (MW) – REGIONAL DISTRIBUTION

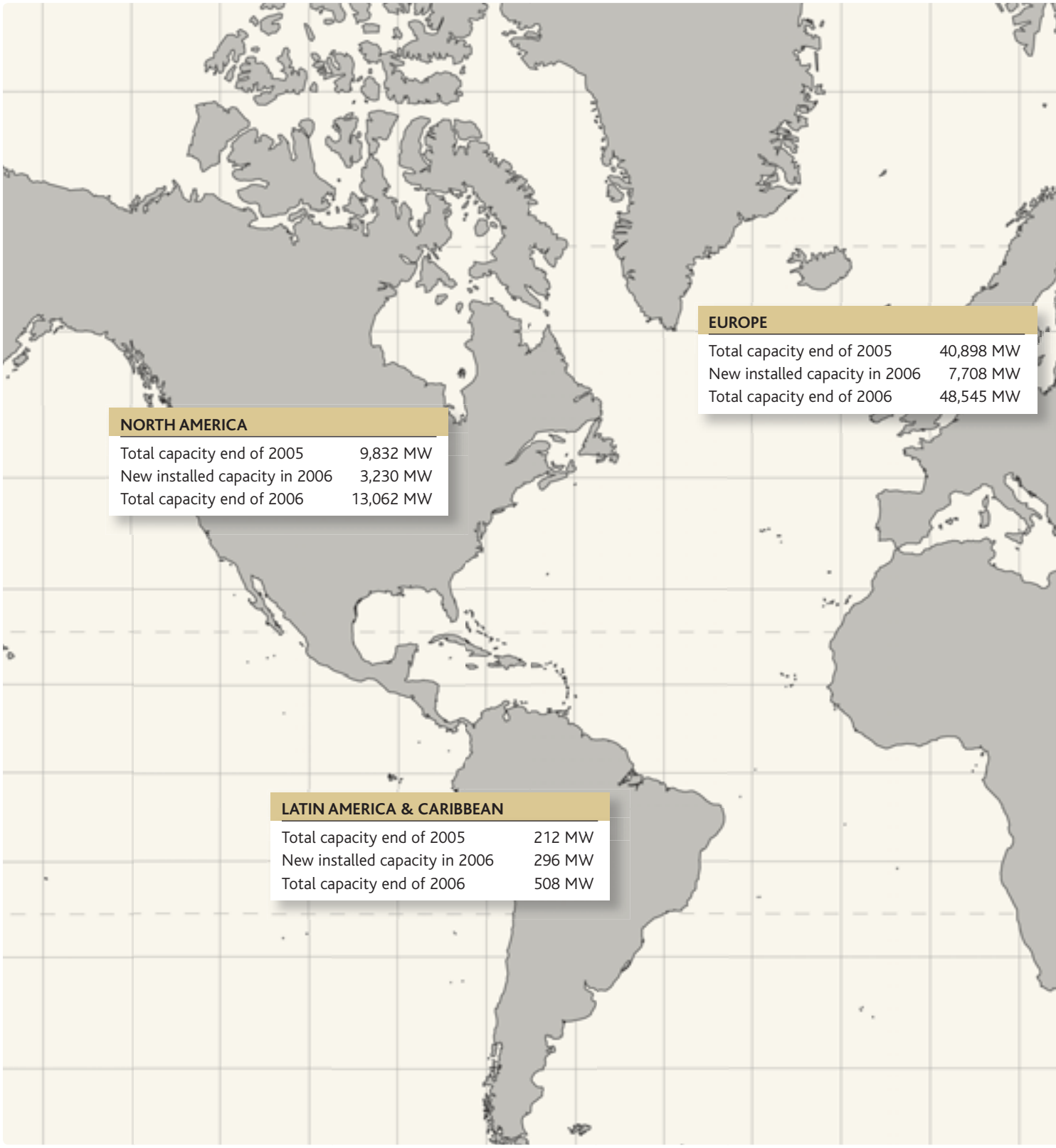
		Total end 2005	New 2006	Total end 2006
AFRICA & MIDDLE EAST	Egypt	145	85	230
	Morocco	64	60	124
	Iran	23	27	48
	Tunisia	20	0	20
	Other[1]	11	0	11
	Total	**271**	**172**	**441**
ASIA	India	4,430	1,840	6,270
	China	1,260	1,347	2,604
	Japan	1,061	333	1,394
	Taiwan	104	84	188
	South Korea	98	75	173
	Philippines	25	0	25
	Other[2]	13	0	13
	Total	**6,990**	**3,679**	**10,667**
EUROPE	Germany	18,415	2,233	20,622
	Spain	10,028	1,587	11,615
	Denmark	3,128	12	3,136
	Italy	1,718	417	2,123
	UK	1,332	634	1,963
	Portugal	1,022	694	1,716
	France	757	810	1,567
	Netherlands	1,219	356	1,560
	Austria	819	146	965
	Greece	573	173	746
	Ireland	496	250	745
	Sweden	510	62	572
	Norway	267	47	314
	Belgium	167	26	193
	Poland	83	69	153
	Rest of Europe[3]	364	192	556
	Total Europe	**40,898**	**7,708**	**48,545**
	out of which EU-27[4]	*40,512*	*7,611*	*48,062*
LATIN AMERICA & CARIBBEAN	Brazil	29	208	237
	Mexico	3	85	88
	Costa Rica	71	3	74
	Caribbean (w/o Jamaica)	35	-	35
	Argentina	27	-	27
	Colombia	20	-	20
	Jamaica	20	-	20
	Other[5]	7	-	7
	Total	**212**	**296**	**508**
NORTH AMERICA	USA	9,149	2,454	11,603
	Canada	683	776	1,459
	Total	**9,832**	**3,230**	**13,062**
PACIFIC REGION	Australia	708	109	817
	New Zealand	169	3	171
	Pacific Islands	12	-	12
	Total	**889**	**112**	**1,000**
	World total	**59,091**	**15,197**	**74,223**

Source: GWEC

[1] Cape Verde, Israel, Jordan, Nigeria, South Africa;
[2] Bangladesh, Indonesia, Sri Lanka, Russia;
[3] Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Finland, Faroe Islands, Hungary, Iceland, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Romania, Slovakia, Slovenia, Switzerland, Turkey, Ukraine; Source: EWEA
[4] Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, United Kingdom; Source: EWEA
[5] Chile, Cuba, Mexico.

Please note: project decommissioning of 65 MW and rounding affect the final sums

TOTAL INSTALLED CAPACITY BY REGION (DECEMBER 2006)




ASIA
Total capacity end of 2005 6,990 MW
New installed capacity in 2006 3,679 MW
Total capacity end of 2006 10,667 MW
AFRICA & MIDDLE EAST
Total capacity end of 2005 271 MW
New installed capacity in 2006 172 MW
Total capacity end of 2006 441 MW
PACIFIC
Total capacity end of 2005 889 MW
New installed capacity in 2006 112 MW
Total capacity end of 2006 1,000 MW

Market forecast for 2007-2010

Næsby wind farm, Denmark

Until the end of the current decade, the cumulative capacity of wind energy installations is predicted to reach 149.5 GW, more than double of the present installed capacity. The average annual cumulative growth rate during the period 2006-2010 will be 19.1 %, compared with the 24.3 % of the period 2002-2006. The annual installed capacity is predicted to reach the 21 GW in 2010, an increase of 38 % from the15.2 GW installed in 2006. This implies an average annual growth rate of 8.4 % 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 around two years.

Europe will continue to be the most important market, but with a smaller share than in the past. In 2004, Europe still represented 72 % of the annual market, but this share went down to 55 % in 2005 and to 51 % in 2006. It is expected for this trend to continue in the future, with Europe representing 44 % of the annual market in 2010 (9.3 GW) and 55 % of the total global installed capacity (82 GW). Delays in the off-shore market have pushed large scale off-shore development towards the end of the decade. However, off-shore 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 in 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 8,000 MW during the period 2007-2010 and reaching its 20,000 MW target by 2010. The German market will decrease, remaining though the second strongest market for the period 2007-2010 with 4,400 MW added and the biggest one in terms of the total installed capacity (~25,000 MW in 2010). The United Kingdom and France are predicted to be the other most important European markets, each increasing by approximately 4,000 MW during the period 2007-2010.

The North American market is expected to continue to be the second largest regional market with an average annual growth rate of 24.6 %. From 9.8 GW installed at the end of 2006, it is estimated to reach 31.6 GW by the end of 2010. The US market will be the most important national market in the world during the period 2007-2010 with a predicted average of 3.5 GW per year. There is an uncertainty with the PTC ending by the end of 2008, 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. By 2010, the US will be on par with Germany in terms of 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 6,000 MW. This means that 4,500 MW will be introduced during the

period 2007-2010 listing Canada in the top five countries for that period.

The Asian market has exceeded all previous estimations thanks to unexpected strong growth in China. It is predicted to have the highest average annual growth rate (28.3 %) during the period under consideration. The total installed capacity in the Asian continent should reach 29 GW at the end of 2010, up from 10.7 GW in 2006. With a predicted installed capacity of 8,000 MW during the period 2007-2010, 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 also of 8,000 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.

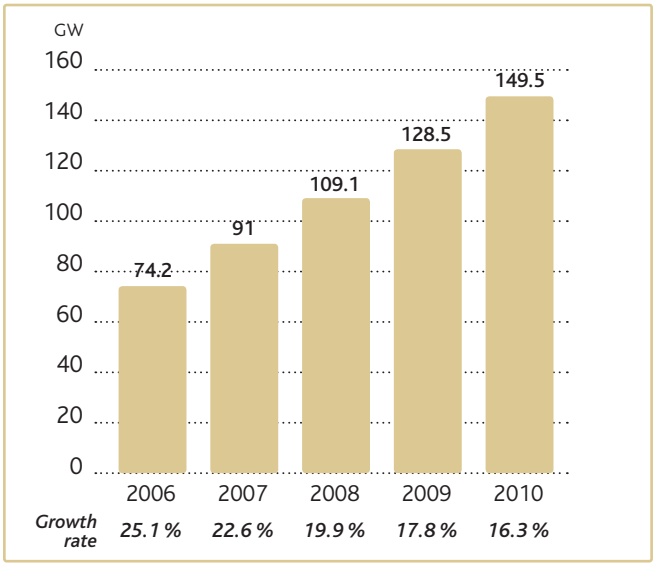
In 2006, first encouraging developments could be noted in Latin America and the Caribbean, with new installations of 296 MW. During the period 2007-2010 it is predicted that the market will take off starting with Brazil and followed to a lesser extent by Mexico. Smaller developments will also take place 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 significant development in the next decade.

In the Pacific region, the wind energy development considerably slowed down in 2006, with only 112 MW of new installations. However, despite some uncertainties regarding the political framework, the development is predicted to continue in Australia with 1,000 GW to be installed in the period 2007-2010. Although very little new capacity was added in New Zealand in 2006, many projects are in different phases of development indicating that 400 MW could be added by 2010.

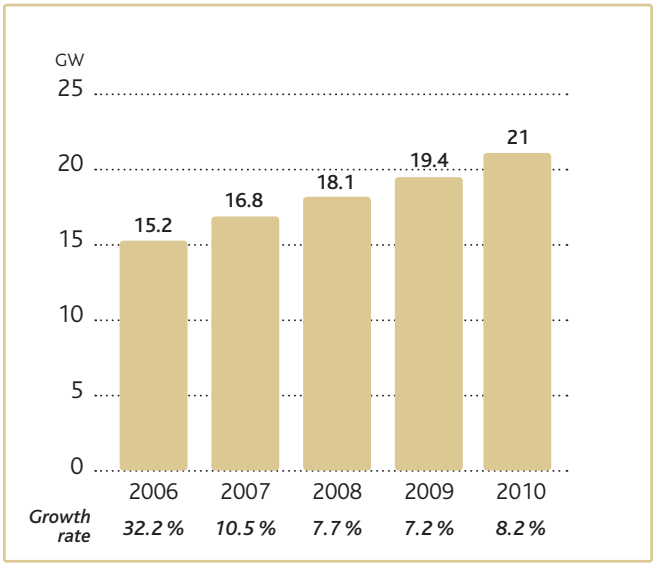
Africa remains the continent with the smallest wind development. Two countries have emerged as leaders of the continent: Egypt and Morocco. The development is expected to continue in these two countries at a more rapid rate than in the past and some development is predicted in other North African and Middle East countries adding a total of 900 MW during the period 2007-2010 for the whole continent.

Little development is expected in the Former Soviet Union countries.

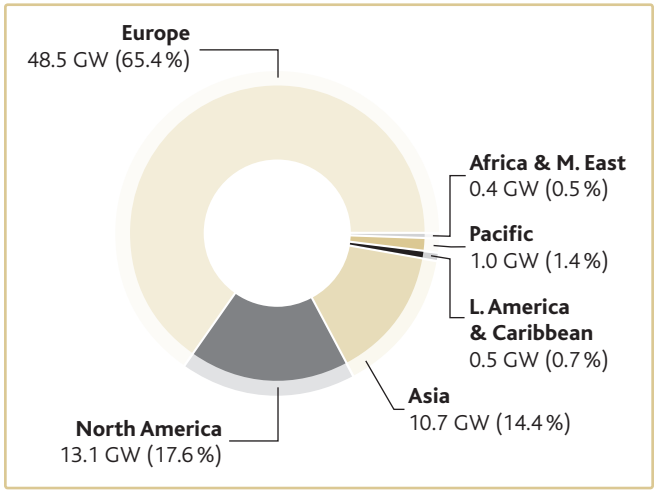
GLOBAL FORECAST 2006-2010: CUMULATIVE CAPACITY



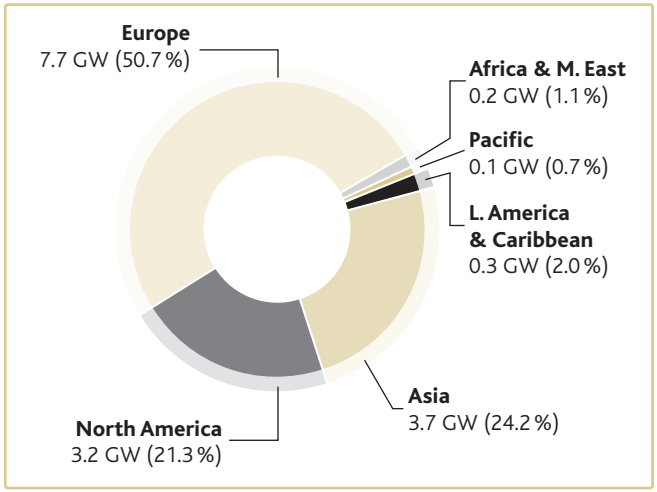
GLOBAL FORECAST 2006-2010: ANNUAL INSTALLED CAPACITY



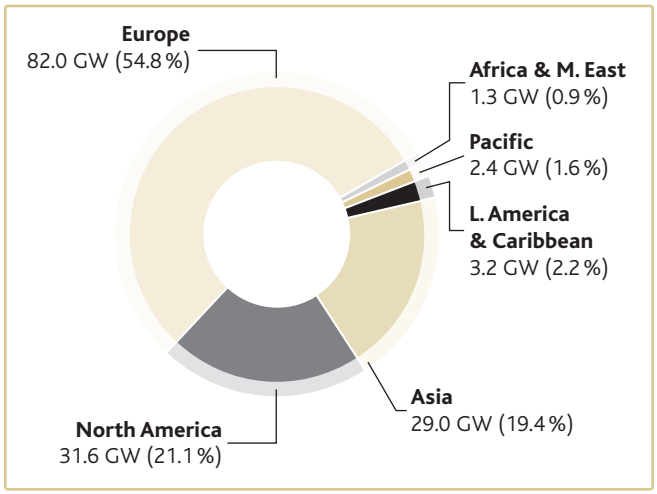
TOTAL CAPACITY END 2006



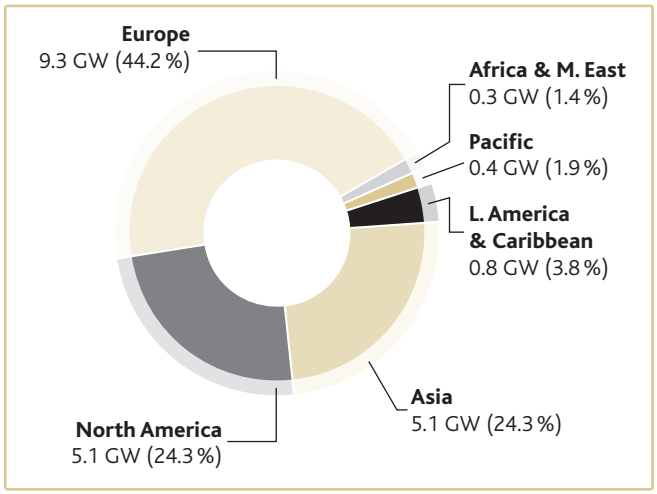
INSTALLED CAPACITY IN 2006



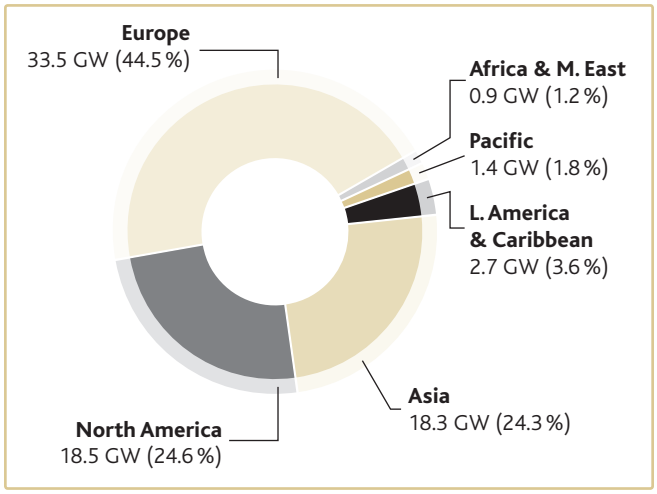
TOTAL CAPACITY END 2010



INSTALLED CAPACITY IN 2010



PROJECTED CAPACITY 2007-2010



COUNTRY REPORTS

European Union

THE WORLD'S LEADING MARKET

Europe has historically been and continues to be the strongest market for wind energy development. In 2006, the European Union has seen another record year with installations above 7,000 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 19 % to 48,062 MW at the end of 2005, in the EU from 40,512 MW at the end of 2006.

7,611 MW of wind power capacity were installed in 2006, representing a wind turbine manufacturing turnover of some € 9 billion. Over the last ten years, cumulative wind power capacity in the EU has increased by an average 30.4 % per year. In terms of annual installations, the European market has grown by an average 25 % over the same period.

SSE's Hadyard Hill, UK

Although there are still several remaining barriers to wind energy development in the 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 2006 were Germany (2,233 MW), Spain (1,587 MW), Portugal (694 MW), the UK (634 MW and Italy (417 MW). In cumulative installed capacity, two countries have more than 10 GW (Germany 20,622 MW and Spain 11,615 MW) and eight countries have more than 1 GW (Denmark 3,136 MW, Italy 2,123 MW, UK 1,963 MW, Portugal 1,716 MW, France 1,567 MW and the Netherlands 1,560 MW , as well as Germany and Spain).

The 48,062 MW installed in the EU by the end of 2006 will, in an average wind year, produce some 100 TWh of electricity, equal to 3.3 % of EU electricity consumption in 2005.

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 was already met in 2005.

THE EU LEGISLATIVE FRAMEWORK FOR WIND ENERGY

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 (77/2001/EC) has been in place since 2001. The EU 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. This target was established by the EU Renewables Directive which sets out differentiated national indicative targets. The Renewables Directive has been a historical step in the delivery of renewable electricity and constitutes the main driving force behind new policies being implemented.

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

EU: TOTAL INSTALLED CAPACITY

year	2000*	2001*	2002	2003	2004	2005	2006
MW	12,887	17,315	23,159	28,598	34,371	40,511	48,062

*EU 15

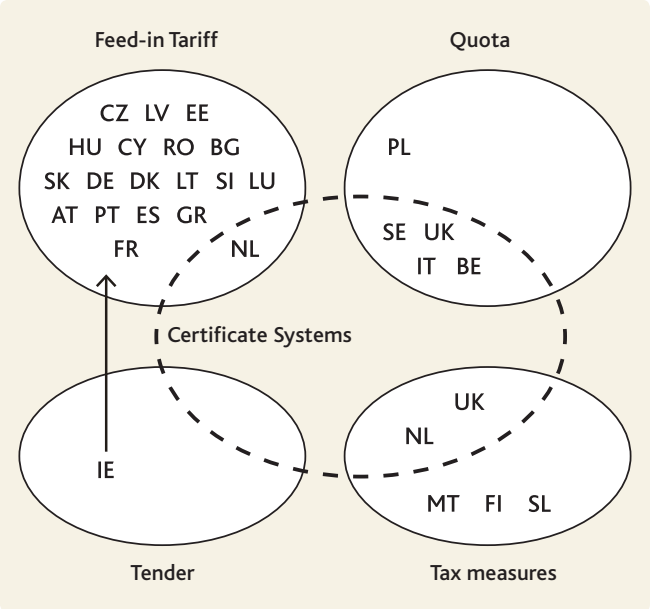
Tauern wind farm, Oberzeiring, Austria

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. According to its last progress report [COM (2006) 849], in the past two years 50 % additional renewable electricity (non-hydro) has been generated, which implies that Europe will, in all likelihood, come close to its target by 2010. This positive overall trend should not disguise the insufficient performance of many Member States. In relation to wind, the progress report highlights that still one third of EU countries do not lend enough support to wind energy. The main cause of the slow development in some Member States is not deliberately policy but delays in authorization, unfair grid access conditions and slow reinforcement of the electric power grid[1].

POLITICAL SUPPORT MECHANISMS

In the pursuit of the overall target of 21 % from renewable electricity by 2010, the Renewables Directive gives EU Member States freedom of choice regarding support mechanisms. Thus, various schemes are operating in Europe, mainly feed-in tariffs, fixed premiums, green certificate systems and tendering procedures. These schemes are generally complemented by tax incentives, environmental taxes, contribution programmes or voluntary agreements.

The graph below gives an overview of renewable electricity support systems in the EU-25.



SOURCE: "Monitoring and evaluation of policy instruments to support renewable electricity in EU member states"; Final report; Fraunhofer, ISI, EEG, 2006.

[1] Page 10 of the Communication.

Burton Wold, Northamptonshire, UK

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. Feed-in tariffs 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. 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.

LONG TERM PLANNING

In a broader context, the European Commission launched in March 2006 a consultation process to discuss the medium and long term strategy for an EU energy policy, including renewable energies. The Green Paper "A European Strategy for Sustainable, Competitive and Secure Energy" [COM (2006) 105] proposed the preparation of a "renewable energy roadmap" that would include an active programme with specific measures to ensure that existing targets are met; consideration of which targets or objectives beyond 2010 are necessary; and research, demonstration and market replication initiatives. The Green Paper also foresaw the preparation of a European Strategic Energy Technology Plan that aims at moving Europe towards a low carbon energy system, e.g. "by permitting a sharp increase in the share of lower cost renewables, including the roll-out of off-shore wind".

Germany

In December 2006, the European Parliament voted on the issue of renewables targets. 479 Parliamentarians voted for sector targets and only 16 against. The European Parliament also voted to have the sector specific targets made mandatory for the Member States. It adopted, in its resolution, a 25 % overall renewable energy target and a sector target for renewable electricity of 35 % by 2020 (it was 14.5 % in 2004).

The Energy Package released in January 2007 is the Commission's follow up on the consultation and has led to the adoption of a binding 20 % target for renewables by 2020. With this decision, if followed by effective implementation, Europe has a real opportunity to change its energy supply structure towards a significantly larger share of renewable resources.

The text approved by the Council states in March 2007 that from the overall renewables target, "differentiated national overall targets should be derived with Member States' full involvement with due regard to a fair and adequate allocation taking account of different national starting points and potentials, including the existing level of renewable energies and energy mix". The next steps, then consist of agreeing on the contribution that the 27 EU Member States have to make in order to reach the target and adapting the legislative framework to allow an adequate monitoring of the new commitments.

Germany

CURRENT MARKET SITUATION

18,685 wind turbines with a total capacity of 20,622 MW were installed in Germany by the end of 2006. 1,208 new wind turbines with a total capacity of 2,233 MW were installed during the year 2006, up from 1,808 MW in 2005. This corresponds to a 23.5 % increase compared to the previous year. While there is a stabilising tendency in the German market exports from manufacturers and suppliers in 2006 clearly were on a rise, thanks to the continuously expanding global market. In the longer run it is also expected that the industry will benefit from the developing off-shore business. The share of wind energy in the net electricity consumption in Germany now stands at 5.7 %. In absolute figures wind power delivered 30.6 billion kWh in 2006, although wind conditions were below the long-time average.

Wind farm in Neuenkirchen, Dithmarschen, Germany

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 grid connection, grid access in either distribution and transmission grid, and power dispatch. 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 a German-wide scheme to equalise these 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 digressions. In the case of wind energy, this is set at an annual 2 % for new wind energy turbines.

As of 1 January 2007 the basic tariff is set at 5.17 euro cent. The initial tariff for onshore wind energy is set at 8.19 euro cent and will be paid for a minimum of five years. Depending on the reference energy yield, the initial tariff is granted between 5 and 20 years. The tariffs are fixed for 20 years. No compensation is granted for turbines with a reference energy yield of less than 60 %. There are additional incentives (prolonged initial tariff) for the repowering of wind farms.

In the autumn of 2006 the German government introduced a new law which ensures that the costs for connecting off-shore wind farms to the mainland grid will be covered by transmission systems operators (TSOs). Since off-shore wind farms are planned at quite a long distance from the coast (20 km and more) grid connection represents an important part of their capital cost. Grid connections are now to be shared by a number of wind farms and cables will be channelled underground. The law applies for turbines that will have begun building before 2011.

The tariff for off-shore wind energy is set at 9.10 euro cent (initial tariff), with the basic tariff at 6.19 euro cent, for a period of 20 years. According to present legislation 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 so called privileged projects. Local authorities are supposed to designate specific

GERMANY: TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006
MW	6,104	8,754	11,994	14,609	16,629	18,415	20,622

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 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. BWE anticipates that around 1.800 MW of new capacity will be installed in 2007.

Already today repowering could play a stronger role in Germany. However, this is not the case mainly due to increasing building restrictions. A number of Federal States (Länder) have issued recommendations concerning 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 future onshore potential will not be realised. But as the new Christian and Social Democratic coalition in the German Parliament announced a better framework for repowering as one of their targets in their agreement, repowering should become more effective in the coming years.

OFF-SHORE EXPECTATIONS

Projections for off-shore wind energy in Germany now predict a capacity of about 500 MW by 2010, and at least 3,000 MW by 2015. The tariff for off-shore installations is currently higher than that for onshore plants. No off-shore projects are in operation or under construction yet.

Mainly for nature conservation reasons, most German off-shore parks will be erected up to 20-60 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. Fifteen projects were licensed by the end of 2006 in the North and the Baltic Seas by the national maritime authority, a smaller number of additional projects by the Federal States, adding up to an overall capacity of over 5,000 MW. The change in legislation concerning the off-shore grid connection (see above) is supposed to speed up future construction. Time is needed, however, to adjust the capacities of a number of projects to bundle the cables for each connection. The first pilot project, the site Borkum West in the North Sea, is expected to come into operation during 2008.

FUTURE DEVELOPMENTS

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.

Another important theme is the future grid expansion. The challenge here is the willingness of the grid operators and the time frame: the planning and licensing process for new transmission lines is lengthy and can take up to ten years and more. In the northern Federal State of Schleswig-Holstein for example grid expansion is very slow. In the meantime the so called "production management" is applied. This means that turbines are taken off the grid on the grounds of grid overload. Next to a speedy grid expansion with also using underground cabling in critical areas it will be important to improve the overall grid transport capacity in Germany through measures such as temperature monitoring of overhead lines in the short and medium run. This is also important for the integration of future off-shore capacities.

In principle there is still a potential for new turbine capacity of around 10,000 MW that could be erected on already commissioned sites onshore. Additional onshore capacity will come from repowering: first projects and new studies clearly state that repowering has the potential to double the amount of wind energy capacity onshore in Germany with significantly fewer turbines and can treble the energy yield.

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 25 % 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 2006, Italy had reached a level of more than 2,100 MW, taking it to fourth position on the European league charts.

Italy

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 25 % 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.

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

ITALY: TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006
MW	427	690	797	913	1,255	1,718	2,123

Florinas (SS) wind farm, Sardinia, Italy

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

The Italian wind industry today employs about 3,000 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 2 MW. 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 2006, more than 30 % 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, for example, the authorities recently called a halt to the installations. Both the Italian National Wind Energy Association (ENEV) and the government have responded critically to this type of radical exclusion of wind energy.

Despite these problems, the year 2006 fulfilled the wind energy industry's expectations, with a growth rate of 30 %. The prospects for 2007 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 10,000 MW in Italy.

Wind energy will be fundamental to reach the target under the European Union's Renewable Energy Directive. ANEV estimates that the wind capacity required to reach the target of 25 % 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), the uncertainty of the legislative system, 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.

Poland

Zagórze wind farm, Poland

In 2006, the total capacity installed in wind energy increased by 83 % in comparison to 2005, going up to 153 MW. At the beginning of 2007, a 22 MW Wind Farm Puck was commissioned, which means that currently the installed capacity amounts to 175 MW. Despite this impressive growth rate, wind power density in Poland remains one of the lowest in Europe, with an installed capacity per capita of around 0.0037 kW.

The amount of energy produced by wind turbines in 2006 amounted to 196 GWh and the share of renewable energy sources in domestic consumption of electric energy stood at about 0.58 %, with a wind generation share of 0.1 %.

POLICY

Recently a draft of "Ecology Policy for years 2007-2010 including the perspective for years 2011-2014" was approved by the Council of Ministers in Poland, and it will also be put to the vote in the Polish Parliament. The draft prioritises the support for construction of new RES installations in order to reach the target of a share of at least 7.5 % for renewable energies in the total energy production by 2010, identification and removal of barriers to development of RES, and educational RES activities. Unfortunately, the ecology policy is very general and does not include an implementation plan, therefore, there are concerns that it could not be taken any further.

Moreover, in November 2006, the Minister of Economy amended the law on the extent of the obligation for Transmission Systems Operators' (TSO's) to purchase RES-certificates, with the target set to increase to 10.4 % by 2010.

In addition, in November 2006 the Council of Ministers approved the "Infrastructure and Environment" Programme to promote investments towards energy efficiency, renewable energies and grid infrastructure.

Furthermore, the Ministry of Economy prepared a draft law on conditions for operation of the power system (the so called system ordinance) that gives further flexibility to wind energy producers.

It is also worth mentioning that a new support system (green certificate system) has been functioning for over a year now (since the end of 2005).

POLAND: TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006
MW	4	18	59	60	65	84	153

DEVELOPMENT TRENDS

As far as new connections are concerned, during the summer and autumn of 2006, approximately 210 MW of wind power generation capacity were installed. Some of these turbines will be commissioned in mid 2007.

While onshore wind energy is slowly progressing, there is no off-shore capacity in Poland at this stage. There is practically no discussion concerning the development of off-shore wind farms at coastal sites in Poland, environmental resources and wind conditions are unexplored, and, more importantly, all off-shore projects have been refused to date due to the fact that the NATURE 2000 Regulation covers most of the Polish coastal regions. The situation may, however, change with the introduction of the "Strategy for development of Polish marine areas until 2015" which is currently being developed, but still far from its final form.

According to the EU Accession Treaty, Poland as a member of the European Union is obliged to reach the indicative target of 7.5 % of national gross energy consumption generated from renewable energy sources by 2010. The Polish government plans to have 2,000 MW of installed capacity and a 2.3 % share of wind generation in domestic energy consumption. To reach this target power growth of over 1,800 MW between 2007-2010 would be required, i.e. approximately 450 MW of new installations per year. It seems the target would not be easily achievable especially taking into consideration the present state of the market development and a whole range of administrative, legal and technical barriers. The most notable obstacles are: lack of financial support mechanisms for investments in wind energy, lack of project evaluation criteria and rules of applying for funds, problems with obtaining technical conditions for connection to the grid, and environmental restrictions linked to NATURE 2000.

The Polish wind energy market is in its early stages of development, but wind conditions are comparable to countries currently leading sector, and the overall potential of Poland is large. With favorable conditions and consequent elimination of barriers to wind energy development, the perspectives for the sector are quite positive.

Zagórze wind farm, Poland

Spain

Sierra Guerinda wind farm, Navarra, Spain

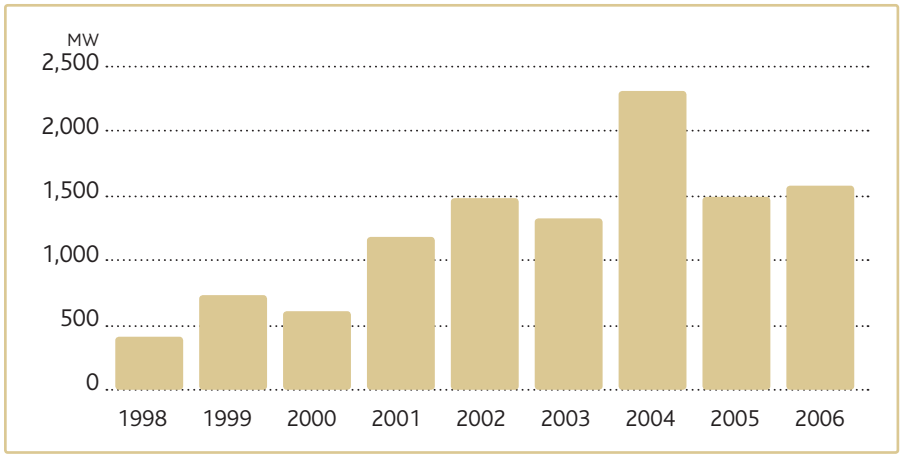
CURRENT MAKER SITUATION

As of 1 January 2007, the installed wind power in Spain stood at 11,615 MW, according to the Wind Energy Observatory of the AEE with data obtained from the Spanish Wind Energy Association and the Association of Renewable Energy Producers (APPA). The 1,587 MW installed during 2006 make for an annual growth of 15.8 %, a percentage similar to that registered in 2005. The figures show that with this growth rate from the last two years, the targets approved by the government in the Renewable Energy Plan (PER) will not be met.

The increase in 2006 was less than expected, given that in the first half of the year 914 MW were installed, whereas in the second – which until now traditionally saw a markedly larger increase – only had 674 MW were taken into operation. In some cases, connection difficulties delayed the initiation of operations in the wind farms until the first trimester of the year, which until now just began to be activated in the last months of the year.

These figures seem to confirm a tendency toward an annual growth (GRAPH 1) of around 1,550 MW, which, according to the associations of the sector, is insufficient to reach the target of the RES PLAN to have 20,155 MW by the end of 2010 (GRAPH 2). The sector considers that this trend can become significantly aggravated if the new regulatory framework for the retribution of renewable energy as proposed by the government and sent to the CNE were to be approved.

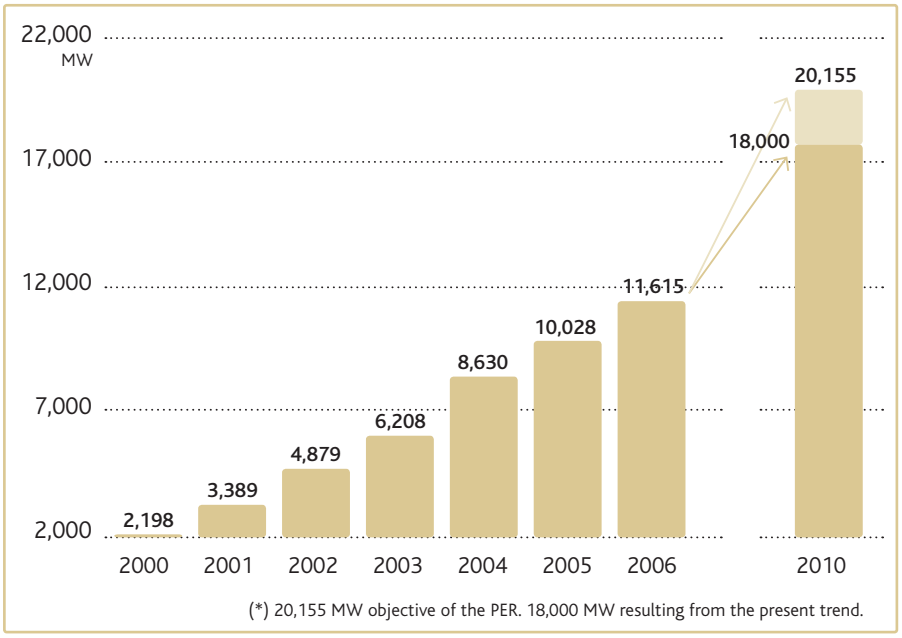
GRAPH 1: **ANNUAL INSTALLED WIND CAPACITY IN SPAIN**



SPAIN: TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006
MW	2,235	3,337	4,825	6,203	8,263	10,027	11,615

GRAPH 2: **DEVELOPMENT OF WIND CAPACITY IN SPAIN**



(*) 20,155 MW objective of the PER. 18,000 MW resulting from the present trend.

GALICIA MAINTAINS ITS LEADERSHIP

With respect to territorial distribution, Galicia continues to lead the autonomous regions with 2,603 MW, with an increase of 234 MW; followed by Castilla-La Mancha, with 2,311 MW, and an increase of 294 MW; and, by Castilla y León, with 2,120 MW, which recorded a growth of 303 MW in 2006. In percentage terms, the most significant growth has been that of the Comunidad Valenciana, with 279 MW of new installations, which makes for an increase of 1,361 %, followed by Cataluña with an increase of 57 % and by Andalucía which was growing at 36 %.

WIND COVERS 9 % OF SPAIN'S ELECTRICITY DEMAND

During 2006, wind power plants generated 22,199 GWh, which is 6.48 % more than in 2005, and which represented almost 9 % coverage of demand (8.8 %). It has been a less windy year than the previous one in spite of a 15 % increase of installed energy with respect to 2005, in a period of three months the 2006 production is less than the same period in 2005. The most significant production increases with respect to the previous year happened only in March and August. This lesser amount of wind coincides with lower prices than in 2005, which will make for a reduction in the end results.

On the other hand it is significant that on numerous occasions wind power exceeded 25 % of demand with a production point of 8,142 MW on 8 December, which made for 31 % of the total production at that time. Furthermore, at the point of consumption that was reached on 30 January 2006 with a demand of 42,153 MW, wind contributed 8 %.

POLICY DEVELOPMENTS

The Spanish Government introduced new tariffs under the Royal Decree 1634/2006 which makes it compulsory for all wind farms to be connected to a Control Center (CC) and all CCs are also connected to the Dispatching Centre of REE for all renewable energies (CECRE). Once this coordination system becomes operational, all wind farms will receive signals to reduce capacity according to different grid situations: over-loading, stability risks, excess of generation.

Also, the Ministry of Environment recently published a 'Spanish Strategy on Climate Change and Clean Energies' which, among other measures, states that the Government will issue a new Renewable Energies Plan for 2008-2020, which will adopt the European Commission target of 20 % renewables energies in the energy mix by 2020 and also will set specific targets for electricity in 2012 and 2020, which would be 32 and 37 %, respectively.

Finally, the Ministry of Defence has also recently published an 'Environmental Initiatives Plan for 2007-2008' which includes a series of measures to promote the use of renewable energies, including the installation of wind energy farms, where feasible.

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, however problems remain in progressing projects through the planning system.

2006 was the best year ever for construction of wind farms in the UK. A total capacity of 630.8 MW was commissioned, taking the total to almost 1,963 MW. A further 985 MW is under construction, and much of this capacity should be completed by the end of 2007, with the largest project being a 322 MW wind farm south of Glasgow, Scotland. There are many further projects on and off-shore approved and due to start construction, however a particular problem lies with the large amount of capacity in the planning system awaiting a decision, which must be decided promptly if the UK's renewable energy targets are to be met, with a more positive approach within the local planning system.

PLANNING SUCCESS

According to the BWEA's latest annual survey, roughly 3,965 MW of capacity on and off-shore is consented, but has not yet gone forward to construction and a very large capacity onshore – equivalent to approximately 6 % of the UK total electricity supply is awaiting determination. In Scotland alone, a total of 5,492 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. Developer confidence has been maintained with a significant number of applications continuing to be submitted into the planning system on and off-shore, and whilst onshore applications in Scotland appeared to have peaked, there was an increased number of applications in England compared to 2005.

Barrow off-shore wind farm, UK

What these figures show is that, despite the perennial UK problem of determined local opposition to specific projects and the many other hurdles to overcome, substantial progress is still being made. Scottish wind farms still accounted for the largest installed capacity in 2006,, and the greatest amount of capacity in planning remains in Scotland, however with the inclusion of off-shore capacity in planning England is not far behind, whilst Northern Ireland shows great potential with a capacity in planning onshore similar to England.

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.

UNITED KINGDOM: TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006
MW	406	474	552	648	888	1,353	1,963

OFF-SHORE DEVELOPMENT

If the 2010 target is to be achieved, 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. Four of these have already been built – at North Hoyle (60 MW) off the west coast, Scroby Sands (60 MW) off the east coast, Kentish Flats (90 MW) in the Thames Estuary and Barrow project (90 MW) off the coast of Cumbria 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 off-shore 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 off-shore to be viable until costs can be brought down through innovation. Meanwhile, starting with the 450 MW Walney scheme, three Round 2 projects totaling up to 1,265 MW applied for construction consent during 2006, a process that could take up to a year to complete. The big news for off-shore came at the end of 2006 with the consent for the 1,000 MW London Array and 300 MW Thanet. When the first of these dips its foundations in the sea, it will place the UK firmly in the vanguard of the European off-shore league.

Burton Wold wind farm, UK

United States

2006: ANOTHER RECORD YEAR FOR U.S. WIND ENERGY, WITH WIND SECOND LARGEST SOURCE OF NEW POWER GENERATION IN THE COUNTRY

The U.S. wind energy industry turned in a record year in 2006 for the second year in a row, and is looking at continued strong performance in 2007 and 2008, according to the American Wind Energy Association (AWEA). This sustained growth is the direct result of stability in the availability of the production tax credit, which Congress has extended until December 2008.

The addition of 2,454 MW established wind as the second-largest source of NEW power generation in the U.S. for the second year in a row, after natural gas. The new installations boosted the country's wind power generating capacity by 27 % with cumulative capacity sailing past the 10-gigawatt mark, to 11,603 MW as of December 31, 2006.

U.S. wind energy facilities will produce an estimated 31 billion kWh or more in 2007 – about 0.7 % of the country's electricity generation, enough to power the equivalent of 2.9 million average American households. The current U.S. electricity mix consists of about 50 % coal, 19 % nuclear, 19 % natural gas, 6.5 % hydropower, with the rest generated from oil and non-hydro renewables, according to the U.S. Energy Information Administration.

STRONG DEMAND, FOUR-YEAR WINDOW OF STABILITY IN PRODUCTION TAX CREDIT SPUR UNPRECEDENTED GROWTH

The U.S. wind energy industry is achieving this record-breaking growth thanks to a powerful combination of (a) strong demand, and (b) a window of stability in the availability of the federal incentive for wind energy, the production tax credit (PTC).

Demand for wind power is driven by wind's cost effective economics and environmental advantage. Wind power competes in the market place today, and a growing number of utilities are diversifying their energy portfolios with wind as protection against volatility in the price of natural gas and other fuels used for electricity generation. Concerns about climate change and energy security also drive public support for this clean, safe, domestic energy source.

A window of stability in the production tax credit (PTC) makes it possible for the industry to meet this growing demand and establish the U.S. wind energy market as one of the largest and most buoyant in the world today. After including the first "seamless" extension ever of the credit in the 2005 Energy Policy Act, Congress has successively pushed the credit's expiration date back to 2007, and 2008. Congress may also consider a longer-term extension in upcoming legislation. This more stable planning horizon provides the U.S. wind energy industry with welcome relief from previous expiration-and extension cycles and with the opportunity to plan ahead and ramp up investments.

John Deere wind farm, United States

US: TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006
MW	2,578	4,275	4,685	6,372	6,725	9,149	11,603

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 energy sector is one of the most heavily subsidized in the U.S. economy, and the credit is needed to help level the playing field for wind and other renewable energy sources.

TEXAS PULLS AHEAD OF CALIFORNIA

The new wind farms completed in 2006 include the world's largest single wind farm at the time of its completion, the 735-MW Horse Hollow wind energy center in Noland and Taylor counties in Texas. In all, Texas added some 774 MW of wind in 2006 – claiming the position of wind energy leader historically held until now by California.

INVESTMENT IN MANUFACTURING, SUPPLY CHAIN, POINTS TO CONFIDENCE IN MARKET

The present stable policy outlook is spurring investment in manufacturing and driving new business to the various sectors that form part of the wind energy supply chain, from nuts and bolts and gearbox production to construction, transportation, and more. This surge in wind energy-driven investment and job creation is occurring across the country.

In 2006, four leading wind turbine companies opened manufacturing facilities in the U.S., a clear signal that the companies believe the market is now ready for long-term growth. In early 2006, Gamesa opened several manufacturing facilities in Pennsylvania, creating jobs in a state that has been suffering from job losses over the past years. Later in the year, Clipper Windpower and Siemens both opened wind turbine manufacturing facilities in Iowa, and Suzlon opened its first U.S. manufacturing facility, in Minnesota. Additional announcements are expected in 2007.

The growth in the U.S. wind energy industry is creating business opportunities and jobs even in states that do not have a large wind resource. In the Southeast, for example, companies such as Aerisyn, in Tennessee and Beaird Industries in Louisiana have put out the "hiring" sign following increases in orders for wind turbine towers.

CONTRIBUTION TO FUTURE ENERGY SUPPLY

The American Wind Energy Association, U.S. Department of Energy, National Renewable Energy Laboratory, and utilities, environmental organizations, technology companies, foundations and other stakeholder groups are evaluating the goal of supplying 20 % of the nation's electricity with wind, following the statement by President Bush on that topic. AWEA believes that producing 20 % of the nation's electricity from wind is feasible and affordable, and will provide reliable and clean power, conserve scarce water resources, create jobs, foster significant rural economic development, and help achieve environmental and climate change goals in a cost-effective way.

Preliminary assessments indicate that supplying 20 % of U.S. electricity is feasible and affordable because:

- the U.S. has a tremendous wind resource,
- the manufacturing capacity is available,
- barriers are in the policy and regulatory realm, not physical or technological,
- there is widespread public demand and support for wind and other renewable energy sources.

In order for wind to expand from less than 1 % of U.S. electricity supply today to 20 % or more, nothing short of dramatic shifts will be needed in policy and in the regulatory arenas, including in the structure and size of power markets, transmission planning and infrastructure development, and energy and environmental policies.

The Democrats' Congressional victory in the U.S. mid-term elections means that a range of renewable energy friendly policies are now up for consideration which were simply not before. These include a national renewable portfolio standard (RPS) and a cap on carbon emissions. It is unclear just how much change the new Congress will be able to deliver. But as of early 2007 the outlook is bright and the country is alive with the sense of new possibilities.

Canada

Soderglen wind farm, Southern Alberta, Canada

A RECORD YEAR IN 2006

Canada's wind energy market experienced a tremendous year in 2006. A total of 776 MW of new installed wind energy capacity was commissioned in 2006, increasing Canada's total installed wind energy capacity by 113% relative to the start of the year and shattering the previous record for annual installations of new wind energy capacity (240 MW in 2005). Canada now has 1,459 MW of installed wind energy capacity.

Twenty-one wind energy projects were commissioned in 2006 in six different Canadian provinces. Some highlights include:

- Ontario, Canada's largest province, saw its installed wind energy capacity increase from 15 MW at the start of 2006 to a total of 414 MW by the end of the year. Included in this total is Canada's largest wind farm, the 189 MW Prince project.
- Quebec saw the commissioning of the 109.5 MW Baie-des-Sables project, the first project to be commissioned from Hydro-Quebec's earlier 1,000 MW request for proposals (RFP).
- Manitoba completed commissioning of its first wind farm, the 103.5 MW St. Leon project.
- Nova Scotia commissioned 9 projects, totaling 13.4 MW of installed capacity, demonstrating that wind energy can be implemented at a number of scales in Canada.
- British Columbia (325 MW) and Newfoundland (52 MW) both awarded power purchase agreements to multiple projects making it clear that it will not be long until all 10 Canadian provinces have installed wind energy capacity.

GROWTH SET TO CONTINUE

Importantly, the record breaking growth of 2006 is simply the first indication of the stable and sustained growth expected in the Canadian market over the next several years. More than 2,500 MW of new wind energy projects have already signed power purchase agreements and are slated for construction in the next few years. At the same time, 2006 saw the announcement of several new procurement processes for wind energy in addition to procurement processes that are still underway. These include:

- Manitoba plans to issue a 300 MW wind energy RFP early in 2007
- Ontario launched a Standard Offer Program in the fall of 2006 that is designed to provide a fixed price to qualifying wind energy projects of 10 MW or less
- Quebec's ongoing 2,000 MW RFP for wind energy is to close in spring 2007 with an announcement of the winners in the fall,
- New Brunswick is expected to announce the results of a 200 MW wind energy RFP in 2007
- Nova Scotia will be issuing a 130 MW renewable energy RFP in 2007

CanWEA projects that a minimum of 500 MW of new wind energy capacity will be installed in 2007 and that 2008 will exceed the annual installation record set this year. Canada is on track to have more than 5,000 MW of wind energy in place by 2010 and Canada's provincial governments have now set targets and objectives for wind energy development that total close to 10,000 MW by 2015.

POLICY DRIVERS AT FEDERAL AND PROVINCIAL LEVELS

Wind energy's rapid expansion in Canada is a product of several factors: concern about greenhouse gas emissions and air quality, an interest in regional and rural economic development, and expectations that electricity costs will increase in the years ahead. In response to these drivers, Canada's federal and provincial governments have implemented policies that have helped to stimulate wind energy deployment.

CANADA: TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006
MW	137	198	236	322	444	684	1,460

At the federal level, 2006 was a year of uncertainty as the new federal government elected in that year froze funding associated with the previous federal government's Wind Power Production Incentive program. This uncertainty was removed, however, in January 2007 as a new ecoEnergy Renewable Power programme was announced that maintained the basic features of the previous program – a 1 cent per kwh production incentive payment for the first 10 years of operation from qualifying windfarms. This new programme is designed to support the deployment of an additional 4,000 MW of renewable energy by 2010.

Virtually all provincial governments have now established targets for future wind / renewable energy production and most have put in place an initial set of procurement policies (primarily competitive requests for proposals for wind energy) that will allow them to achieve some or all of their goals.

OVERCOMING THE REMAINING CHALLENGES

The rapid growth in Canada's wind energy industry has also created challenges. An emerging "patchwork" of municipal regulations is posing challenges from a permitting and approvals perspective. In some parts of the country, transmission availability is emerging as a potential barrier and there is increasing discussion about "limits" to wind energy integration. While public opposition to wind energy projects is still an issue with respect to only a minority of projects, such opposition is gaining a higher profile in light of the rapid expansion of the industry. Finally, increased turbine costs and issues related to turbine availability are having an impact on the marketplace.

None of these challenges are insurmountable. In fact, it is increasingly the case that government, electricity sector stakeholders and the wind energy industry are working together to address these issues. Accordingly, the future for Canada's wind industry looks bright with stable and sustainable growth foreseen for the next several years.

This prognosis is supported by growing international interest in Canada's wind energy market. While many of Canada's major energy companies have now incorporated wind energy into their portfolios, leading European and American wind energy companies are increasingly active in the Canadian market and several acquired smaller Canadian wind energy companies in 2006.

Baie-des-Sables wind farm, Quebec, Canada

Brazil

Prainha wind farm, 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.

According to a wind atlas published by the Brazilian Wind Energy Centre (CBEE) the total wind potential in Brazil is estimated to be in the range of 143,000 MW, however, at this stage, wind still plays a secondary role in Brazil. Areas with the greatest wind energy potential are in the North Eastern, Southern and South Eastern regions. By the end of 2005 total cumulative capacity stood at 28.55 MW. During 2006 208 MW were installed bring the total to 239 MW, equalling a tremendous growth rate of 717 %. Between 1999 and 2005 total installed capacity increased only in small increments. This mainly could be attributed to the fact that Brazil has significant import duties and taxes making projects less bankable unless complete local production and sourcing are established. Also, the country over the past few years has been tapping into its biomasss potential as a source of renewable energies. Wind power is expected to grow substantially in the coming years.

THE PROINFA PROGRAMME

Due to the high dependency on hydroelectric power generation, Brazil faced a power shortage in 2001. In order to remedy the situation and avoid more severe power crises in the future, the Brazilian Government launched incentive programmes to encourage thermal and renewable power generation.

In 2002, the Brazilian government passed a programme called PROINFA to stimulate the development of biomass

BRAZIL: TOTAL INSTALLED CAPACITY

year	2002	2003	2004	2005	2006
MW	22	29	29	29	237

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 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 government expects the programme to generate 150,000 jobs and to attract private investments worth some 2.6 bn 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, 100 MW of which should be from wind. In this state, renewable energy generators will be required to issue a number of Renewable Energy Certificates proportional to the amount of clean energy produced.

Sorocaba factory, Brazil

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. The installed wind capacity by 2007 is now estimated at 1,451 MW.

The Federal Government is also expected to announce a 5,000 MW wind energy program to be realised between 2009 and 2015.

KEY PLAYERS IN THE BRAZILIAN MARKET

In 2007 the largest players are expected to be Ventos do Sul Energia (SPC), Energias Renováveis do Brasil and SIIF Énergies do Brasil. All players are in the process of constructing large wind farms in the regions Rio Grande do Sul, Rio Grande do Norte and Ceará. There are a number of foreign groups looking for project development opportunities as well as acquisition of developed projects. Enercon is the largest supplier of wind generators in Brazil with Suzlon expected to enter the market in 2007.

Financing is typically done via National Economic & Social Development Banks (BNDES), Agencia de Desenvolvimento do Nordeste (ADENE) and Banco do Nordeste (BNB), all facilities focus on ethical and environmental friendly projects. Furthermore the PROINFA also assures low-interest loans from BNDES.

Grid operators include Centrais Elétricas Brasileiras (Eletrobras) and Operador Nacional do Sistema Elétrico (ONS) who guarantee the first phase of PROINFA.

More than 5,000 MW of wind energy projects have already been registered with Brazilian Electricity Regulatory Agency called Agência Nacional de Energia Elétrica (ANEEL) and awaiting approval for supply contracts with utilities in order for these projects to move forward with planning and construction.

Mexico

GREAT POTENTIAL FOR WIND DEVELOPMENT

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 87 MW with a small share of this total in operation since the mid-nineties.

POLITICAL FRAMEWORK CONDITIONS

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 Lower Chamber of the Mexican Congress approved the initiative for the Renewable Energy Utilization Law (LAFRE), which aims at establishing a Renewable Energy Utilization Program 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.

PROJECTS

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, who commissioned this facility during the fourth quarter of 2006.

The Federal government also announced provisions in the 2007 budget for the construction of another wind farm in Oaxaca (LA Venta III) where CFE intends to buy the energy of a 101 MW wind plant to the private producer (IPP). 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.

MEXICO: TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006
MW	0	0	0	0	0	3	85

La Venta wind farm, Oaxaca, Mexico

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 for the first five years of operation.

This IPP will be tendered in 2007 to begin operation in 2009. 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

Wind farm located near the Coimbatore Area of Tamikl Nadu

India's wind energy sector registered impressive growth and expansion during 2005 and 2006. Total installed capacity stood at 6,300 MW at the end of December 2006, an increase of more than 1,430 MW over the previous year (2005), which makes India the fourth largest producer in the world. The growth witnessed during 2006 was also the highest ever in a single year, a massive 51 % increase over the previous year. Even so, given the country's vast potential, progress could be further accelerated.

WIND POTENTIAL

The original impetus to develop wind energy in India came in the early 1980s from the then Ministry of Non-conventional Energy Sources (MNES), now renamed as the Ministry of New and Renewable Energy (MNRE). 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. MNRE 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 Centre for Wind Energy Technology at around 45,000 MW. This figure was also adopted by the MNRE 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 has been carried out by government agencies and private sector has identified many more resource areas. 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.

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

The Electricity Act 2003 has also introduced a unique feature the Renewable Portfolio Standards (RPS) under which every

INDIA: TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006
MW	1,220	1,456	1,702	2,125	3,000	4,430	6,320

utility has to source a certain percentage of their supply from renewables.

One result of these incentives and tariffs has been to encourage energy intensive and profit making industries and businesses to invest in wind power. In addition, the introduction of a Production Tax Credit (PTC) which would attract investment from Non Resident Indians (NRI) as well as foreign investment in the Indian Market is currently being considered. 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).

Wind farm located near the Coimbatore Area of Tamikl Nadu

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. About nine wind turbine manufacturers are currently offering their products on the Indian market. The major players are Suzlon, Enercon, Vestas Wind Technology India Pvt. Ltd, Vestas RRB and Pioneer Asia Wind Energy Group. 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 Karnataka, West Bengal, Madhya Pradesh and Andhra Pradesh starting to catch up. As a result 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 10,000 MW by 2010. 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.

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 2006, total installations in mainland China had reached 2,604 MW, with an annual growth of more than 1,300 MW. 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 Chinese government estimates that the localisation of wind turbine manufacturing brings benefits to the local economy and helps keeping costs down. In the year of 2006, about 400 MW wind turbine came from the local manufactures. 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 promoting "Wind Power Concessions" for large scale commercial development. It will encourage the local authorities to invite investors, both international and domestic, for developing 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.

Up to end of 2006, there 4 phases of the wind concession programme have been launched with 15 projects and a total capacity of 2,550 MW, with approval by the central government. A further 3,000 MW have been approved by the local wind bidding procedures based on the same principles as the wind concession programme.

By the end of 2005, the total installed capacity of wind power concession projects had reached 1,260 MW. A further 1,347 MW were installed 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 tariffs offered by winning concessions have

CHINA: TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006
MW	346	402	469	567	764	1,260	2,604

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 2006, the market share of domestic made turbines had already reached 25 %. 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 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, the Price Department and the Energy Bureau of the 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.
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, 3,500 MW of wind capacity could be installed by the end of 2007. Based on the "learning curve" theory of cost reduction, this volume could 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 only 800 MW. However, based on the approval projects both in central and local level, the national target of wind in 2010 would be much bigger than 5,000 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 less than 1.5 % of total power production.

Major developed areas for wind in China in the next 5 to 10 years are the following:
- Inner Mongolia, currently 500 MW, 2,000 MW by 2010, 10,000 MW by 2020;
- Jiangsu, currently, less than 100MW, 1,000 MW by 2010, and 3,000 MW by 2020;
- Hebei, currently less than 300 MW, 1,000 MW by 2010 and 3,000 MW by 2020;
- Jilin, currenlt less than 300 MW, 1,000 MW by 2010, 2,000 MW by 2020.

CDM CONTRIBUTIONS FOR WIND

About 52 wind projects (with a total capacity of 3,700 MW) have received approval of the Government of China, out of which about 17 projects (with a total capacity of 700 MW) have successfully registered with the CDM Executive Board of the UNFCCC. The price ranges from 6 to 9 Euros per ton of CO_2 and the expected income for CERs sales would be about 37 million Euro per annum.

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 15 to 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 to nearly 1,400 MW by December 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.

Summit Wind Power Kashima, Kashima-shi, Ibaraki Prefecture, Japan

However, the law has a number of weaknesses, including 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 initial subsidies such as the 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.

Other issues which have created challenges for Japanese wind developer's concern grid infrastructure and security of supply (stability). 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 and the monopolistic hold over wind power by power companies, that use intermittency issues as an excuse for not investing in more capacity. has hampered the development of wind generation.

Also, local opposition has come up rapidly for reasons of bird strike and landscape esthetics.

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 Development Organization (NEDO) have recently set up various committees, such as

JAPAN: TOTAL INSTALLED CAPACITY

fiscal year*	2000	2001	2002	2003	2004	2005	2006
MW	139	308	461	678	936	1,061	1,394*

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

Summit Wind Power Kashima, Kashima-shi, Ibaraki Prefecture, Japan

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. The 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 off-shore wind energy potential. However, only one big project to develop and research Japanese off-shore technology has been initiated by Tokyo Electric Power Co. and Tokyo University. The first report said 10 % of electricity supply could come from Tokyo off-shore. The main hurdles to the development of off-shore wind farms in Japan are social issues, especially the social acceptance process and compensations for the fishery industry.

Korea

The year 2005 was a turning point in Korea for the deployment of wind power generation facilities. Throughout 2004, the cumulative installed capacity of commercial wind power generators of the 100 kW-class or more was 28 MW. New capacity installed in 2005 and 2006 was 70 MW and 75 MW respectively, taking the total cumulative capacity by the end of 2006 to 173 MW. The market in Korea for wind power development is expanding, and deployment would increase even more rapidly if wind power could be proven competitive against other energy sources.

In December, 2003, the Korean government established the "Basic Plan for New and Renewable Energy Technology Development and Dissemination," as a mid- to long-term policy to proactively facilitate technology development. Accordingly, the government is implementing detailed annual plans to raise the share of renewable energies (RE) to 5 % of Total Primary Energy Supply (TPES) by 2011. The government has set targets for wind power capacity of 1,137 MW by 2010 and 2,250 MW by 2012.

DEVELOPMENT OF DEPLOYMENT PROGRAMS FOR MARKET CREATION, AND PROVISION OF SUPPORT TO ESTABLISH INFRASTRUCTURE

To ensure rapid deployment of renewable energies the government devised subsidy program is underway; preferential loans are being granted; and a feed-in-tariff system has been established. Since the feed-in-tariff system for RE-generated electricity took effect May 2002, private investments have been the driving force behind installation of commercial wind power generators. To secure private investment, an application period for the base price was established as a guarantee.

CONSTRAINTS TO MARKET DEVELOPMENT

One of the obstacles toward the development of wind farms in Korea is the relative scarcity of geographically suitable locations. Most areas outside populous centers are

Hangwon wind farm in Jeju island, Korea

KOREA: TOTAL INSTALLED CAPACITY

year	2001	2002	2003	2004	2005	2006
MW	7.9	12.6	18	68	98	173

mountainous, so the infrastructure (road, power grid, etc) necessary for installing wind farms is inadequate despite the great wind resource potential. Establishing wind farms therefore entails huge up-front costs. In addition, these areas are usually designated nature preserves, such as public parks, so obtaining legal permits is difficult, if not impossible. Private wind power generation companies are trying to reduce the unit cost of construction by pursuing large-scale deployment projects of more than several 10 MWs.

Various measures are being taken to overcome these geographical limitations, such as the construction of off-shore wind farms. In order to secure off-shore wind power technology, Korea constructed a demonstration site in Jeju island with 3 MW of power capacity.

THE STATUS OF THE INDUSTRY

At present, four domestic manufacturers are developing mid- to large-class wind power generators with capacities of 750 kW ~ 3,000 kW. Two prototype wind power turbines with a capacity of 750 kW are currently in operation on a pilot demonstration site. In addition, the construction of a 2MW-class wind turbine has started and a prototype could be completed by the first half of 2007.

The Korean wind power industry is growing rapidly, benefiting from the major wind power generation projects that are underway. Companies operating wind farms, and manufacturers of wind turbines, turbine towers, and components, are expected to see steady growth into the foreseeable future.

Australia

With some of the world's best wind resources and highest capacity factors, Australia is a prime market for wind energy. Further advantages come from a stable, growing economy, good access to grid infrastructure and well organised financial and legal services. However 2006 has been a year of mixed fortunes for wind energy in Australia which has, thankfully, ended on a positive note.

THE POLICY ENVIRONMENT

With the decision not to extend the MRET Australia's wind energy industry faced tough times until three state governments stepped up to provide a change of fortune in the second half of the year.

Victoria, with the VRET scheme, pledged to source 10 % of all electricity from renewables by the year 2016, effectively requiring 3,274 GWh of renewable energy by that date. A threat to repeal this legislation was averted when the Victorian government was returned at the state election after campaigning strongly on the issue of renewable energy and using wind energy imagery extensively in its campaign publicity material.

South Australia, which is home to nearly half of Australia's installed wind energy capacity, followed suit and went one better with plans for 20 % from renewables by 2014, however the industry is waiting to see the details of how this target is to be achieved.

And New South Wales (NSW) announced its own target in the form of the NRET, which aims for 10 % from renewables by 2010 and 15 % by 2020. The major difference between VRET and NRET at this stage is that the renewable energy specified in the NRET legislation is not required to be produced within NSW, whereas the VRET specifies production within Victoria.

The combined effect of these schemes has been to see plans progressing for several new wind farms throughout south-eastern Australia

Federally the attention has been on nuclear energy and the prospect of so-called "clean coal". The Prime Minister

Woolnorth Bluff Point wind farm in Tasmania, Australia

commissioned a report titled "Uranium Mining, Processing and Nuclear Energy – Opportunities for Australia?", which concluded that with the introduction of carbon pricing at moderate levels, atomic energy as well as a range of renewables would become cost-competitive with coal in the short term, but that it would likely be at least 15 years before the first nuclear power plant could be operating in Australia.

The first half of 2007 will see another task force looking into Australia's options for carbon pricing mechanisms, however the government's long-standing reluctance to ratify the Kyoto protocol may leave it with somewhat limited options.

MANUFACTURING – A POSITIVE OUTLOOK

In the absence of positive signals from the federal government, Australia's wind energy manufacturing sector had a productive, if nervous, year. Orders and interest remain high, however the announcement late in the year that Vestas would close its nacelle assembly plant at Burnie in Tasmania caused some apprehension, which was later erased by positive signals from the state governments in Victoria, new South Wales and South Australia.

AUSTRALIA: TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006
MW	32	73	105	198	380	708	817

Meanwhile, those businesses having established Australian operations are reaping the benefits of access to a skilled and educated workforce and convenient location to the growing markets of the Asia Pacific region. With hundreds of MW of new projects announced in the last quarter of 2006, opportunities for growth are set to flow in the coming years.

CURRENT INDUSTRY GROWTH

After a huge expansion in 2005 Australia's wind energy sector saw a slow-down in 2006, due largely to the federal government's Mandatory Renewable Energy Target (MRET) scheme becoming fully subscribed four years ahead of time. This left Australia with no real incentive schemes to promote the deployment of renewable energy until late in the year when several state governments stepped in to fill the breach with schemes of their own.

Two new projects were completed during 2006, with Pacific Hydro's 30 MW Yambuk wind farm in Victoria and the 79.2 MW Emu Downs project in Western Australia – a joint venture between Stanwell Corporation and Griffin Energy – coming to fruition. They took the current total installed capacity to 817 MW, with this figure expected to increase substantially over the next year or two.

A large amount of new capacity is currently under construction and several new facilities have either received planning approval or been given the final go-ahead since the state-based incentive schemes were announced.

Among the projects approaching completion are: Hallett (AGL; 95 MW) and Lake Bonney Stage 2 (Babcock & Brown National Power; 159 MW) projects in South Australia, Woolnorth Studland Bay (Roaring 40s; 75 MW) in Tasmania, and the Portland Wind Energy Project (Pacific Hydro; 165 MW) in Victoria.

COMMUNITY AND LANDSCAPE ISSUES

The Australian wind energy industry has focused a great deal of attention on managing and improving its interactions with the public. This has included a range of projects, such

Cathedral Rocks wind farm in South Australia

as the review of Auswind's Best Practice Guidelines, which were re-launched in early December, the development of an industry Accreditation Scheme to accompany the guidelines, and continuing work on a national landscape assessment methodology.

It is this last project – a joint effort between Auswind and the Australian Council of National Trusts – which will be the subject of a series of community information and feedback forums throughout the country in 2007. This process will provide the industry with an opportunity to continue to improve its practices in line with community needs and expectations.

Egypt

Zafarana wind farm, 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.

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. The New and Renewable Energy Authority (NREA) was founded in 1986, with the aim to boost wind and solar 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 installed capacity with renewable energy by 2020; 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 average wind speeds reach over 10 m/sec. A detailed Wind Atlas for the region was published in March 2003 in cooperation with Risø National Laboratory, Denmark, concluding that the region can host about 20,000 MW of wind farms. The Wind Atlas for Egypt, covering the whole country, was issued in December 2005 in cooperation with Risø National Labatory.

EGYPT: TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006
MW	5	5	68	98	145	145	230

WIND ENERGY PROJECTS IN EGYPT

HURGHADA 5.2 MW WIND FARM

The first commercial wind farm of 42 turbine of different technologies (2 blades, 3 blades, tubular & rigid towers has been operational since 1993 as part of the local grid. About 40 % of the wind farm components were locally manufactured (towers, blades, cables, transformers, some other electrical & mechanical parts).

ZAFARANA 225 MW WIND FARM

With the Zafarana project, Egypt has moved on from limited experimental projects to the phase of large scale grid connected wind farms. An area of 80 km^2 on the Gulf of Suez besides another area of 64 km^2 to the west of the 1st site at Zafarana were earmarked for NREA's wind projects, showing institutional support and governmental commitment to the wind energy programme. Currently, there is 225 MW wind farm operated into stages. The 1st stage was 63 MW operated in 2001, the 2nd one was 77 MW operated in 2003/2004. Both of them were implemented in cooperation with Denmark and Germany. Meanwhile, the last installation of 85 MW in cooperation with Spain was operational in July 2006. The energy production from the farm was about 552 GWh at an average capacity factor of 40.6 %, saving about 127 thousand ton of oil equivalent and abating emissions of about 305 thousand ton CO_2 in 2005/2006. Presently, another 80 MW wind project is under implementation. While another 240 MW wind farms are in the pipeline.

GABAL EL-ZAYT

Recently, an area of 656 km^2 has been earmarked to host a 3,000 MW wind farm at Gabal El-Zayt on the Suez Gulf coast. Two studies are being conducted to assess the site potentials to host large scale grid connected wind farms of about 3,000 MW and to establish an 80 MW wind farm at that site in cooperation with Germany.

Zafarana wind farm, Egypt

Iran

Iran's wind energy sector has seen an increase of more than 25 MW in 2006, with total installed capacity more than doubling to reach a total of 48 MW at the end of December 2006. Iran has tremendous wind energy potential and could have far exceeded current capacity if an appropriate policy framework had been in place. In 2006 however, various initiatives have been set up to improve the electricity generation conditions. Although Iran has large fossil fuel resources such as natural gas and crude oil, given the nature and supply of these resources wind energy is being developed quickly.

POLICY

The Government of Iran put in place new polices and measures to encourage sustainable use of its various energy resources and proposed to increase the share of electricity produced from renewables.

Manji wind farm, Iran

These measures also included the establishment of a dedicated Renewable Energy Organization of Iran (SUNA) under the Ministry of Energy in 1999. SUNA has already commissioned studies on resource assessments analysis and has set up pilot wind farms to test the technical feasibility of wind energy in Iran. The programme will also focus on assigning purchase guarantees for RES. Given the viability of wind energy, the Government of Iran plans to invest more resources in developing it further.

In order to attract more investment for the private sector the government is pushing renewables by creating incentives and good conditions for developing projects. The government has also invested in pilot projects and is currently in talks with the industry to set up a 300 MW wind farm.

POLICY SUPPORT MECHANISMS

With government support, SUNA not only hopes to increase incentives for wind energy development but also hopes that by investing in research and development to make wind power commercially viable. An article on financing regulations has also been introduced in the government's National Development Programme, whereby the government will purchase a certain amount of electricity produced by renewables from state owned or private producers at guaranteed prices. However, due to the very low tariff, this scheme has not provided the impetus for wind farms and renewables in general as hoped.

Due to environmental benefits and economies of scale of developing wind farms the government wants to encourage investment in this sector, hence prices have been set at 650 Rials (0.5 euro cents) for each kilowatt-hour of generated electricity at the peak hours and 450 Rials (0.3 euro cents) at the low consuming hours of the day (maximum four hours in one day). Development has also been encouraged by the approval of article 11 of current regulation on the national budget to subsidise the optimisation of energy consumption projects. According to this article, it is possible to acquire a credit or grant for energy efficiency projects in the development of public transportation or renewable energy technology.

IRAN: TOTAL INSTALLED CAPACITY

year	2002	2003	2004	2005	2006
MW	12	15	21	23	48

Two research and development initiatives to design and manufacture 1.5 MW wind turbines for the installation of two wind farms of 12 MW and 60 MW capacity were approved by SUNA at the end of 2006. These projects are now under consideration for approval with the Iran Management and Planning Organization.

MANUFACTURING BASE

The wind turbines for the first installed wind farm (12 MW) in Iran were imported from external companies by the government in 2000, but Iran hopes to establish a sturdy manufacturing base in order to export wind turbines to other nations.

SabaNiroo Co., the first and only wind turbine manufacturer in Iran and Middle East, was founded in April 2000 and was officially set up by the Energy Industry & Mines Minisry in November 2003. The company's main objectives are the design, development and manufacturing of wind turbines. Its products are manufactured using the latest technology and are in compliance with all applicable standards (i.e. ISO-9001-2000 certification in Quality Management System, ISO 14001: 2004 in Environmental Management System and OHSAS 18001:1999 in Occupational Health and Safety Management System in the fields of design, manufacturing and after-sales services of large wind turbines).

Saba Niro blade production, Iran

The main customers of SabaNiroo:

- SUNA commissioned 143 units of 300, 550 and 660 kW wind turbines for 90 megawatts wind farms in Manjil, Harzevil and Siahpoosh wind farms (Guillan province)
- TAVANIR Co. commissioned 43 units of 660 kW wind turbines as a 28.3 MW wind farm in Binalood region (Khorasan province).
- SUNIR Co. commissioned four units of 660 kW wind turbines.

By March 2007, SabaNiroo had installed and commissioned ten 300 kW, ten 550 kW, and 22,660 kW wind turbines in Manjil (Guillan Province), 20,660 kW turbines in Binalood (Khorasan Razavi Province) and four 660 kW turbines in Armenia (Pushkin Pass Site).

WIND POTENTIAL

Iran has a good wind energy potential due to its geographic location. In addition to onshore areas, Iran has tremendous off-shore potential in the Persian Gulf. However no projects or research programmes have been initiated to develop Iranian off-shore technology. Given the country's vast potential, progress in research and development activities for identification of suitable areas to exploit these resources has been set as one of the government's objectives.

In order to determine the portion of renewable energy in the total amount of energy and to prepare organised and reliable information for internal investors, a wind atlas covering the whole country will be issued in the first half of 2007. This project is being developed according to international standards. It was started in 2005 in cooperation with SUNA. These projects have made it possible to assess the national wind potential and identify suitable areas for harnessing wind power for commercial use. Total potential for wind power was initially estimated as 30,000 MW.

Morocco

Amogdoul wind farm, Morocco

DEVELOPMENTS IN 2006

In 2006, Morocco nearly doubled its installed wind capacity with 60 MW of new installations, bringing the total up to 124 MW.

The new 60 MW wind farm called "Amogdoul" is situated on Cap Sim, at 15 km in the South of Essaouira city. The site is famous for its strong and regular wind. With a power of 60 MW and an average annual productivity of 200 GWh, the "Amogdoul" wind farm will reinforce of electricity production through wind energy and the interconnection network of the Essaouira region. It consists of 71 generators.

The wind farm was achieved within 18 months. Its realization by the company Gamesa was entrusted following an international call to competition. This project benefited from a financing of the German bank KfW and has been registered under the Clean Development Mechanism (CDM).

On the environmental level, this project will allow a saving of 48,000 tons of fuel. This contributes to a reduction of greenhouse gas emission of 156,000 t of CO_2 per year.

The wind farm also brings economic and social benefits to the area of Essaouira. It is actually part of the integrated development of the city and contributes to reinforcing the city's international renown and its historical and tourist vocation.

THE INITIATIVE 1,000 MW PROGRAMME

The Moroccan government is set to substantially increase the country's wind capacity with a very ambitious target of 1,000 MW by 2012. The Office National de l'Electricité (ONE) launched a strategy for large scale wind energy deployment in order to satisfy the increasing demand for electric power in the country. Following the various studies on the wind prospect in Morocco in particular that of the southern and northern areas which have an high wind potential, the ONE decided to exploit this tremendous wind resource by approving wind farms with a total capacity of 1,000 MW.

This expansive program named "Initiative 1,000 MW", aims to have this capacity up and running by 2012. This will allow for the reinforcement of renewables, the diversification of the national energy resources and ensure security of supply.

The main scope of the programme is to ensure:
– renewable energies in the Moroccan energy context,
– participation of the private sector in the development of the electric energy sector,
– emergence of experienced Moroccan players in the electric energy sector, through a certain number of initiatives, such as the "EnergiPro" initiative, which was launched by the ONE in favour of its major customers.

MOROCCO: TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006
MW	53.9	53.9	53.9	53.9	53.9	63.9	63.9

THE ENERGIPRO INITIATIVE

Through this initiative, ONE offers its big clients to produce electricity from renewable energy source, by transporting the power produced to the point of consumption in its grid and paying them an incentive tariff for the transit.

This initiative includes two components:
– Assuring the transit of all electricity produced through the national high voltage grid
– Guaranteed purchase of the excess electricity produced and not consumed by the producers at an incentive tariff.

FUTURE PROJECTS

WIND FARM IN TARFAYA

This project aims to promote the use of wind energy for satisfying electricity demand in the region and will also feed into the national grid. The site of the project is located 2 km south of Tarfaya, along the coastal highway Tarfaya – Laayoune.

The wind farm will initially be set up with a capacity of 200 MW, with the aim to increase this to 300 MW. It will be equipped with 850 kW wind turbines. Its initiation is planned for 2010. This wind farm will be developed under the Independent Power Production (IPP) framework.

WIND FRAM IN TOUAHAR

The site of this project is located approximately 12 km north-west of Taza. The wind farm will have a capacity of 100 MW, which is estimated to produce 290 GWh of electricity. The project was set up under the Clean Development Mechanism (CDM), in line with the aim to further the development of clean energy and the reduction of greenhouse gas emissions.

13 OTHER IDENTIFIED SITES

- Tiniguir: located 2 km south of Argoub in the Dakhla region.
- Boujdour: located 2 km north of the Boujdour.
- Tarfaya (Tah): located 30 km south of Tarfaya.

Amogdoul wind farm, Morocco

- Laayoune (Tiskrad): located 30 km north Laayoune.
- Laayoune (Foum Al Wadi): located 25 km west of Laayoune.
- Moulay Bouzerktoun: located 30 km north of Essaouira.
- Sendouk: located 16 km north-east of Tangier.
- Nouinouich: located 10 km north-east of Tangier.
- Ferdioua: located 25 km north-east of Tangier.
- Ain Armel: located 10 km west of Ksar Sghir.
- Haouma: located 6 km north-east of Ksar Sghir.
- Fnideq: located 4 km south-west of Fnideq.
- Midelt: located 10 km east of Midelt.

Conclusions: The need for solid political frameworks

This report has shown that wind energy is fast becoming a mainstream energy source in an increasingly globalised 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 21st century. Decision makers around the world are now putting energy policy at the centre of international meetings and initiatives, such as the 15th session of the UN Commission on Sustainable Development (CSD) in May 2007 in New York, the G8 Summit in June in Heiligendamm; climate and energy policy were the subject of a recent debate in the UN Security Council and a General Assembly debate is planned for later in the year. 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. Governments must agree a clear negotiating mandate and timeline for these negotiations at the UNFCCC COP13/MOP3 in Bali, Indonesia, in December 2007.

Setting legally binding targets is crucial as a driving force behind successful political frameworks for wind power and other renewables, as well as for protecting the climate. 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.

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. While the industrialized world must accept its responsibility for moving first on transforming our unsustainable energy system, 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.

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
GLOBAL WIND ENERGY COUNCIL

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 60 countries
- The world's major wind turbine manufacturers
- 99 % of the world's 74,000 MW of installed wind power capacity

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