GLOBAL WIND **2007** REPORT

GWEC

GLOBAL WIND ENERGY COUNCIL

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Foreword

2007 was yet another banner year for the wind industry, with a 27% increase in installed capacity, bringing the global total to more than 94,000 MW. The increasingly mature and global industry installed more than 20,000 MW of clean, emissions free wind energy capacity in the course of the year, representing about € 25 billion (about $US 37 billion) of investment, and by the time this publication is released, the total global capacity will no doubt have passed the 100,000 MW mark.

With the price of oil hovering around $US 100 per barrel, and the price of coal and gas at historically high levels, the advantages of an energy source independent from the vagaries of the international commodities markets has never been clearer. 'Resource depletion' will never be a problem for wind power. We have only just begun to scratch the surface of its potential.

This is good news not only for energy planners seeking to achieve security of supply, but also for politicians and diplomats searching for solutions to the global crisis of human-induced climate change. As governments frantically negotiate a new agreement for the period after 2012, the wind industry stands ready to make a very substantial contribution to solving what most now acknowledge is the greatest long term threat to our civilization.

The wind energy industry is also playing a major role in another kind of boom: regional economic (re)development. From the Texas Panhandle to Inner Mongolia, and from Schleswig-Holstein to Andalucía, the wind industry is building new factories, expanding local tax bases and creating thousand of new 'green collar' jobs at an ever-expanding rate. At the local, regional, and national level as well as globally, wind power is more and more often the answer to questions about our energy future.

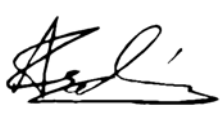
2007 will be remembered as the year when the global community finally started to get to grips with the climate issue. Most notably, the release of the IPCC's 4th Assessment Report put all reasonable doubts to rest about the nature and causes of climate change. The thousands of scientists, reviewers and editors who volunteer their time to make up the Panel were the much deserved recipients of the Nobel Peace Prize, shared with former US vide-President Al Gore for his film 'An Inconvenient Truth'.

One clear 'take home' message from the IPCC report is that regardless of long term targets, if we are going to have any chance of avoiding the worst ravages of climate change, then the one thing we must do is to stop increasing greenhouse gas emissions: they must peak and begin to decline globally *before the end of the next decade*.

While the power sector is far from being the only culprit when it comes to climate change, it is the largest single source of emissions, accounting for about 38% of CO_2 emissions, and about 25% of overall emissions. Our options for making major emissions reductions in the power sector between now and 2020 are basically three: energy efficiency and conservation; fuel switching from coal to gas; and renewable energy, primarily wind power.

As policy makers become more aware of this reality, they appreciate more and more wind power's technological maturity, widespread availability, speed of deployment, and the fact that there is a robust, growing industry becoming more and more global with every passing year. The wind industry is ready, willing and able to fulfill these growing expectations and responsibilities.

This is the third annual report on the status of the global wind industry by the Global Wind Energy Council, and it provides a comprehensive snapshot of this global industry, which is now present in more than 70 countries. The data and country profiles for this report have been collected through GWEC's member associations around the world and additional government and industry contacts. The Council wishes to thank the contributors and is looking forward to an equally fruitful cooperation for future editions.



Arthouros Zervos
Chairman
Global Wind Energy Council

Steve Sawyer
Secretary General
Global Wind Energy Council

The globalisation of the wind industry

The last few years have witnessed a sea change in both the scale and extent of the international wind industry's operations. Individual wind farms have grown in size from a few dozen megawatts capacity up to several hundred. Out at sea, giant wind parks of 1,000 MW capacity or more are now waiting for construction. Successful wind turbine models are pouring out from manufacturing facilities much like other mass produced hardware. And the continued growth in demand for clean, emissions-free wind power has outstripped the available supply, creating a demand for very large investments in manufacturing capacity, long term equipment purchase arrangements and project development.

The structural changes which have accompanied this expansion have concentrated around two key trends. One has been the involvement in the business of companies from outside the traditional wind turbine manufacturing and project development community. The other has been the spread of the wind power market well beyond its core geographical centres of Europe and the United States. Significantly, the two trends have overlapped with each other.

Sottevast wind farm, Manche, France
© Pascal Lecoeur

Increasing involvement of new players in the market is in part a reflection of wind power's success. This is now a business from which it is clearly possible to make a secure and profitable return. In most countries where the technology has been successful there is a structural framework in place which supports renewable energy because of the environmental benefits it brings, especially in the battle against climate change. They also help counter the effects of the massive subsidies over many decades to conventional energy generation. These frameworks have in some cases stood the test of time over a number of years.

An additional factor is the pressure from some national governments to place an obligation on energy producers to source an increasing percentage of their electricity from renewables. This is the case for instance in the United Kingdom, with its Renewables Obligation, and in the United States, with its state by state Renewable Portfolio Standards. At an international level, the European Union has led the way by introducing a legally binding target for 20% of the region's energy to come from renewable sources by 2020.

These twin encouragements have generated a surge of interest in renewable energy, and particularly wind power, from companies whose previous investment portfolio had been mainly concentrated in fossil fuels or nuclear or even outside the energy sector. Most importantly, these newer entrants have both the advantage of the available balance sheet to consider large investments and the incentive to diversify away from increasingly uncertain traditional power sources.

Changing ownership

The result has been a shift in the type of companies developing and owning wind farms - from relatively small independent project developers towards general power generation and supply companies (utilities) and large IPPs (Independent Power Producers), often financed by investment banks. At the same time there has been an important commitment to wind energy from a number of the largest multinational oil companies, most notably Shell and BP. Shell, for example, is a partner in the proposed 1,000 MW London Array offshore wind farm in the UK's Thames Estuary as well as an even larger project in the US state of Texas. According to market analysts Emerging Energy Research, seven of the top ten global owners of operating wind power capacity are now either European utilities or IPPs.

The most prominent example from Europe of utility involvement is the Spanish electricity company Iberdrola, which had previously concentrated on its gas, nuclear and hydro generation businesses. Starting less than ten years ago it began to invest seriously in wind, mainly in Spain using the domestically produced Gamesa turbines.

Last year Iberdrola merged with the Scottish utility Scottish Power, which owned a number of wind farms in the UK as well as the US wind developer PPM Energy. It has since made further US acquisitions. By the end of 2007 the company had reached a total of 7,704 MW of renewable capacity, 7,362 MW of which was wind power. This made it the world leader in wind capacity. Its current target is to increase this at a rate of 2,000 MW a year, reaching 13,600 MW of renewables by the end of the decade.

Other large utilities which have moved into wind in a serious way, by investing in large project development, are Florida Power and Light (FPL) in the United States, the former state power company Energias de Portugal (EdP), Endesa from Spain, DONG from Denmark, Vattenfall from Sweden, Enel from Italy, EdF from France and E.ON and RWE from Germany.

On the manufacturing side, the increase in the size of the market and the requirement for a substantial investment in expanded production facilities has also brought new players on board. The first major example was General Electric, which purchased the Enron Wind business, with assembly plants in both Germany and the US. GE Energy is now the third largest supplier of wind turbines. Three years ago, the giant engineering company Siemens acquired Bonus, one of the original Danish turbine makers. Siemens is currently the most successful supplier of turbines for the offshore market.

Wind park, Germany
© Bundesverbansd WindEnergie e.V.

An indication of how successful these acquisitions have been was the confirmation from General Electric at the beginning of 2008 that it would increase its investment in renewables to $6 billion by 2010. The majority of that is likely to go into wind. This figure represents about a quarter of the corporation's total investment in energy and water assets.

More recently, with the offshore market beginning to seriously take off, the French energy/nuclear company Areva acquired a majority shareholding in Multibrid, a German-based manufacturer developing a 5 MW turbine specifically designed for operating out at sea. Engineering giant Alstom has meanwhile taken over Ecotecnia, the Spanish turbine manufacturer with a long and impressive track record. These moves are seen as significant examples of broader industrial conglomerates wanting to gain a toehold in the attractive wind market.

Another factor which has encouraged the involvement of larger companies is the current shortage of turbines, a result of the global boom in wind power development. Project developers now need to make orders for their turbines in large blocks up to several years in advance, requiring a substantial financial commitment in order to ensure a firm delivery date from the manufacturers. At the same time the manufacturers themselves are having to invest large sums to expand their production facilities so that they can meet the soaring demand.

Greater globalisation

The involvement of these larger players has in turn encouraged a greater globalisation of the industry, although other factors are involved here as well as the simple drive to exploit new markets. In the US, for example, the explosion of the wind power market has been driven by a mixture of attractive state and federal incentives, encouraging the supply of green energy, and the competitiveness of wind compared with increasingly expensive gas. There is also much more space for large projects than in the more crowded European landscape.

Dabancheng wind farm, Dabancheng, Urumqi, Xinjiang
© Greenpeace.

In Asia, on the other hand, the market has been spurred as much by the sheer growth in demand for more electricity to feed new industries as by wind's environmental credentials. Indian businesses are also investing in their own wind generators as a more reliable source of power than the over-stretched and temperamental grid.

As a result, both Asia and the United States have witnessed a recent burst of activity by mainly Europe-based companies to gain a slice of their burgeoning wind markets. In the US this has seen Energias de Portugal acquire the developer Horizon Wind Power and E.ON buy developer Airtricity's North American assets. In Asia the activity has mainly been in the form of joint ventures established by European and US turbine manufacturers with Chinese companies to establish local production facilities. Under its bidding rules for development sites the Chinese government has decreed that 70% of the hardware used in any commercial wind farm built in the country must be sourced from a domestic manufacturer.

Many observers believe that Asia, and China in particular, will be central to the future of the global wind energy market. Not only does China have an insatiable demand for energy, it also has the industrial infrastructure and manpower to create a major powerhouse for turbine production. More than 40 companies are now involved in turbine manufacture. Last year they increased their share to 56% of the almost 3,500 MW of new capacity installed.

Most of the Chinese manufacturers have used European or US technology as the basis for their designs. Goldwind, for instance, the market leader, has relied on German companies REpower and Vensys. Among other foreign companies which have already gained a foothold in the Chinese market are Acciona, Nordex, Vestas, Gamesa, Suzlon and General Electric. But the traffic is beginning to reverse. One Chinese company, MingYang Wind Power Technology, recently signed a deal to supply its turbines to the United States. An agreement with developer GreenHunter means that all the company's initial production of up to 900 MW capacity will cross the Pacific Ocean.

Melanchton wind farm in Shelburne, Ontario
© CanWEA

Mergers and acquisitions

At the same time, wind developers and manufacturers have been expanding their international horizons through a series of mergers and acquisitions. Spanish group Acciona and Italian utility Enel, for example, jointly bought Spanish utility Endesa during 2007, dividing up its wind power assets.

The most dramatic example has been that of Suzlon, the Indian wind turbine manufacturer created in 1994 by Tulsi Tanti, then running a family textile business. After achieving a strong position in the Indian wind market using imported German technology, Suzlon moved abroad, opening new headquarters in Denmark and manufacturing capacity in the US. In 2005 it acquired the Belgian gearbox company Hansen Transmissions, which has about 30% of the wind power market, and last year took over German turbine manufacturer REpower. It is now knocking on the door of the world's top five turbine suppliers.

On the project development side, according to Danish consultants MAKE Consulting, "large IPPs and utilities are aggressively seeking to increase their own portfolios of wind power by acquiring smaller developers. The end result will be seen in a couple of years' time, when the number of companies active in project development will be reduced, as the market is moving towards fewer, but larger, players."

But whilst current trends might point to North America and Asia as the front-runners in the globalisation of wind, other markets are certain to emerge soon. Within Europe, investors are turning to the potential of the new EU member states, especially in Eastern Europe, with Turkey another giant market on Europe's doorstep. In South America, a number of countries are on the verge of take-off, including Brazil and Mexico. Meanwhile, with a new government elected on a mandate to sign up to the Kyoto Protocol, Australia could soon see its massive wind power opportunities finally realised. What is certain is that the changes of the last few years mean that a growing list of large globalised companies are ready, waiting and have the financial muscle to exploit these new markets as soon as the starting gun is fired.

The status of global wind power in 2007

Wild Horse wind farm, Ellensburg, Washington, USA
© Renewable Energy Systems Group

US, China & Spain lead world market

In its best year yet, the global wind industry installed over 20,000 MW in 2007. This development was lead by the US, China and Spain, and it brought the world-wide installed capacity to 94,123 MW. This is an increase of 31% compared with the 2006 market, and represents an overall increase in global installed capacity of about 27%.

"The growth rates we are experiencing in wind energy continue to exceed our most optimistic expectations," said GWEC Secretary General Steve Sawyer. "Globally, wind energy has become a mainstream energy source and an important player in the world's energy markets, and it now contributes to the energy mix in more than 70 countries across the globe.

The top five countries in terms of installed capacity are Germany (22.3 GW), the US (16.8 GW), Spain (15.1 GW), India (8 GW) and China (6.1 GW). In terms of economic value, the global wind market in 2007 was worth about 25bn EUR or 37bn US$ in new generating equipment.

US market continues its boom

The US reported a record 5,244 MW installed in 2007, more than double the 2006 figure, accounting for about 30% of the country's new power-production capacity in 2007. Overall US wind power generating capacity grew by 45% in 2007, with total installed capacity now standing at 16.8 GW.

American wind farms will generate around 48 bn kWh of electricity in 2008, just over 1% of U.S. electricity supply, powering the equivalent of over 4.5 million homes.

In 2007, 34 US states were producing electricity with wind power. The states with the most cumulative installed wind power capacity are: Texas (4,356 MW), California (2,439 MW), Minnesota (1,299 MW), Iowa (1,273 MW) and Washington (1,163 MW).

It is expected that the US will overtake Germany as the leader on wind energy by the end of 2009. AWEA's initial estimates indicate that another 5GW of new wind capacity will be installed in 2008. Developers report that with strong demand for wind power across the country, wind turbines are sold out for the year. However, AWEA projects that with more companies entering the market, more turbines will become available. The pace of growth in 2008 and beyond is expected to largely depend, not on turbine availability, but on the timing and duration of an extension of the federal production tax credit (PTC), which is due to expire at the end of 2008.

"This is the third consecutive year of record-setting growth, establishing wind power as one of the largest sources of new electricity supply for the country," said AWEA Executive Director Randall Swisher. "This remarkable and accelerating growth is driven by strong demand, favorable economics, and a period of welcome relief from the on-again, off-again, boom-and-bust cycle of the federal production tax credit (PTC) for wind power."

"The extension of the production tax credit (PTC) is urgently needed to protect tens of thousands of U.S. manufacturing and construction jobs and create tens of thousands more, and to keep investment flowing into one of the fastest-growing and brightest sectors of our economy: renewable electricity," he adds.

China sees doubling of annual market - again

China added 3,449 MW of wind energy capacity during 2007, representing market growth of 156% over 2006, and now ranks fifth in total installed wind energy capacity with over 6,000 MW at the end of 2007. However, experts estimate that this is just the beginning, and that the real growth in China is yet to come. Based on current growth rates, the Chinese Renewable Energy Industry Association (CREIA) forecasts a capacity of around 50,000 MW by 2015. The regions with the best wind regimes are located mainly along the South-East coast and Inner Mongolia, Xinjiang, Gansu Province's Hexi Corridor and in some parts of North-East China, North-West China, Northern China and the Qinghai-Tibetan Plateau.

The wind manufacturing industry in China is booming. While in the past, imported wind turbines dominated the Chinese market, this is changing rapidly as the growing wind power market and the clear policy direction have encouraged domestic production.

At the end of 2007, they were 40 Chinese manufacturers involved in wind energy, accounting for about 56% of the equipment installed during the year, up from 41% in 2006.

"This percentage is expected to increase substantially in the future. Total domestic manufacturing capacity is now about 5,000 MW, and is expected to reach 10-12 GW by 2010," predicts GWEC President Prof. Arthouros Zervos. Established major Chinese manufacturers are Goldwind, Sinovel Windtec, Windey and Dongfeng Electrical.

While in 2006, only about 400 MW of new capacity was manufactured by Chinese manufacturers, in 2007, the top two Chinese companies (Gold Wind and Sinovel) alone accounted for 1,460 MW of the new installed capacity,representing about 42% of the annual market. This compares to only 37% provided by the top three foreign manufacturers (Gamesa, Vestas and GE).

Druiberg wind farm, Sachsen-Anhalt, Germany
© Energiepark Druiberg

National growth inconsistent in Europe, Spain leading the way

The capacity of new wind turbines brought on line across Europe last year was 8,662 MW. Total wind power capacity installed by the end of 2007 reached 57,135 MW, which will avoid about 90 million tonnes of CO_2 annually and produce 119 TWh in an average wind year. Wind energy is now increasing more than any other power technology in Europe, making up 40% of total new power installations in 2007, according to EWEA.

The big surprise in the European market was Spain with 3,522 MW of new capacity installed in 2007, the highest amount of any European country ever, earning it second place globally after the US. Total installed wind energy capacity now stands at over 15 GW in Spain. There was also sustained growth in France with 888 MW of added capacity to reach 2,454 MW and Italy, with 603 MW added for a total of 2,726 MW. The new Member States performed well and increased installed capacity by 60%, with Poland, the most successful, reaching a total of 276 MW. The Czech Republic installed 63 MW, its best year ever, and Bulgaria 34 MW.

Nevertheless, a handful of markets pulled in the opposite direction, including Germany, whose annual market shrank by 25% compared to 2006. Portugal and the UK also slumped. As a result, the overall annual market growth in Europe in 2007 of 11% was not what the industry had hoped for.

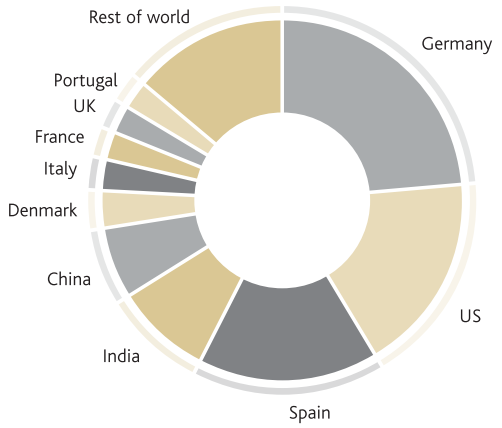
Majority of new installations in 2007 outside of Europe

While Europe remains the leading market for wind energy, new installations represented just 43% of the global total, down from nearly 75% in 2004. For the first time in decades, more than 50% of the annual wind market was outside Europe, and this trend is likely to continue into the future.

While Europe, North America and Asia continue to see the most important additions to their wind energy capacity, the Middle East/North Africa region increased its wind power installations by 42%, reaching 538 MW at the end of 2007. New capacity was added in Egypt, Morocco and Iran.

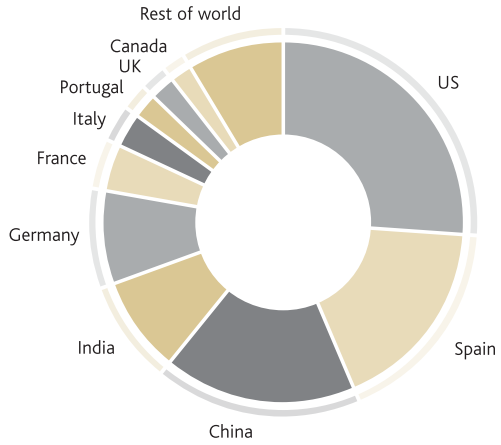
Growth in the Pacific region was led by New Zealand with 151 MW in new capacity, which nearly doubled the country's total installations, reaching 322 MW. While Australia had an exceptionally weak year with only 7 MW of new installations, the change in government at the end of 2007 spurs hopes for a brighter future for wind energy. Within hours of being sworn in to office, the new Labour Prime Minister Kevin Rudd signed the ratification of the Kyoto Protocol, and the new government is now making good on its promise of a target of 20% power production by renewables by 2020. This is likely to have positive long-term impacts for wind energy development on the continent.

TOP 10 TOTAL INSTALLED CAPACITY



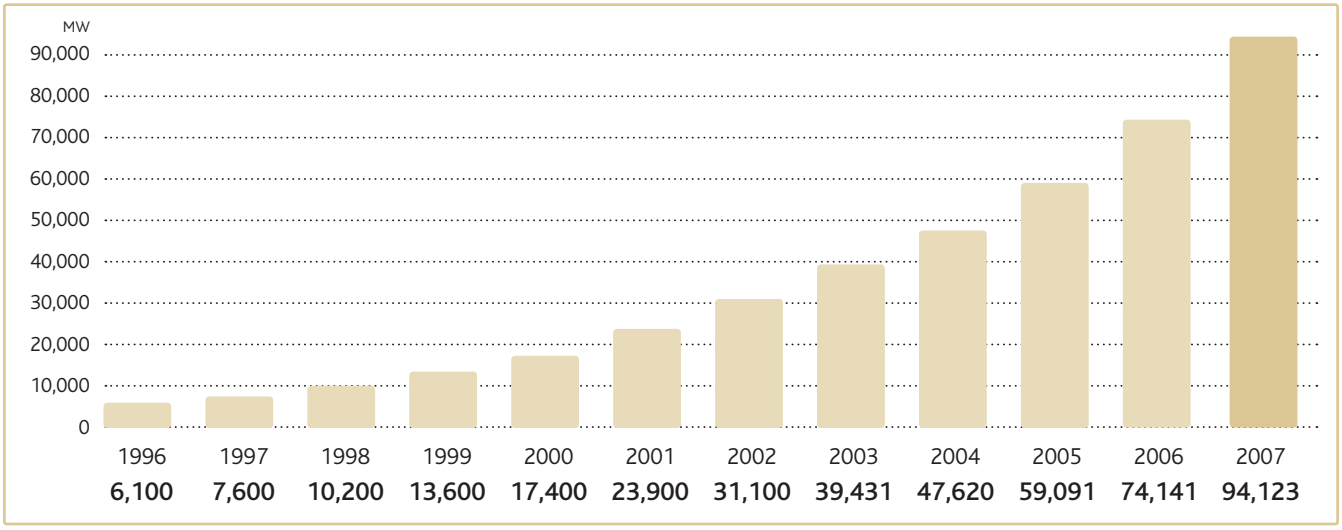
	MW	%
Germany	22,247	23.6
US	16,818	17.9
Spain	15,145	16.1
India	8,000	8.5
China	6,050	6.4
Denmark	3,125	3.3
Italy	2,726	2.9
France	2,454	2.6
UK	2,389	2.5
Portugal	2,150	2.3
Rest of world	13,019	13.8
Total top 10	**81,104**	**86.2**
Total	**94,123**	**100.0**

TOP 10 NEW CAPACITY

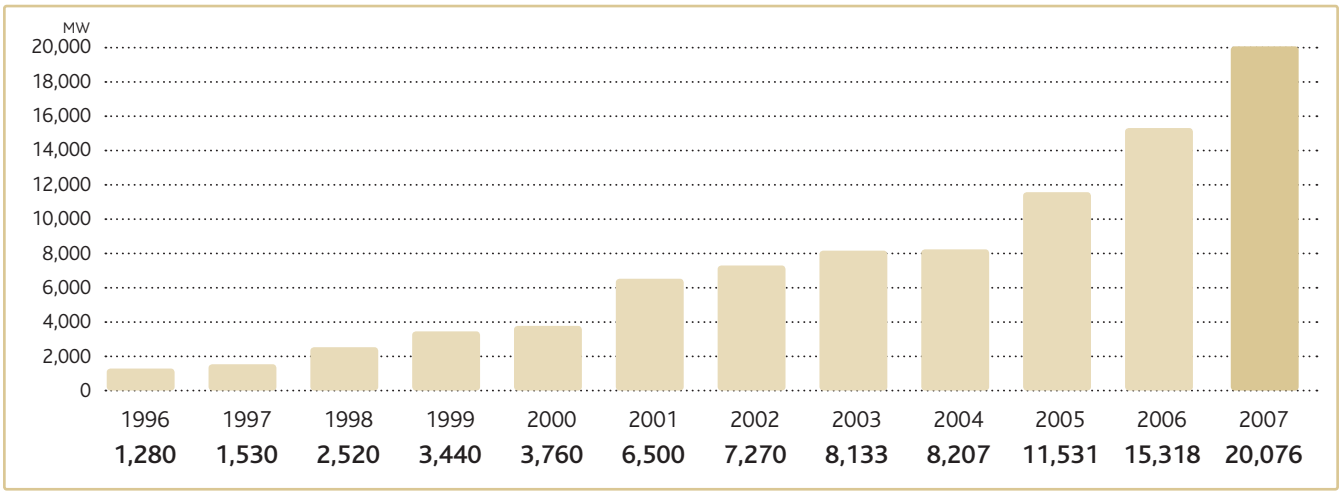


	MW	%
US	5,244	26.1
Spain	3,522	17.5
China	3,449	17.2
India	1,730	8.6
Germany	1,667	8.3
France	888	4.4
Italy	603	3.0
Portugal	434	2.2
UK	427	2.1
Canada	386	1.9
Rest of world	1,726	8.6
Total top 10	**18,350**	**91.4**
Total	**20,076**	**100.0**

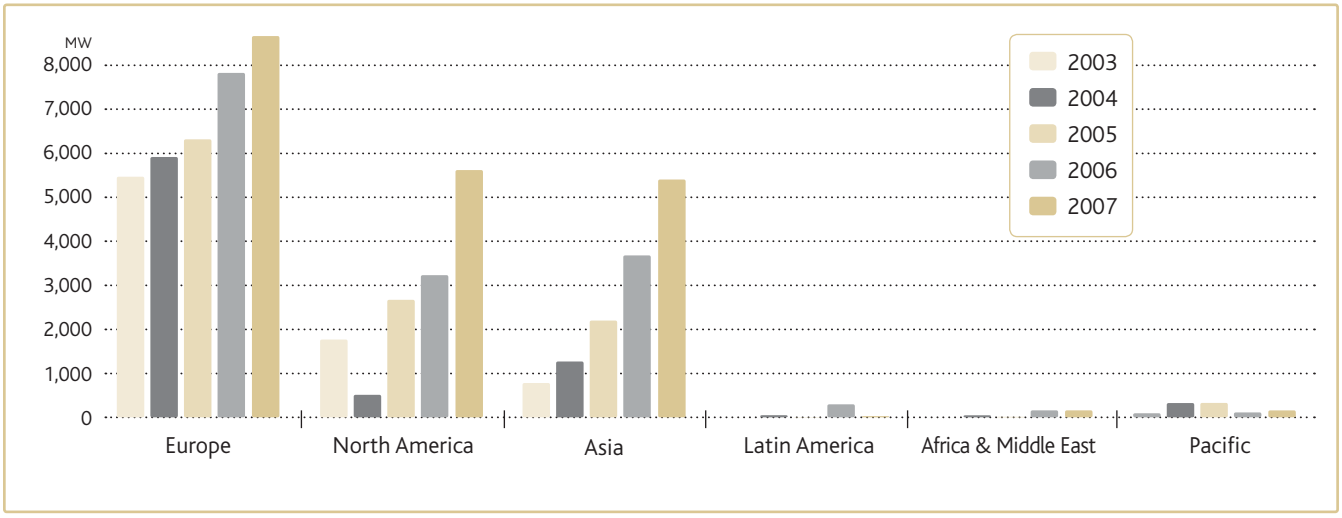
GLOBAL CUMULATIVE INSTALLED CAPACITY 1996-2007



GLOBAL ANNUAL INSTALLED CAPACITY 1996-2007



ANNUAL INSTALLED CAPACITY BY REGION 2003-2007



GLOBAL INSTALLED WIND POWER CAPACITY (MW) – REGIONAL DISTRIBUTION

		Revised end 2006	New 2007	Total end 2007
AFRICA & MIDDLE EAST	Egypt	230	80	310
	Morocco	64	60	124
	Iran	48	19	67
	Tunisia	20	0	20
	Other [1]	16	1	17
	Total	**378**	**160**	**538**
ASIA	India	6,270	1,730 *	8,000 *
	China	2,604	3,449 *	6,050 *
	Japan	1,394	139	1,538
	Taiwan	188	100	282
	South Korea	173	18	191
	Philippines	25	0	25
	Other [2]	5	0	5
	Total	**10,659**	**5,436**	**16,091**
EUROPE	Germany	20,622	1,667	22,247
	Spain	11,623	3,522	15,145
	Denmark	3,136	3	3,125
	Italy	2,123	603	2,726
	France	1,567	888	2,454
	UK	1,962	427	2,389
	Portugal	1,716	434	2,150
	Netherlands	1,558	210	1,746
	Austria	965	20	982
	Greece	746	125	871
	Ireland	746	59	805
	Sweden	571	217	788
	Norway	325	8	333
	Belgium	194	93	287
	Poland	153	123	276
	Rest of Europe [3]	556	263	812
	Total Europe	**48,563**	**8,662**	**57,136**
	of which EU-27 [4]	*48,069*	*8,554*	*56,535*
LATIN AMERICA & CARIBBEAN	Brazil	237	10	247
	Mexico	87	0	87
	Costa Rica	74	0	74
	Caribbean (w/o Jamaica)	35	0	35
	Argentina	27	2	29
	Colombia	20	0	20
	Jamaica	20	0	20
	Chile	2	18	20
	Cuba	5	0	5
	Total	**507**	**30**	**537**
NORTH AMERICA	USA	11,575	5,244	16,818
	Canada	1,460	386	1,846
	Total	**13,035**	**5,630**	**18,664**
PACIFIC REGION	Australia	817	7	824
	New Zealand	171	151	322
	Pacific Islands	12	0	12
	Total	**1,000**	**158**	**1,158**
	World total	**74,141**	**20,076**	**94,123**

Source: GWEC

1 Cape Verde, Israel, Jordan, Nigeria, South Africa;
2 Bangladesh, Indonesia, Sri Lanka;
3 Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Faroe Islands, Finland, Hungary, Iceland, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Norway, Romania, Russia, Slovakia, Slovenia, Switzerland, Ukraine;
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, UK;

Please note: project decommissioning of 93 MW and rounding affect the final sums

*These numbers are provisional and are awaiting final confirmation.

Market forecast for 2008-2012

Fujian Dongshan Wujiao Wan wind farm, Dongshan, Fujian, China
© Greenpeace

GWEC is predicting the global wind market to grow by over 155% from its current size to reach 240 GW of total installed capacity by the year 2012. This would represent an addition of 146 GW in 5 years, equaling an investment of over 180bn EUR (277 bn US$, both in 2007 value). The electricity produced by wind energy will reach over 500 TWh in 2012 (up from 200 TWh in 2007), accounting for around 3% of global electricity production (up from just over 1% in 2007).

The main areas of growth during this period will be North America and Asia, and more specifically the US and China.

This forecast exceeds previous estimates by GWEC, and the total installed capacity for 2010 has been corrected upwards to reach 171.9 GW (from 149.5 GW). These figures also lie above GWEC's most ambitious scenario as outlined in the Global Wind Energy Outlook in 2006, which forecast a total global installed capacity of 221 GW in 2012, i.e. 19.3 GW below the current estimate.

The reasons for this adjustment are twofold: Firstly, both the US and the Chinese market have been growing and will continue to grow at a much faster rate than expected even a year ago. Secondly, the emergence of significant manufacturing capacity in China will have a more important impact on the growth of the global markets than originally thought. While tight production capacity is going to remain the main limiting factor of further market growth, machines 'made in China' will help take some of the strain out of the current supply situation.

Tauern wind park Oberzeiring
© Vestas

The average growth rates during this five year period in terms of total installed capacity are expected to be 20.6%, compared with 23.4% during 2003-2007. In 2012, Europe will continue to host the largest wind energy capacity, with the total reaching 102 GW, followed by Asia with 66 GW and North America with 61.3 GW.

The additions in installed capacity every year are predicted to grow from 20 GW in 2007 to 36.1 MW in 2012, with an average growth rate of 12.4%. Considering that annual markets have been increasing by an average of 24.7% over the last 5 year, growth could be much stronger also in the future, were it not for continuing supply chain difficulties which considerably limit the growth of annual markets for the next two years. This problem should be overcome by 2010, and along with the development of the offshore market, growth rates are expected to recover in the next decade.

Asia is predicted to overtake Europe as the biggest annual market, with as much as 12.5 GW of new wind generating capacity installed during the year 2012, up from 5.4 GW in 2007. This growth will be mainly led by China, which has since 2004 doubled its total capacity every year, thereby consistently exceeding even the most optimistic predictions.

By 2010, China is expected to be the biggest national annual market globally. This development is underpinned by a rapidly growing number of domestic manufacturers operating in the Chinese market, delivering home made turbines to large scale wind energy projects. Already in 2007, 40 domestic suppliers supplied 56% of the new installations in the domestic market, up from 41% in 2006.

While China will emerge as the continental leader in Asia, sustained growth is also foreseen in India, while other markets such as Japan, South Korea and Taiwan will also contribute to the development of wind energy on the continent.

The European market will by 2012 have fallen to third place in terms of annual installations (10.3 GW), behind North America (10.5 GW). Overall, this means that over 71% of new installations will occur outside of Europe in 2012, up from 28% in 2004 and 57% in 2007. While in terms of total installed capacity, Europe will continue to be the biggest regional market, its share will have fallen to 42.4%.

The large scale development of offshore wind energy is further delayed and will only start to have a significant impact on European market growth towards the end of the time period under consideration. However, it is expected that offshore development will lend new momentum to growth in Europe during the next decade.

In Europe, Germany and Spain will remain the leading markets, but their relative weight will decrease as a larger number of national markets emerge on the scene. While the spectacular growth of the Spanish market in 2007 with over 3.5 GW of new installations will not be sustained, a stable pace of 2-2.5 GW per year on average can be expected, enabling Spain to reach the government's 2010 target of 20 GW. The size of the German annual market will continue to decrease, but it will remain the second strongest European

market for the 2008-2012 period, and the biggest in terms of total installed capacity. By 2010, offshore developments will give new impetus to the German market, resulting in stronger growth. Other important markets in Europe will be France and the United Kingdom, each increasing by an average of 1 GW per year.

The North American market will grow even stronger than previously thought, led by significant growth in the US, as well as sustained development of the Canadian market. In total, North America will see an addition of 42.6 GW in the next five years, reaching 61.3 GW of total capacity in 2012. This represents an average of 8.5 GW of new capacity added every year, the bulk of which will be in the US.

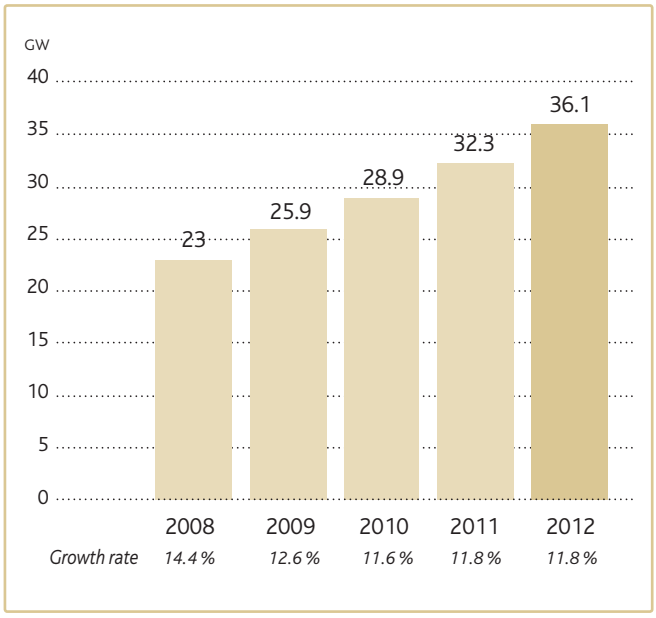
These figures assume that the US Production Tax Credit (PTC) will continue to be renewed in time for the current strong growth to continue. Moreover, high level engagement of an increasing number of US states, 24 of which have already introduced Renewable Portfolio Standards, will also assure sustained growth. A change in US administration may further underpin this development.

Latin America is expected to contribute to the global total in a more substantial way in the future, mainly driven by Brazil, Mexico and Chile. By 2012, the total installed capacity in Latin America and the Caribbean will increase 8-fold to reach 4.5 GW, with an annual market of 1.4 GW. However, despite its tremendous potential, Latin America is likely to remain a small market until the end of the period under consideration, progressing towards more significant development in the next decade.

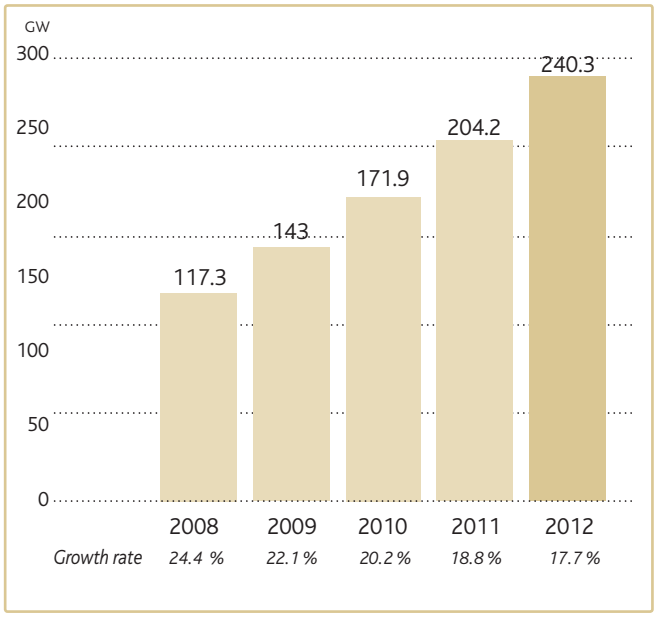
The Pacific region will see around 2.3 GW of new installations in 2008-2012, bringing the total up to 3.5 GW. While in Australia, wind energy development slowed down considerably in 2006 and 2007, the outlook for the future is more optimistic, mainly thanks to the change in federal government at the end of 2007, the ratification of the Kyoto Protocol and the pledge to implement a new target for 20% of electricity to come from renewables by 2020. New Zealand, however, got new impetus with 151 MW of new installations, and many more projects are at various stages of development.

Africa and the Middle East will remain the region with the smallest wind energy development, with a total installed capacity of 3 GW by 2012, up from 500 MW in 2007. However, it is expected that market growth will pick up in the coming five years, with annual additions reaching around 800 MW by 2012. This development will be driven by Egypt and Morocco, with some development also predicted in other North African and Middle Eastern countries.

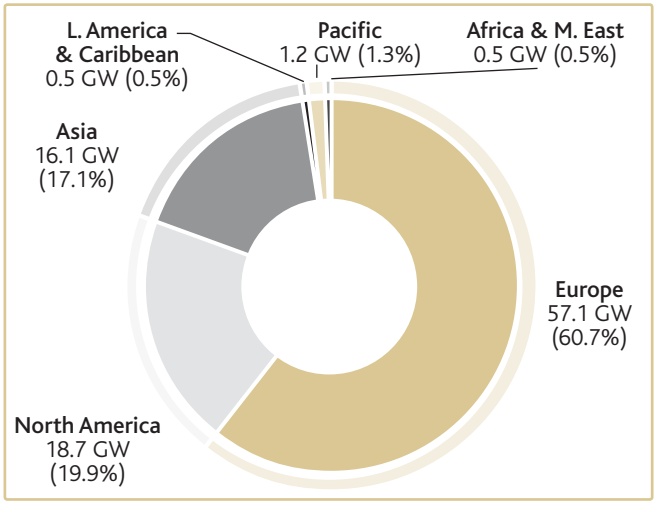
ANNUAL INSTALLED CAPACITY 2008 - 2012



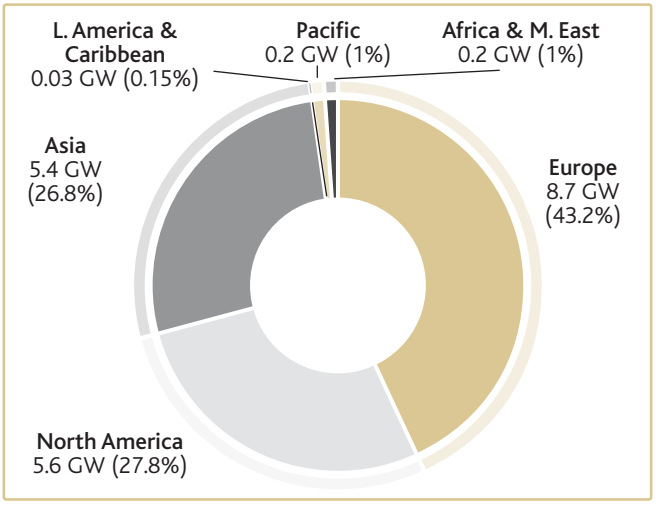
CUMULATIVE CAPACITY 2008 - 2012



CUMULATIVE CAPACITY END 2007



ANNUAL CAPACITY IN 2007



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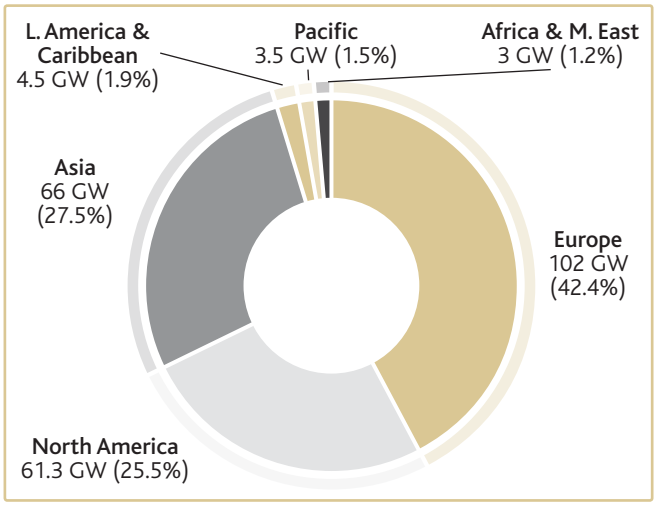
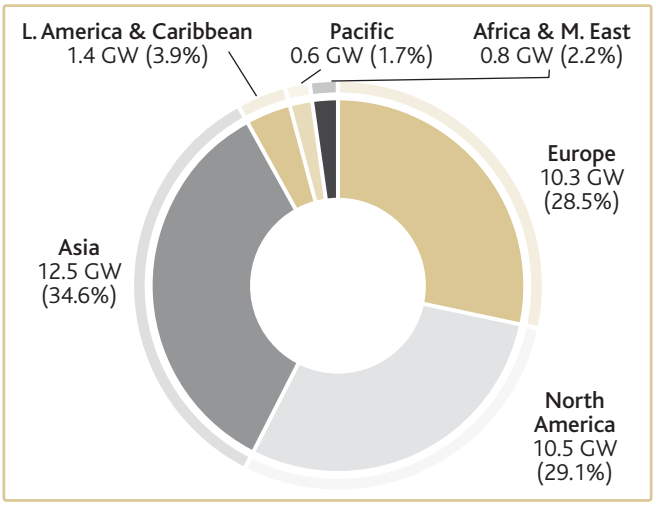
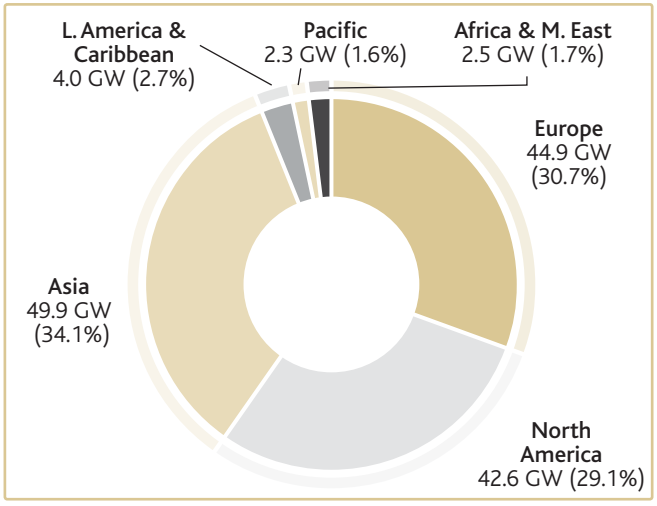


ANNUAL CAPACITY IN 2012

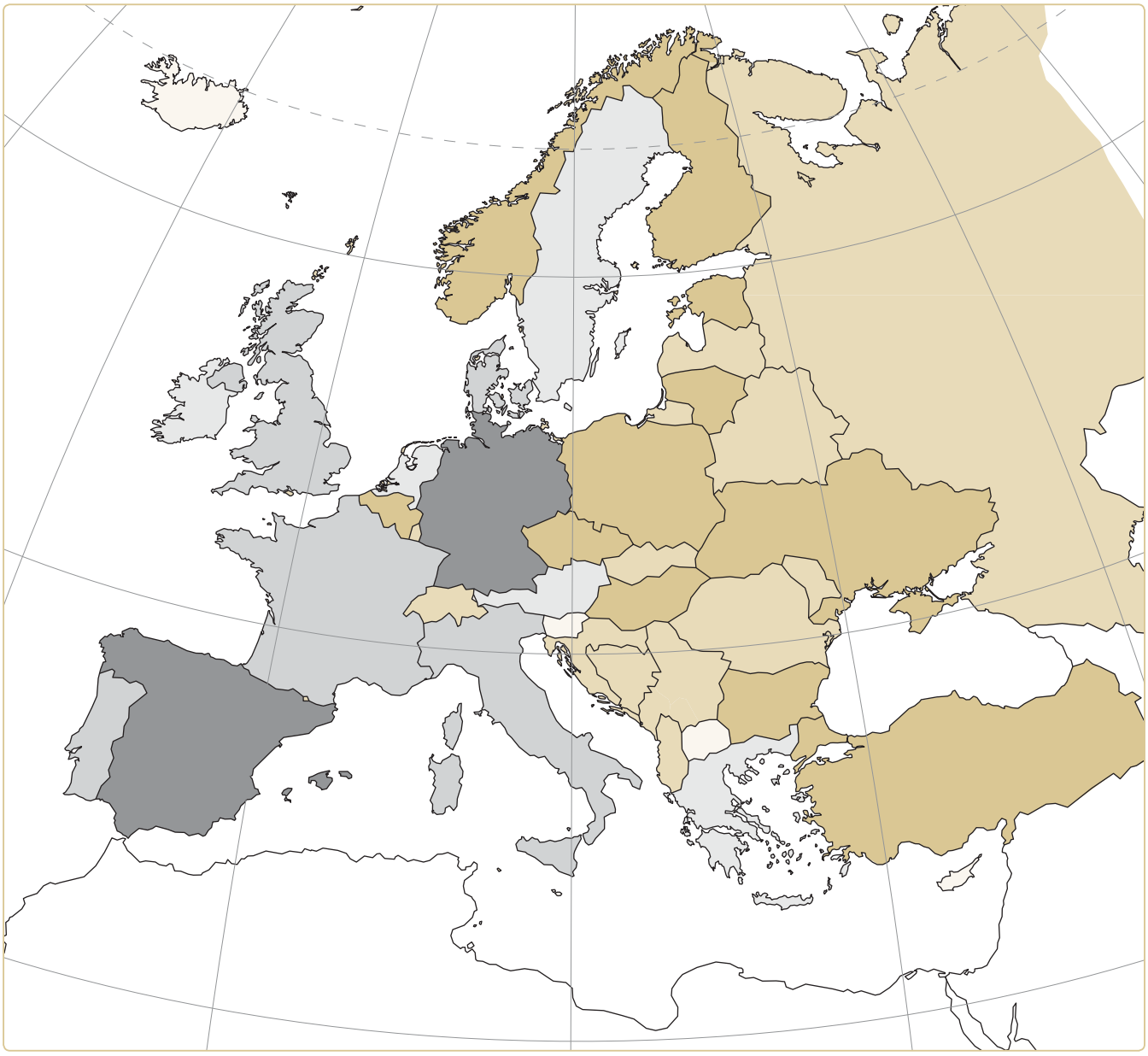


NEW INSTALLED CAPACITY 2008-2012



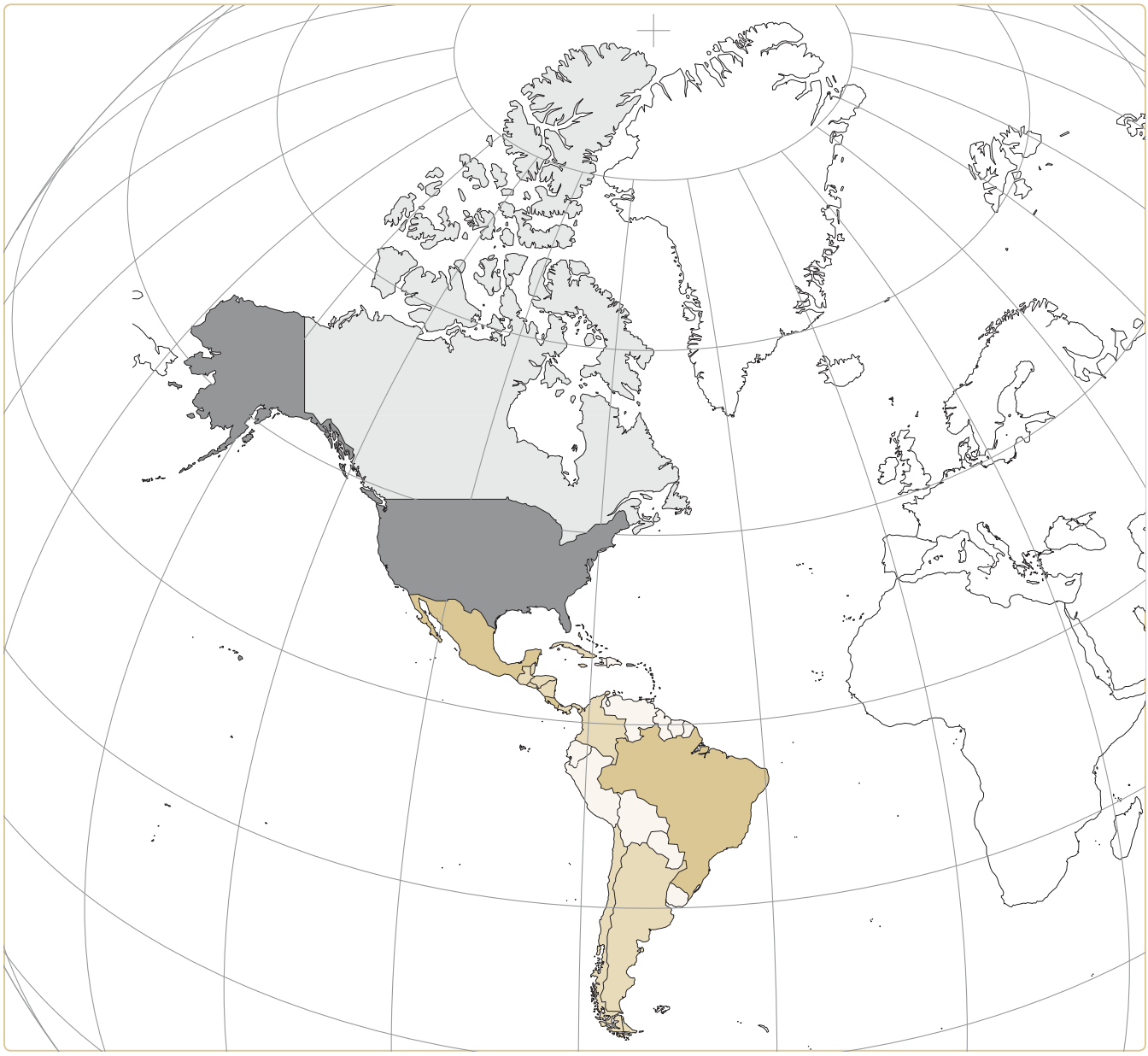
Installed capacity by region

Europe



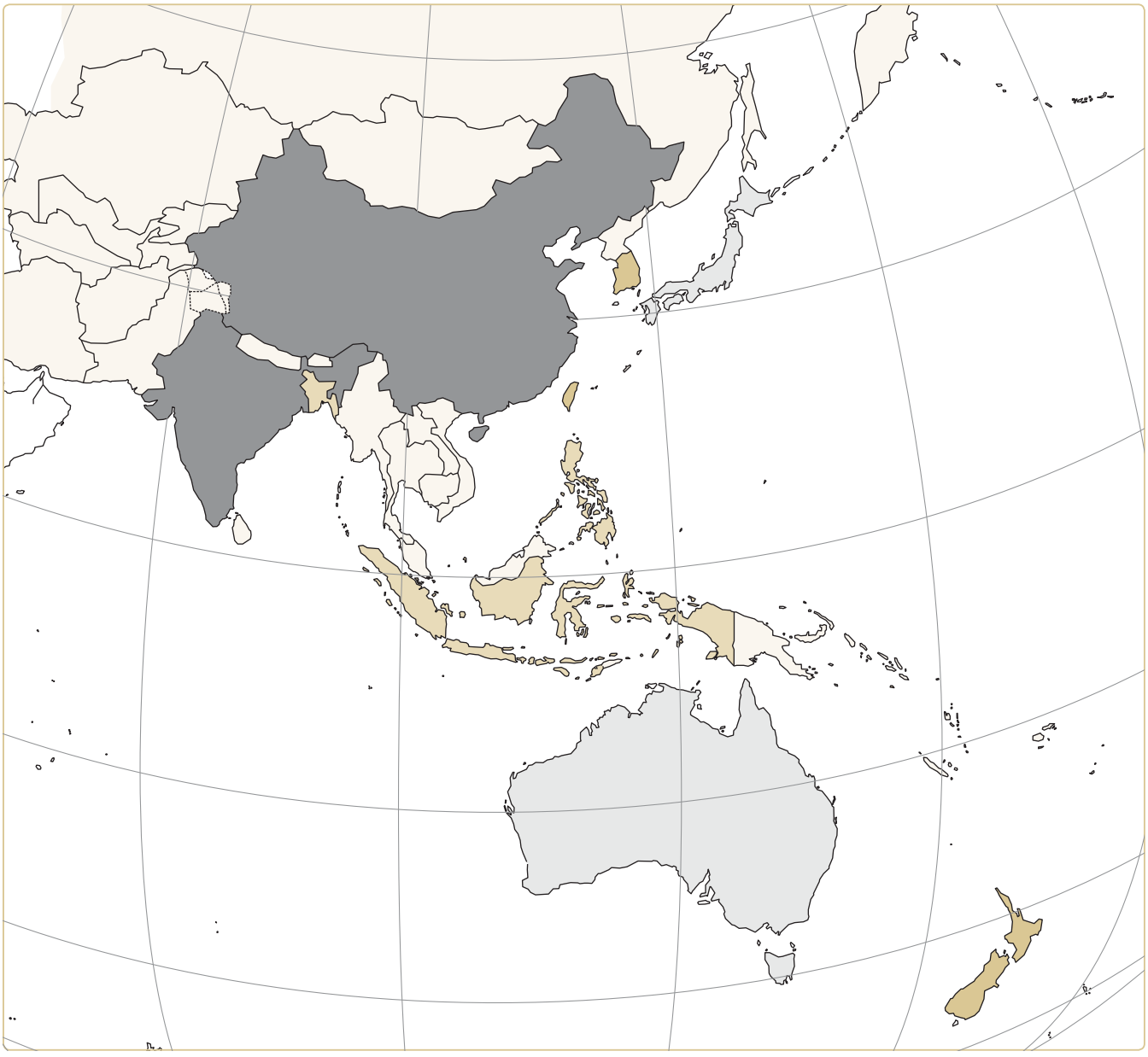
>5,000 MW
2,000 - 5,000 MW
500 - 2,000 MW
50 - 500 MW
<49 MW
0 MW

North America, Latin America & Caribbean

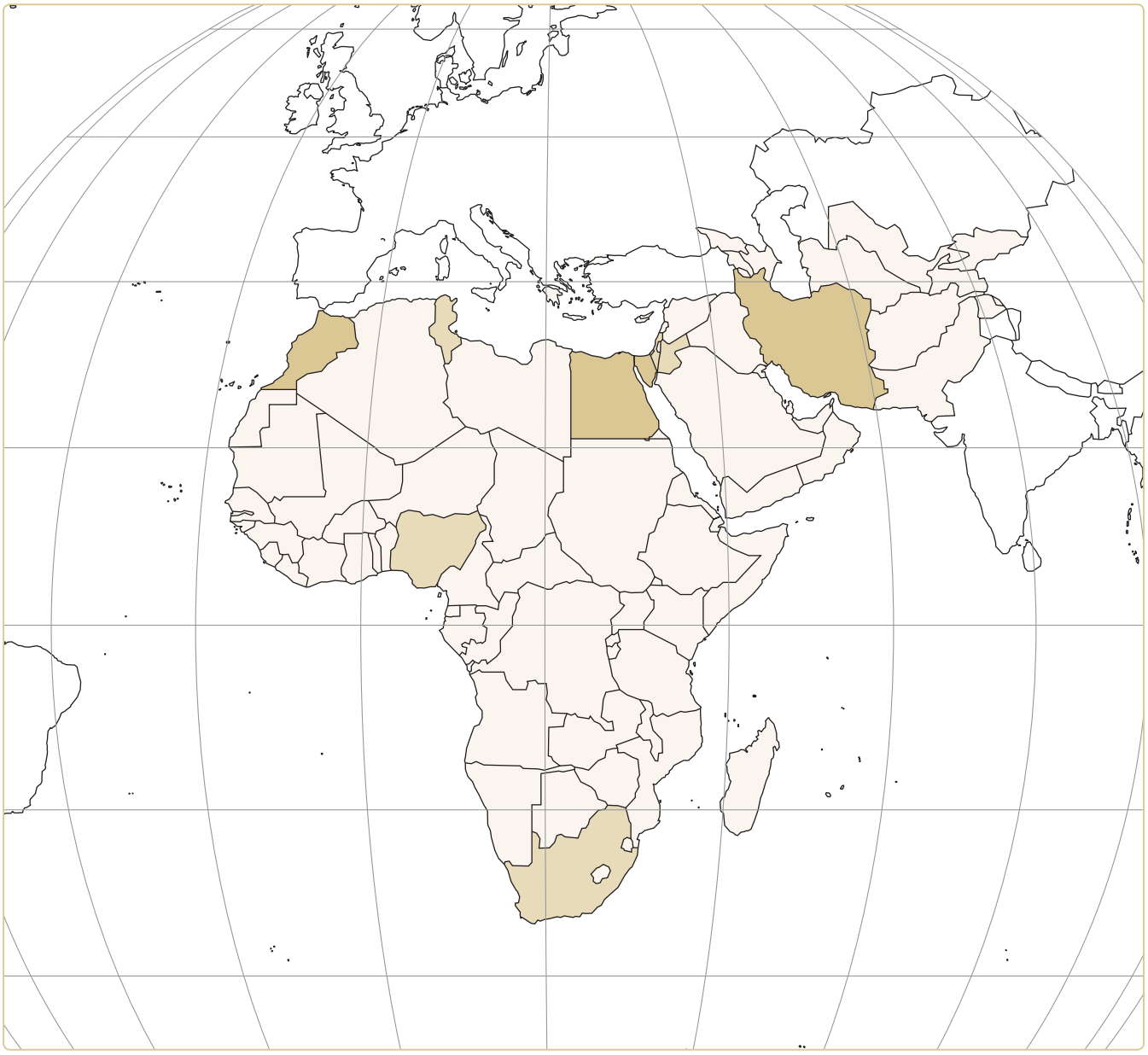


>5,000 MW
2,000 - 5,000 MW
500 - 2,000 MW
50 - 500 MW
<49 MW
0 MW

Asia & Pacific Region



Africa & Middle East



>5,000 MW
2,000 - 5,000 MW
500 - 2,000 MW
50 - 500 MW
<49 MW
0 MW

Country reports

Australia

With some of the world's best wind resources, Australia is a prime market for wind energy. The growing industry can take advantage of a stable, growing economy, good access to grid infrastructure and well organised financial and legal services. A change in government in late 2007 signalled a major shift for climate change policy – placing the Australian wind industry in a strong position with a very positive outlook for growth in 2008 and beyond.

Cathedral Rocks wind farm, South Australia
© Roaring 40s

The policy environment

2007 was a watershed year in terms of Australia's approach to climate change policy that will result in positive long-term impacts for the wind industry.

Bipartisan acceptance of the need for strong supportive policies for technology deployment, not just research and development programs, is a major shift in the policy landscape and will drive deployment in the near term to ensure the lowest cost in the long-term to meet emissions targets.

Despite little movement in federal policy for most of 2007 – particularly in relation to extending the national Mandatory Renewable Energy Target (MRET) – momentum to support renewable energy deployment was building at the state and territory level. By August 2007, the states of Victoria, New South Wales, Queensland, Western Australia and the Australian Capital Territory were all at various stages of implementing state-based mandatory renewable energy deployment schemes.

There were initial fears that the previous Liberal Government would move to wind-up technology deployment policies such as MRET and attempt to abolish state schemes, including the Victorian Renewable Energy Target. However, in September they surprised many by announcing that rather than scrapping all renewable energy deployment schemes they would consolidate all schemes into a national Clean Energy Target scheme of 15% of electricity coming from 'low emissions technologies'.

However, the overwhelming breakthrough of the year for the Australian wind industry came during the election campaign when the Labor Party, now the new government, met one of the key asks of the Clean Energy Council – committing to an expanded national target of 20% of electricity coming from renewable energy by 2020. The new renewable energy target will underpin a strong and consistent growth in renewable energy projects over the coming decade.

Bipartisan support for a domestic emissions trading system emerged in 2007, with both major parties going into the federal election pledging to implement a domestic emissions trading program. The Labour Party had also announced its commitment to a long term emissions reduction target of 60% (compared with year 2000 levels) by 2050 as part of their campaign. These policies will gradually begin to level the playing field between wind and other renewable energy and coal power, which holds a 77 per cent share of Australia's electricity generation.

2007 also saw the amalgamation of the Australian Wind Energy Association (Auswind) and the Australian Business Council for Sustainable Energy to form the Clean Energy Council - a single powerful industry voice for the clean energy sector in Australia.

It is expected that 2008 is going to be an exciting and challenging year. The Clean Energy Council is focussing on ensuring that the details of the RE support scheme deliver investment certainty to wind and clean energy developers. Key issues include: the build-up of electricity retailer liabilities (i.e. the amount of renewable energy each retailer must buy and surrender under the scheme); project eligibility (i.e. which

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007
MW	32	73	105	198	380	708	817	824

projects are eligible to be accredited under the scheme); and how intentions and interests of the various states which had planned their own schemes might be accommodated.

Manufacturing – Heading for recovery

Manufacturing in Australia saw a dramatic turn around at year's end in what was a slow year for new Australian projects. Vestas' closure of their Victorian blade factory came on the heels of their nacelle plant closure in Tasmania during 2006. However by the end of the year the market saw a much improved outlook with the anticipation of increased renewable energy targets and the start of Victorian electricity retailers' renewable energy liabilities. Australia experienced only limited delays due to international supply bottle-necks.

Current industry growth

The total operating wind capacity at the end of 2007 was 824MW. While there were only three new project commitments during 2007 - amounting to $440 million Euros of investment - the 2008 outlook is rosier as a result of the growing political and public support. Significant wind capacity is moving through the project planning stage – with over 400MW of projects receiving planning approval during 2007.

Nine projects (over 860MW) were commissioned although not yet operating as at December 2007; including three new projects totalling 290MW of capacity.

To fulfil the demand created by the incoming government's renewable energy policies, around 10,000MW of new renewable energy projects will be built over the next decade. The wind industry is poised to play a major role in meeting this demand.

Among the projects which are currently commissioned are: Snowtown (TrustPower; 88MW), Hallett (AGL; 95 MW), Hallett Hill (AGL; 71MW), Mt. Millar (Transfield Services Infrastructure Fund; 70MW) and Lake Bonney Stage 2 (Babcock & Brown Wind Partners; 159 MW) projects in South Australia; Waubra (Acciona Energy; 192MW) and Cape Bridgewater (Pacific Hydro; 71MW) projects in Victoria; and Capital Wind Farm (Babcock & Brown Wind Partners; 132MW) in New South Wales. Each of these is expected to be commissioned during 2008 except for Hallett Hill and Capital.

Grid connection issues

The increasing penetration of wind energy in the National Electricity Market (NEM) has identified the need for better forecasting of wind energy production. Under a federal government grant, NEMMCO (the market and system operator for the NEM) has contracted an international consortium to develop a sophisticated forecasting model. This will be implemented in mid 2008 and allow better management of the grid with the higher levels of wind generation expected.

Community and landscape issues

The Australian wind energy industry focused a great deal of attention on managing and improving community consultation processes. The Clean Energy Council launched Certified Wind Farms Australia (CWFA), which aims to promote the sensitive and responsible uptake of wind energy in Australia by ensuring that the development and operation of wind farm projects is consistent with best practice standards.

The CWFA scheme is based on the Auswind Best Practice Guidelines. It provides participating organisations access to a suite of environmental and stakeholder management resources that will be continually improved throughout the life of the scheme. It also includes an auditable framework for managing the environmental, stakeholder consultation and amenity aspects (visual impact, noise, shadow flicker, glint etc) of wind farms.

With input from the Clean Energy Council, Australia.

Brazil

The power generation mix in Brazil consists of 84% 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, 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 about 143,500 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.

Between 1999 and 2005, wind energy capacity in Brazil increased only in very small increments, until in 2006, when 208 MW were installed in one year, bringing the total to 237 MW. In 2007, only one wind farm of 10.2 MW came online: Eólica Millennium, a project acquired by Pacific Hydro from local company Bioenergy. The total now stands at 247 MW.

The main obstacles to Brazilian wind power are significant import duties and taxes making projects less profitable, unless complete local production and sourcing are established. Also, the country has prioritised the development of its biomass potential in the past few years. Wind power, however, is expected to grow substantially in the near future.

The PROINFA programme

Due to the high dependency on Brazil's large but already mostly exploited hydro resources, the country faced a power shortage in 2001. In order to remedy the situation and avoid more severe power crises in the future, the 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, wind and small hydro power generation. This law was revised in November 2003.

Mucuripe wind farm, Ceará
© A WOBBEN WINDPOWER Ind. e Com. Ltda

In the first stage (up to 2008), the programme guaranteed power sale contracts of 3,300 MW of projects using these technologies. The Brazilian state-controlled electricity utility Eletrobrás will buy power produced by RES under power purchase agreements (PPAs) of 20 years at pre-set preferential prices.

As some projects under construction at the present stage may not reach the PROINFA time limit of 2008, Eletrobrás is considering the possibility of extending the deadline to June 2009.

The incremental costs of the RES power will be passed on to the end-use consumers. 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 2.6bn USD.

TOTAL INSTALLED CAPACITY

year	2002	2003	2004	2005	2006	2007
MW	22	29	29	29	237	247

Originally, a second stage of PROINFA was foreseen once the 3,300 MW objective had been met, with the aim to increase the share of the three renewable sources to 10% of annual electricity consumption within 20 years. Renewable energy generators would then have been required to issue a number of Renewable Energy Certificates proportional to the amount of clean energy produced.

However, 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. As a result, the current government is showing little interest in taking PROINFA to its second stage, and is considering replacing it with an auction system. The Brazilian Wind Power Association (ABEEolica) is lobbying to proceed with PROINFA II while at the same time introducing an auction process.

Predictions for 2008 are quite optimistic: there are 14 wind energy plants under construction financed by the PROINFA programme, amounting to 107.3 MW of installed capacity. In addition, experts estimate that another 27 wind farms representing 901.29 MW could be added to the grid in 2009, provided that PROINFA is extended until the first semester of 2009.

Key players in the Brazilian market

In 2008, 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 of Rio Grande do Sul, Rio Grande do Norte and Ceará. SIIF Energies do Brasil intends to install 928 MW of wind energy by 2010.

There are also a number of foreign groups looking for project development opportunities as well as acquisition of developed projects. Fortuny intends to install 223 MW of wind energy in the south by 2011. Enercon is the largest supplier of wind generators in Brazil, while Suzlon entered the market in 2007, signing two large contracts for a total of 350 MW (for 'nationalisation' requirements, tower and other components will be bought from Brazilian factories). Argentinean Impsa has also started building a factory in Pernambuco to produce Vensys turbines, and is planning to manufacture its own machines in the future.

Financing is typically done via the National Economic & Social Development Bank (BNDES), the Development Agency of the Northeast (ADENE) and the Bank of the Northeast (BNB), all of which focus on ethical and environmentally 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).

More than 5,000 MW of wind energy projects have already been registered with Brazilian Electricity Regulatory Agency (ANEEL), awaiting approval for supply contracts with utilities in order to move forward with planning and construction. These projects are non-PROINFA, but they are being developed in the anticipation of an auctions scheme, despite the fact that the conditions of this scheme are as yet unknown.

WIND FARMS IN BRAZIL

	Wind Park	Rated Power (MW)
1	Eólica de Prainha	10
2	Eólica de Taíba	5
3	Eólica-Elétrica Experimental do Morro do Camelinho	1
4	Eólio - Elétrica de Palmas	2.5
5	Eólica de Fernando de Noronha	0.225
6	Mucuripe	2.4
7	Rio do Fogo	49.3
8	Eólica de Bom Jardim	0.6
9	Eólica Olinda	0.225
10	Parque Eólico do Horizonte	4.8
11	Macau	1.8
12	Eólica Água Doce	9
13	Parque Eólico de Osório	50
14	Parque Eólico Sangradouro	50
15	Parque Eólico dos Índios	50
16	Eólica Millennium	10.2
	Total	**247.10**

With input from AEEolica and Greenpeace Brazil.

Canada

Canada's wind energy market experienced its second best year ever in 2007. A total of 386 MW of new wind energy capacity was installed in 2007, increasing Canada's total by 26%. Canada now has 1,846 MW of installed wind energy capacity.

2007 Projects

Ten wind energy projects were commissioned in 2007 in five different Canadian provinces.

- Alberta led all provinces in 2007, installing three new projects totaling 139 MW. Alberta is now Canada's leading jurisdiction for wind energy with 524 MW.
- The largest wind energy project commissioned in Canada in 2007 was the 100.5 MW Anse-a-Valleau project in Quebec, the second project to be commissioned from Hydro-Quebec's earlier 1,000 MW request for proposals.
- Two new projects, totaling 77.6 MW were commissioned in Ontario. These two projects brought Ontario's total installed capacity to 491 MW.
- Three smaller projects, totaling 59 MW, were installed in Canada's smallest province, Prince Edward Island (P.E.I.). The installation of these facilities means that P.E.I. has now met its target to produce wind energy equivalent to 15% of its total electricity demand three years ahead of schedule.
- One new 10 MW project was commissioned in Nova Scotia.

Turbines for these projects were provided by three manufacturers: Enercon (169 MW), Vestas (116.4 MW) and GE (100.5 MW).

Future Growth Prospects

Canada enters 2008 with signed contracts in place for the installation of an additional 2,800 MW of wind energy, most of which is to be installed by 2010.

In addition, several new competitive tendering processes for wind energy were launched in 2007 in Manitoba, Quebec, New Brunswick and Nova Scotia and in early 2008, this is expected to lead to the signing of an additional 2,800 MW of contracts for new wind energy development in Canada.

Melanchton wind farm in Shelburne, Ontario
© CanWEA

In 2008, Ontario is planning to issue a call for another 500 MW of renewable energy (most of which is likely to be supplied by wind), Quebec will issue calls for another 500 MW of wind energy and British Columbia will issue a major new call for clean power.

Moreover, the removal of the 900 MW threshold on wind energy development in Alberta in late 2007, accompanied by new investments in transmission resources, is likely to stimulate significant new wind energy investment in that province.

Finally, several of Canada's provincial governments (e.g., Saskatchewan, Manitoba, Ontario) have made commitments to significant additional future procurements of wind / renewable energy, although these will take place after 2008.

If all of Canada's provincial governments / utilities meet their stated targets for wind / renewable energy development, it is anticipated that Canada will have a minimum of 12,000 MW of installed wind energy capacity by 2016.

12,000 MW of installed wind energy capacity would produce around 31,200 GWh, enough to meet about 4% of total Canadian electricity demand in 2016. However, the new wind energy facilities constructed in Canada between 2005 and 2015 would produce enough electricity to meet 21% of Canada's projected increase in electricity demand over that period.

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007
MW	137	198	236	322	444	684	1,460	1,846

Canada's Policy Framework

Canada's federal and provincial governments have both developed policy frameworks to support the deployment of wind energy in Canada. The Federal Government's ecoEnergy Renewable Power Program provides a production incentive of 1 cent / kWh for the first 10 years of production at a wind energy facility.

Provincially, most governments have either legislated renewable portfolio standards, or simply directed government owned utilities to meet wind / renewable energy targets. Procurement to meet these targets is usually conducted through a competitive tendering (request for proposals process), although Ontario has implemented a Standard Offer Contract (i.e. feed-in tariff) program for projects of 10 MW or less and similar programs are under consideration in other provinces. The only exception is Alberta, where a deregulated market means that wind developers must build plants on a merchant basis.

It also appears likely that wind energy projects will be able to create greenhouse gas emission offsets within both Federal and Albertan greenhouse gas emission regulatory frameworks that are to be put in place in 2008, providing an opportunity for wind energy projects to obtain some value for their environmental attributes in a domestic carbon market.

Emerging Challenges

While the prospects for wind energy in Canada are extremely positive, the industry does face a number of challenges that must be addressed if Canada is to maximize the economic and environmental benefits of its massive wind energy potential.

On the policy front, the federal ecoEnergy Renewable Power Program is likely to have fully allocated its funds in 2009 and it is not yet clear what form future federal support will take. At the same time, several provinces have now procured enough wind energy to meet their initial wind / renewable energy targets and subsequent targets still need to be established. Permitting and approval processes can still be made more efficient and streamlined, particularly at the municipal level.

The availability of transmission capacity is also an emerging issue. There are already some areas of Canada where wind developers must await the completion of major transmission upgrades before work can proceed. More generally, Canada expects to make significant investments in new transmission over the next decade, but it remains to be determined how much of this will be designed to facilitate both access to wind resources and greater wind integration.

While public opposition to wind energy projects is still an issue with respect to a minority of projects in Canada, 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.

With input from the Canadian Wind Energy Association (CanWea)

Mount Copper wind farm in Murdochville, Quebec
© 3Ci and Creststreet Asset Management Ltd

Chile

At the end of 2007, the first wind park was connected to the main grid system in Chile, adding 18.2 MW of power generating capacity. There is another small wind park in the far south of the country. Since May 2006, another six projects totalling 257 MW are being evaluated by the environmental authorities. The construction of three of them has already been approved and the rest are waiting for an answer.

Canela wind farm
©EndesaEco

Renewable energy policies in Chile

President Bachelet has committed her government to a target for 15% of new power capacity to come from new renewable energy between 2006 and 2010.

The previous government already eliminated some of the barriers to renewable energy in 2004 and 2005:

- the right to provide renewable energy to distributors who supply small consumers;
- the obligation of the distribution operators to allow the connection of small power stations to their networks;
- the elimination of the obligation to pay dispatching costs to the system operator;
- priority access to the grid without a specific generation requirement;
- the partial exemption from transmission costs; this exemption applies only if small generators of renewable energy do not exceed 5% of the total demand of small consumers, who are regulated separately. A distinction is also made between power stations smaller than 9 MW that have the full exemption and power stations smaller than 20 MW that can claim partial exemption.

These changes in legislation have encouraged the study of several wind power stations, supported by a fund established by the government, which provides support of up to 150,000 dollars per project. To speed up the development of new renewable energy projects, the government introduced a new modification of the law governing electricity at the beginning of 2007.

This law, which is currently still being discussed, obliges the big power companies to purchase 5% renewable energy by the end of 2010 until the year 2035; this percentage obligation will increase gradually, by 0,5% each year, until it reaches 10%.

Failure to fulfil this requirement will invoke a fine of about 30 USD for each MWh that was not purchased each year. These fines will be turned over to the consumers who buy power from companies that did fulfil the requirement.

Barriers to wind energy development

These legal modifications are insufficient support to promoters and investors in new renewable energy, as this law does not incorporate mechanisms for fixing or supporting tariffs, which would increase certainty for investors. Furthermore the new renewables generators have the same obligations in their supply contracts as a big thermal or hydroelectric power stations; they have to pay the transmission costs which are highly variable but can be very substantial, and are obliged to assume the costs of grid connection.

Another barrier to the development of wind energy is the lack of good publicly available resource mapping. Most measurements have been done on a commercial basis and are therefore not available for public planning purposes. The government is looking to do resource assessment in those areas that have been identified as suitable: the coastal zones of the regions of Atacama, Coquimbo and Maule. Other areas

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007
MW	0	2	2	2	2	2	2	20

with potential include Calama and the high plateau zones in the region of Antofagasta, and around the headlands along the entire coast of the north and central zones.

The real trigger for new wind projects in Chile is the current energy crisis because of gas supply disruptions from Argentina, which has caused acute shortages for long periods. In addition, 2007 was a very dry year, with a notable decrease in spring runoff, which is a major contributor to the flow in most Chilean rivers.

This crisis, which foreshadows energy rationing for 2008, has caused an abrupt change in the energy supply of the country. Up until 2006, 75% of the electricity generated was based on hydro resources and natural gas. This was reduced to 50% in 2007, when it was largely replaced by diesel generators (22% of the total). The skyrocketing of the price of energy was inevitable, reaching 140 USD per MWh in November of 2007, practically double the price established by the authorities in April of 2007.

Existing wind parks in Chile

Parque Alto Baguales. Operated by PSEG Energy Holdings and located in the extreme south of the country in the region of Aysén. With its 2 MW of power it has been supplying the city of Coyhaique since 2001. They are planning to increase the capacity of this project in 2008 by installing an additional 1.98 MW.

Alto Baguales wind farm, Aysen
© Alejandro Medina B

Parque Eólico Canela. Operated by Endesa and located in the region of Coquimbo, this station was connected to the grid in November 2007. With an investment of USD 35 million, its capacity is 18.15 MW, and will avoid about 30,000 tons of $C0_2$ in an average year. The second phase of the park will add an additional 70 MW and will be operational in 2009, after an investment of USD 120 million.

Future outlook

257 MW of wind projects are under consideration by the environmental authorities, including projects proposed by Acciona, GHF mbH, Eólica Navarra, Barrick Gold, SeaWind and SN Power. In addition, there are other projects under development, including by: Iberdrola (150 MW), BHP Billiton with Pacific Hydro (100 MW) and Ecopower (140 MW).

These projects are competing with new conventional supply projects that have been presented to environmental authorities, including: diesel (21 new projects with a capacity of 1,626 MW); coal (11 projects with a total of 5,515 MW); and hydroelectricity (11 projects with a total of 1.286 MW). This is in addition to the large dam project in Aysén being developed by Endesa/Colbún, which is expected to deliver an additional 2800 MW.

All of this is happening in a system with a total of 13,000 MW of installed capacity, where part of the recently installed gas generation capacity needs to be replaced, and there is a need for 700 MW of new power capacity annually to cover the increasing demand.

Chile doesn't have a local wind industry and it doesn't have any national experience in the development of this industry. However, the current changes are opening up new possibilities. Wind energy, small hydro and geothermal energy can add to the diversity of the electricity supply network, which is one of the objectives of the government. This will require the cooperation of government and society in the establishment of a long term energy development plan, rather than just reacting to short term market forces.

With input from Cooperativa Potencia Verde

China

The world's fastest growing wind energy market

China is the world's fastest growing wind energy market, with an average annual growth rate of 56% in the past seven years. The country has now reached the fifth place for installed wind energy capacity, with over 6 GW at the end of 2007. However, experts estimate that this is just the beginning, and that the real growth in China is yet to come. Based on the current growth rates, the Chinese Renewable Energy Industry Association (CREIA) forecasts a capacity of around 50 GW by 2015.

With its large land mass and long coastline, China is exceptionally rich in wind energy potential. In 2007, national research showed that the on-shore technically feasible wind resource in China is around 1,000 GW. In addition to that, the off-shore potential is estimated at around 300 GW. The regions with the best wind regimes are located mainly along the South-East coast and Inner Mongolia, Xinjiang, Gansu Province's Hexi Corridor and in some parts of North-East China, North-West China, Northern China and the Qinghai-Tibetan Plateau.

The first Chinese wind farm went online in 1986 as a demonstration project, followed by further projects financed by foreign grants or soft loans. In 1994, the former Ministry of Electric Power took the decision to develop wind energy as a new clean power source for the country. Regulations were issued to address issues of grid connection and payment mechanisms.

The main drivers for wind energy

Satisfying rocketing electricity demand and reducing air pollution are the main driving forces behind the development of wind energy in China. However, given the country's substantial coal resources and the still relatively low cost of coal-fired generation, cost reduction of wind power is a crucial issue, which is being addressed through the development of large scale projects and boosting local manufacturing of wind turbines.

The Chinese government estimates that the localisation of wind turbine manufacturing brings benefits to the local economy and helps keep costs down. Moreover, since most good wind sites are located in remote and poorer rural areas, wind farm construction benefits the local economy through the annual income tax paid to county governments, which represents a significant proportion of their budget. Other benefits include grid extension for rural electrification as well as employment in wind farm construction and maintenance.

Fujian Dongshan Wujiao Wan wind farm, Dongshan, Fujian
© Greenpeace

The growth of the domestic industry

The wind manufacturing industry in China is booming. While in the past, imported wind turbines dominated the Chinese market, this is changing rapidly as the growing wind power market and the clear policy direction have encouraged domestic production.

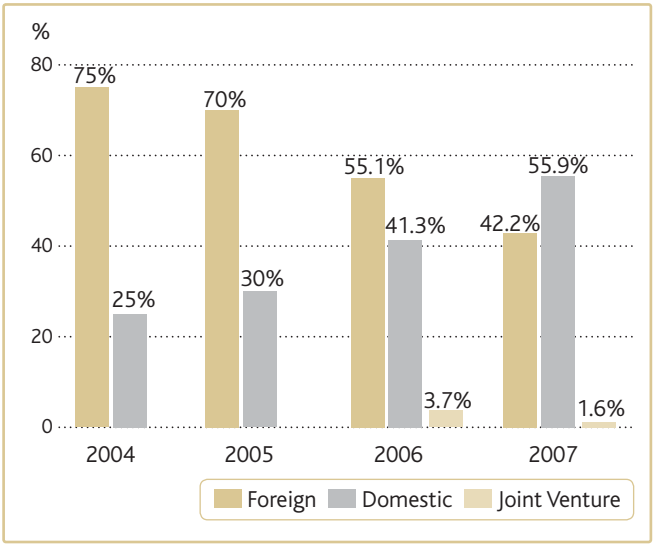
TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007*
MW	**346**	**402**	**469**	**567**	**764**	**1,260**	**2,604**	**6,050**

*This number is provisional and is awaiting final confirmation.

At the end of 2007, they were 40 Chinese manufacturers involved in wind energy, accounting for about 56% of the equipment installed during the year, up from 41% in 2006. This percentage is expected to increase substantially in the future.

ANNUAL INSTALLED CAPACITY 2008 - 2012



Source: 2007 China Wind Power Report (Li Junfeng, Gao Hu); CREIA

While in 2006, around 400 MW of new installations were manufactured in China, in 2007, the top two Chinese manufacturers (Gold Wind and Sinovel) alone accounted for 1,460 MW of the new installed capacity, which represented about 42% of the annual market. This compares to only 37% provided by the top three foreign manufacturers (Gamesa, Vestas and GE).

Total domestic manufacturing capacity has now approached 5,000 MW, and is expected to reach 10-12 GW by 2010 with 50% (about 6 GW) of the capacity coming from the big domestic manufacturers including Sinovel Windtec, Goldwind and Dongfeng Electrical Machinery. Joint ventures in the Chinese market include Nantong CASC Wanyuan Wind Acciona Wind Turbine Manufacture, REpower North, Nordex (Yinchuan) and Hunan Hara XEMC Windpower. Foreign companies operating in China include GE, Gamesa, Vestas and Suzlon.

Policy support for wind energy

In order to promote the development of renewable energy technologies, the Chinese government published its Renewable Energy Law in February 2005, and it entered into force on 1 January 2006. This law was complemented by two regulations defining the pricing and cost sharing of renewable energy power and promoting renewable power grid connection. While the law set a target for renewable energy development in China, the regulations introduced a bidding procedure to determine the price, which then has to be approved by the government. The additional cost of renewable energy for power and the grid connection cost are shared by all electricity users.

In September 2007, the National Plan for Renewable Energy Development was issued. The Plan set out the national target and a mandated market share (MMS) system for the development of renewable energy. This plan officially confirms the target to increase the share of renewable energy in the country's total primary energy consumption to 10% by 2010, and to 15% by 2020. Moreover, it aims to have 5GW of grid-connected wind capacity installed by 2010 (although this figure was already exceeded in 2007), and to have about thirty 100 MW-scale wind farms established, mainly in the eastern coastal areas and "Sanbei Region" ("Three Norths Region"), thus building up three 1 GW-scale wind farm bases in Jiangsu, Hebei, and Inner Mongolia, respectively. In addition, one or two 100 MW-scale pilot offshore wind projects will be set up.

The plan also confirmed the target to reach 30 GW of installed wind capacity by 2020. Rich wind energy resources in provinces such as Guangdong, Fujian, Jiangsu, Shandong, Hebei, Inner Mongolia, Liaoning, and Jilin, will be exploited in adjacent swaths, thus establishing a backbone of major wind provinces, each with over 2 GW of capacity installed. Six wind farm bases (Dabancheng in Xinjiang, Yumen in Gansu, the eastern coastal area around Jiangsu and Shanghai,

Huitengxile in Inner Mongolia, the Zhangbei Region of Hebei, and Baicheng in Jilin) will be developed each with a GW-level installed capacity. In addition, 1 GW offshore wind capacity will be installed.

In December 2007, a White Paper Council on energy conditions and policies by the Office of the State did not, as expected, emphasise coal as the main energy source for the country, but focused on energy diversification, environmental protection and clean energy.

Concession projects

Encouraging large scale commercial development of the domestic wind power industry is a priority for the Chinese government, and wind power projects larger than 50 MW are approved by the national government through the National Development and Reform Commission (NDRC). The NDRC evaluates submissions according to the price per kWh of power produced and the share of domestic components used.

Jieyuan Yumen wind farm, Yumen, Gansu
© Greenpeace

The main elements for wind power concession projects are:

- Each project should be 100MW and the turbines no smaller than 600kW.
- 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.
- The difference between the wind power price and the conventional power price is shared among the provincial grids.
- 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.

In 2003-2006, four rounds of wind concession tendering programmes have been conducted and by the end of 2006, fifteen projects were approved, accounting for 2.55GW of wind energy capacity. All the projects have started construction, but only 25% of them have been completed. Full completion should be achieved by 2009. A further 3,000 MW have been approved by the local wind bidding procedures based on the same principles as the wind concession programme.

The aim of the concession scheme has been to encourage a reduction in the price of wind power within China's reformed electricity industry. As a result, the tariffs offered by winning concessions have been extremely low, causing the bidders to either overestimate the power output of their project or underestimate the costs involved. It is significant to note that successful bidders have been predominantly Chinese state-run companies prepared to sacrifice the short-term profitability of their projects. For international market entrants, however, this provided little incentive for further investment.

To remedy this situation, changes were made to the concession bidding process in the 5th round of tendering in 2007 with the aim to discourage bidders from using an unreasonably low price for their bid. The weight of the bidding price is 25% and those bidders with the bidding price closest to the average bidding price score the highest.

Another major adjustment relates to the specific regulation for wind power equipment manufacturers. As a supplier joining the bidding, one manufacturer can sign supply contracts for a single type of wind turbine with up to three developers. In the first four rounds, a supplier contract had to be exclusively with one developer. This adjustment means that developers have more choice of turbines, thereby improving the technical quality of the project plan.

Meanwhile, some adjustment has been made to the bidding papers according to the changes of national policies and relevant technical regulations and different requirements of the bidders. At this point in time it is difficult to evaluate the 5th round of bidding since the results have not yet been published. However, the adjustments are promising in terms of optimising the wind power pricing mechanism.

The 5th round of concession projects called for a total capacity of about 2,700 MW, including six wind farms of 300 MW, three of 200 MW and two of 150 MW.

Future Prospects

According to the list of approved projects and those under construction, 5,000 MW of new wind capacity could be installed in 2008. Based on the "learning curve" theory of cost reduction, this volume could bring the cost of wind power down closer to that of coal, especially in the current climate of rising coal prices.

The government target of installing 5 GW of wind power by 2010 was already exceeded in 2007, and the 2020 target of 30 GW is also likely to be exceeded well ahead of time. 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.

Major areas for wind energy development in China in the next 5 to 10 years are poised to be Inner Mongolia, Jiangsu, Hebei and Jilin.

CDM contributions for wind

Since 2005, 90% of the non-concession wind projects in China have applied for registration under the Kyoto Protocol's Clean Development Mechanism (CDM). About 54 Chinese wind energy projects (with a total capacity of 2,750.8 MW) are registered at the CDM Executive Board to date, and 149 projects have received approval of the Government of China. The price ranges from 9 to11 Euros per ton of CERs. In total, as of 1 March 2008, there were 171 projects totaling 8,990 MW in the 'CDM pipeline'.

Additional funding generated through CERs could further stimulated the development of wind power in China, and the international carbon market will continue to provide additional incentives for the Chinese wind market, both in terms of financing and technology.

WIND CDM PROJECTS (AS OF 1 MARCH 2008)

Country	Projects	MW
India	168	3569
China	171	8990
Mexico	10	1172
South Korea	9	253
Brazil	7	436
Dominican Republic	3	173
Philippines	2	73
Morocco	2	70
Cyprus	2	44
Egypt	1	120
Panama	1	81
Mongolia	1	50
Jamaïca	1	21
Costa Rica	1	20
Colombia	1	20
Israel	1	12
Argentina	1	11
Chile	1	19
Ecuador	1	2
Total	**384**	**15133**

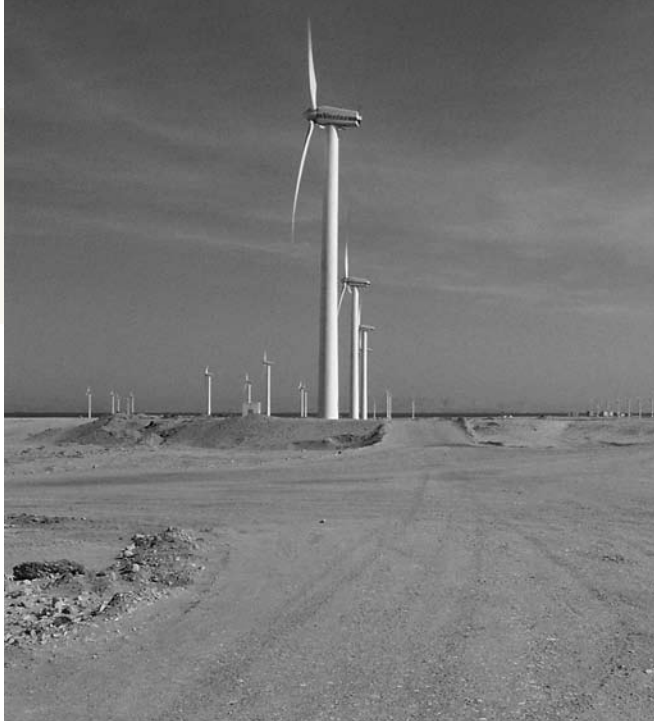
Source: http://www.cdmpipeline.org/cdm-projects-type.htm

With input from the Chinese Renewable Energy Association (CREIA).

Egypt

Egypt enjoys an excellent wind regime, particularly in the Suez Gulf, where average wind speeds reach over 10 m/sec. A detailed wind atlas which was issued in cooperation with Risø National Laboratory, concludes that the region can host about 20,000 MW of wind farms.

The Egyptian wind energy market increased from just 5 MW in 2001 to 310 MW at the end of 2007, and 80 MW of new capacity were added in 2007 to the Zafarana wind farm. Over 3,000 MW are earmarked for wind power developments in the near future on the Gulf of Suez coast.



Zafarana wind farm, Gulf of Suez
© NREA

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 power production 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.

Renewable energy policies: 20% by 2020

In April 2007, the Supreme Council of Energy in Egypt announced an ambitious plan to generate 20% of the country's electricity from renewable sources by 2020, including a 12% contribution from wind energy, translating into 7,200 MW of grid-connected wind farms. This plan will provide investor security and stimulate private investment in wind energy.

Moreover, a new draft energy act has recently been submitted to the Egyptian parliament to encourage renewable energy deployment and private sector involvement. In addition to guaranteeing third party access, power generation from renewable energy would enjoy priority grid access under this law.

Zafarana wind farm, Gulf of Suez
© NREA

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007
MW	5	5	68	98	145	145	230	310

The proposed polices to foster increasing wind power contribution to the Egyptian electricity mix consist of two phases:

During **Phase 1**, tenders will be issued requesting the private sector to supply power from wind energy. The guarantee of a long term power purchase agreement will reduce the investors' financial risk. The documents relating to the tender for the Competitive Bids are presently under preparation in cooperation with the World Bank.

Phase 2 will see the implementation of a feed-in-tariff taking into consideration the prices achieved in phase 1.

NREA has taken the decision to further support the wind energy business by providing resource assessment, necessary data for feasibility studies and technical support for potential project developers. Besides the already earmarked areas, work is underway to earmark other promising areas; these areas will be also available for future wind projects carried out by the private sector.

Zafarana wind farm, Gulf of Suez
© NREA

Wind energy projects in Egypt

Hurghada 5.2 MW wind farm
The first commercial wind farm of 42 turbines of different technologies (2 blades, 3 blades, tubular & rigid towers) has been operational since 1993 as part of the national grid. About 40% of the wind farm components were locally manufactured, including towers, blades, cables and transformers.

Zafarana 305 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 first site at Zafarana were earmarked for NREA's wind projects, showing institutional support and governmental commitment to the wind energy programme. Overall, 305 MW have been installed in stages: 63 MW in 2001 and 77 MW in 2003/2004 in cooperation with Denmark and Germany; 85 MW in July 2006 in cooperation with Spain; 80 MW in cooperation with Germany was operational in December 2007. Presently, a further 240 MW extension of the wind farm is under implementation.

The electricity production from the Zafarana farm is about 636 GWh at an average capacity factor of 40.6%, saving about 146,000 toe and abating emissions of about 350,000 tons of CO_2 in 2007.

Gulf of El-Zayt
Recently, an area of 656 km^2 has been earmarked to host a 3,000 MW wind farm at Gulf of El-Zayt on the Gulf of Suez coast. Studies are being conducted to assess the site potential to host large scale grid connected wind farms: 200 MW in cooperation with Germany, 220 MW in cooperation with Japan and 400 MW as a private sector project.

With input from the New & Renewable Energy Authority (NREA), Egypt

European Union

The world's leading market

The EU has historically been and continues to be the world's strongest market for wind energy development, with over 8.5 GW of new installed capacity in 2007. Industry statistics compiled by the European Wind Energy Association (EWEA) show that cumulative wind capacity increased by 18% to reach a level of 56,535 MW, up from 48,069 MW at the end of 2006.

In the EU, wind power continues to be one of the most popular electricity generating technologies. Since 2000, the installed wind capacity has increased almost six-fold from 9.7 GW to 56.5 GW. The total new power generating capacity installed in the EU in this period was158,000 MW, out of which 88,000 MW was new gas and 47,000 MW was new wind installations. Wind thus represents 30% of the new generation installations over this eight-year period. According to figures from Platts PowerVision and EWEA, in 2007, wind power installations made up 40% of total new power installations, representing the fastest growing power-generating technology in Europe.

Over the last ten years, cumulative wind power capacity in the EU increased by an average of 28 % per year. In terms of annual installations, the European market grew by an average 21 % per year over the same period.

In 2007, the total capacity of new wind turbines brought on line across the European Union was 8,554 MW, an increase of 935 MW on the 2006 total. Total wind power capacity installed by the end of 2007 will avoid about 90 million tonnes of CO_2 annually and produce 119 Terawatt hours in an average wind year, equal to 3.7% of EU power demand. In 2000, less than 0.9% of EU electricity demand was met by wind power. 8,554 MW of new wind power capacity also represents a wind turbine manufacturing turnover of some € 11 billion.

The 2007 capacity increase was driven by Spain which represented more than 40% of the total new installations. Indeed, Spain set a new record in 2007, installing 3,522 MW – the highest amount for any European country in any year ever. 10% of Spain's electricity now comes from wind. There was also sustained growth in France, which added 888 MW to reach 2,454 MW, and Italy, with an addition of 603 MW for a total of 2,726 MW. The EU's new Member States performed well and increased installed capacity by 60%, with Poland leading the way and reaching a total of 276 MW. The Czech Republic installed 63 MW, its best year ever, and Bulgaria 34 MW.

San'Agata wind farm (FG), Apulia, Italy
© Vestas

Nevertheless, a handful of markets did not grow as expected, including Germany, Portugal and the UK. As a result, the overall market growth in 2007 of 12% in the EU was not as striking as it could have been. Looking beyond Europe, the global market for wind turbines grew by 31% last year to more than 20,000 MW.

The change of pace in some countries can be explained by a mixture of slow administrative processes, problems with grid access and legislative uncertainty. The figures demonstrate the existence of continuing barriers to wind energy development

Offshore wind, seen as a key market for European expansion, continues to progress slowly, both in Europe and outside Europe.

The current EU legislative framework for wind energy

Up to now, 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

TOTAL INSTALLED CAPACITY

year	2000**	2001**	2002*	2003*	2004*	2005*	2006*	2007
MW	12,887	17,315	23,159	28,598	34,371	40,511	48,029	56,535

** EU 15
* EU 25

(77/2001/EC) has been in place since 2001. The EU aimed 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. The Directive, which set out differentiated national indicative targets, has been an historical step in the delivery of renewable electricity and constitutes the main driving force behind recent policies being implemented.

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.

European Commission progress reports in 2005 and 2008 have highlighted that despite the requirements of the Renewables Directive, despite the efforts of Member States and despite some improvements of the regulatory frameworks, major barriers to the growth and integration of renewable electricity remain. The main causes of the slow development in some Member States are not policy-related, but delays in authorization, unfair grid access conditions and slow reinforcement of the electric power grid. The reports invite the Member States to give a high priority to removing administrative barriers and improving grid access for renewable energy producers.

Finally, the EC reports conclude that the harmonisation of support schemes remain a long term goal on economic efficiency, single market and state aid grounds, but that harmonisation in the short term is not appropriate. By adopting best practices or combining national support schemes, Member States can continue to reform, optimise and coordinate their efforts to support renewable electricity. EWEA is of the opinion that real competition in the conventional power market must precede a harmonized market for renewable electricity. The association also fears that a hasty move towards a harmonised 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.

The future EU legislative framework for wind energy

In March 2006, the European Commission launched 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" 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.

In January 2007, the European Commission released its "Strategic Energy Review" - also called "Energy Package" -, a comprehensive set of 19 documents, which intend to shape the EU energy landscape in the medium and long term. The package proposes an overall binding target of 20% of EU energy consumption coming from RES by 2020 without specifying how that overall target should be split among the different sectors (electricity, heating & cooling and transport).

In March 2007, the EU Heads of State responded by adopting a binding 20% target for renewables by 2020 and asked the European Commission to put forward a legislative package. On 23 January 2008, the Commission published its Renewable Energy and Climate Change Package which calls 20% of final energy consumption to come from RES by 2020. The 20% target at the EU level has now been translated into concrete figures for the 27 EU Member States. The "national action plans" will indicate how the agreed target for each Member State is going to be achieved and the measures that will be put into place for that. The proposal also contains measures which positively address obstacles that wind energy is currently facing, such as heavy administrative procedures and grid access issues.

The swift approval of the Commission's proposed directive by the 27 Member States and the European Parliament is essential for the sustained expansion of wind energy in all countries of the European Union.

With input from the European Wind Energy Association (EWEA)

France

The third largest European market

France enjoys an abundant wind potential, and after a slow start, the wind energy market has been progressing steadily in recent years. While in 2000, there were only 30 MW of wind generating capacity in France, the total installed capacity at the end of 2007 was 2,454 MW, representing an annual growth rate of 57% in terms of total capacity. A further 3,500 MW have been approved.

The annual market also grew to 888 MW in 2007, making it the third largest market in Europe after Spain and Germany.

The average size of an installed wind turbine has increased, from an average of 1.2 MW per turbine in 2005 to 1.7 MW in 2007. This is expected to reach 2 MW by 2008

The average size and output of wind farms has been continuously increasing, from 4.7 MW to 13 MW between 2002 and 2007. Average wind farm size could reach 17 MW by 2010.

In 2007, the production of wind energy was 4 TWh, with an average capacity factor of 24%. Wind energy in France now provides around 5,000 jobs to the French economy.

Wind power has been growing fast in all French regions, except the south west, where the wind regime is less favourable. Since 2006, there has been a shift in wind farm development from the windiest areas of Bretagne, Midi-Pyrenees and coastal areas to inland regions such as the regions of Centre, Picardy, Lorraine and Champagne-Ardenne. The biggest potential in the coming years is in the north and the north east areas.

The largest wind park in France is in the north of the country (Fruges) with 70 wind turbines producing 140 MW. Built in 2007, Cormainville wind park in the Eure-et-Loire produces 60 MW and La-voie-sacré wind park in Lorraine produces 54 MW. France has a further 10 wind farms which exceed 30 MW. A further wind parks bigger than 30 MW are scheduled to be built in 2008.

Porz-Piron wind farm, Finistère
© Daniel Heureus

TOTAL INSTALLED CAPACITY

year	2002	2003	2004	2005	2006	2007
MW	148	253	390	757	1,567	2,454

The largest manufacturers working in France are Nordex, Enercon, Repower, Vestas and Gamesa, accounting for 84% of the capacity in 2007. The French manufacturer Vergnet has erected 80 wind turbines in 2007, mainly in French overseas territories.

Policy development: The ZDE law & the 25 GW target

The European Renewables Directive set France a target of 21% for gross electricity production from renewable sources by 2010. In 2004, however, this share was only 12.6%, down from 15% in 1997.

The healthy growth of wind energy in France can be explained by the implementation of a feed-in tariff system (introduced in 2001 and 2002), which ensures a tariff of 8.2 ct€/kWh for a period of 10 years for wind farms. In July 2005, this law was amended to stipulate that wind farms must be constructed in ZDE (Wind Power Development Zones) in order to benefit from the tariff. These zones are defined at regional level. The law has also done away with the previous limit of 12 MW for the size of wind farms.

According to industry groups, the ZDE law has, rather than promoting wind energy development, somewhat hampered the growth of the French market, since it resulted in longer and more complex administrative and grid connection procedures.

In late 2007, the French Syndicat des Energies Renouvelables suggested a wind power generation target of 25 GW by 2020, including 6 GW offshore, and there are indications that this target will be adopted by the French government.

Obstacles to wind energy development

Given the tremendous wind resources and renewed government commitment to renewable energy, France has the potential to remain Europe's fastest growing market in the future. However, some unresolved problems remain, which could jeopardise growth.

Port Saint-Louis du Rhône wind farm, Bouches du Rhône
© Georges Moreau

The main difficulties facing wind energy deployment are the number of areas where wind farms are still forbidden, such as radar zones, natural protected areas and aviation paths. The lack of connection capacity is also a barrier in some areas, particularly in centre of France, near the Massif Central, and in the northern regions of Nord-Pas de Calais and Picardy, where the grid is saturated in some areas.

Public opposition is another major issue in France, with various grassroots campaigners fighting against the development and the implementation of wind farms on the whole French territory, under the pretext of landscape protection.

Offshore wind energy in France

Offshore wind farm development in France is still slow, as the legal framework is still very complex or non-existent. Only a few projects are at an advanced stage of development and one of them may start construction in 2008.

Although France has one of the longest coastlines in Europe, it appears that the wind potential is not as favorable as in the in North Sea. Nevertheless, the government aims to install 4,000 MW by 2015. It is still uncertain whether or not the feed-in tariffs will be high enough to achieve this goal.

With input from the Syndicat des Energies Renouvelables.

Germany

Current market situation

A total of 883 turbines with a total capacity of 1,667 MW were installed in Germany in 2007.

This brings the total overall installed capacity in Germany to 22,247 MW, made up of 19,460 turbines. Wind power is the leading renewable energy in Germany, providing around 7% of the country's total electricity consumption.

The installed capacity in 2007 was 25% less than the 2,233 MW installed in 2006, showing a slowdown in the German market. Nonetheless, German turbine manufacturers are among the market leaders, representing a global market share of 22%. Furthermore, German turbine and component manufacturers generated six billion euros in exports in 2007. The sector currently employs more than 100,000 people, up from 82,100 in 2006.

The leading state in Germany in terms of installed capacity is Lower Saxony with over 5,600 MW of wind power. In three states, electricity produced by wind energy now accounts for over 33% or more of the total power demand: Saxony-Anhalt, Schleswig-Holstein and Mecklenburg–Western Pomerania, while in Berlin-Brandenburg, it is 28.6%.

According to the EU Renewables Directive, 12.5% of Germany's electricity consumption is to be met by renewable energy by 2010, but this target was already exceeded in 2007, with a share of 14%. In its recent energy and climate package, the German government increased its target for 2020 to 25-30%, up from the previous target of 20%.

Legislative framework: Feed-in tariff

An early feed-in law for wind-generated electricity has existed in Germany since 1991. The Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz / EEG) came into force in 2000, and it still provides the main stimulus for the German wind market. It was revised in 2004 and the next amendment is scheduled for 2008, in order to adapt tariffs to new market conditions and technological developments.

Under the EEG, electricity produced from renewable energy sources is given priority for grid connection, grid access in both distribution and transmission grids, and power dispatch. The EEG stipulates a fixed feed-in tariff for each kWh of power produced and fed into the grid. This 'initial tariff' is fixed for at least five years, and may then be reduced to the 'basic tariff', depending on how local wind conditions compare to a "reference yield". Wind installations on very good sites (reference yield of 150%) only receive the initial tariff for 5 years, while for wind farms on lesser sites, this period can be extended. No compensation is granted for turbines with a reference energy yield of less than 60%. The aim of this rule is to provide a disincentive for installing wind turbines on sites with poor wind conditions.

Fuhrlaender wind park
© Fuhrlaender AG

The average feed-in tariff over 20 years for turbines installed in 2007 ranged from 8.19 euro cent/kWh ('initial tariff') to 5.17 euro cent/kWh ('basic tariff'). The initial tariff is reduced by 2% every year, so it will be 8.03 to 5.07 euro cent/kWh for turbines installed in 2008.

Special tariffs exist for onshore repowering, i.e. the substitution of older, smaller installations by state-of-the-art, high-output turbines, as well as for offshore installations

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

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007
MW	6,104	8,754	11,994	14,609	16,629	18,415	20,622	22,247

Repowering trends

Recent studies estimate that repowering has the potential to double the amount of onshore wind energy capacity in Germany with significantly fewer turbines and to triple the energy yield.

Despite of the technical potential, though, repowering in Germany is proceeding at a slower pace than expected, mainly due to building restrictions which make repowering projects unattractive. In 2007, repowering only accounted for 108 MW of installed capacity.

Height restrictions also inhibit the production of turbines yielding the maximum energy. Modern turbines with hub hights of 100 meters or more can reach capacity factors of 35% (3,000 full load hours) in the German mainland, and 45% in coastal areas. The German government and some Federal States are rethinking the framework conditions to allow for continuous onshore development. The revision of the EEG, for example, foresees a remarkable improvement of repowering incentives. The aim is to make repowering more attractive in the coming years.

Offshore expectations

Projections for offshore wind energy in Germany now predict a capacity of about 500 MW by 2010, and about 3,000 MW by 2015. The first pilot project, the test site "Alpha Ventus" with 60 MW in the North Sea, is expected to come into operation during 2009.

Most German offshore parks will be erected 20 to 60 km off the coastline in waters 20 to 40 meters deep, mainly for nature conservation reasons. Thus far, the national maritime authority has licensed 19 projects, while the some Federal States have approved a small number of additional projects, adding up to an overall 5,000 MW.

In the autumn of 2006, the German government introduced a new law, the Infrastructure Acceleration Act, which ensures that, for turbines installed prior to 2011, the costs for connecting offshore wind farms to the mainland grid will be covered by transmission systems operators (TSOs).

Future developments: Wind energy in Germany by 2020

The domestic market is expected to grow again once the administrative hurdles such as general distance regulations and height limits are overcome and construction can continue. This is mainly a political issue, and there are expectations that high renewable energy and CO2 reduction targets will help put pressure on the government to resolve these issues in order to ensure continuing growth in the sector.

According to calculations from the German Wind Energy Association (BWE), there is still potential for up to 10,000 MW to be erected on already earmarked onshore sites. Additionally, more onshore capacity could come from repowering.

By 2020, the overall German onshore capacity could be at 45,000 MW, assuming an optimal use of sites and no general height restrictions for turbines, with an additional 10,000 MW offshore. This would account for about 25% of German electricity consumption, or about 150 TWh/year.

Reaching these targets will be difficult unless the correct framework conditions are in place. The amendment process of the regulations and tariffs of the EEG has begun and is currently being debated by the parliament. Improvements are already visible for offshore tariffs. The discussion for onshore wind, however, is much more difficult. With higher costs for wind turbines and restrictive planning framework conditions, implementing attractive new projects in Germany is becoming ever harder.

With input from the German Wind Energy Association (BWE).

India

Great wind potential

The original impetus to develop wind energy in India came in the early 1980s with the establishment of the Ministry of Non-conventional Energy Sources (MNES), now renamed the Ministry of New and Renewable Energy (MNRE). Its purpose is 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 the Centre for Wind Energy Technology (CWET) 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.

Wind farm located near the Coimbatore Area of Tamil Nadu
© IWTMA

Wind energy is continuing to grow strongly in India, with over 1,700 MW of new installed capacity in 2007, hitting 8,000 MW in total. This represents a year on year growth of 28%.

The development 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 envisages an annual capacity addition of up to 2,000 MW in the coming years.

Policy developments at federal and state level

While there is no country-wide support for renewable energies, either in the form of a feed-in tariff or a set quota, MNRE has 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, and 10 out of India's 29 states have set up renewable purchase obligations, requiring utilities to source up to 10% of their power from renewable sources.

There are, however, a number of fiscal incentives for the wind energy sector established at national level, including:

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007*
MW	220	1,456	1,702	2,125	3,000	4,430	6,270	8,000

*This number is provisional and is awaiting final confirmation.

- Direct taxes – 80% depreciation in the first year of installation of a project;
- A ten year tax holiday;
- No income tax to be paid on power sales to utilities;
- Foreign direct investments are cleared very fast.

The Indian government is considering accelerating depreciation, and replacing the ten year tax holiday with tradable tax credits or other instruments. While this would be an issue for existing companies, new investors are less reliant on the tax holiday, since they often have little or no tax liability.

CDM projects

The possibility to register projects under the Kyoto Protocol's Clean Development Mechanism (CDM) has provided a further incentive to wind energy development in India. As of 1 March 2008, 168 projects were registered with the CDM Executive Board, accounting for 3,569 MW, second only to China (see p. 31 for a complete list of registered countries).

The development of a domestic industry and foreign investment

India has a solid domestic manufacturing base, including global player Suzlon, who accounts for over half of the market, and Vestas RRB. In addition, international companies have set up production facilities in India, including Enercon, Vestas, Repower, Siemens and LM Glasfiber.

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. Most recently, some Indian manufacturers, most notably Suzlon, have started to export their products.

Wind farm located near the Coimbatore Area of Tamil Nadu
© IWTMA

Iran

Binalood wind farm Khorasan Razavi
© Saba Niroo Co. Wind Turbines & Power Plants

19 MW of wind power was installed in Iran in 2007. This is an increase of 40% compared to 2006, for a cumulative total of 67 MW installed as of December 2007.

Wind Potential

Iran has a large wind energy potential due to its geographic location, especially offshore in the Persian Gulf. Thus far, however, no projects or research programs have been initiated to develop Iranian offshore technology.

Research by the Iran Renewable Energy Organization (SUNA), which was established by the Ministry of Energy, shows that the country has a significant potential for wind, biomass, solar and geothermal power. This is backed up by studies by the International Energy Agency and the German Wuppertal Institute, who estimate the potential for wind energy to be at least 6,500 MW, while some sources quote as much as 30,000 MW.

Policy

Despite Iran's tremendous potential, favorable policy frameworks are not yet in place, partly due to Iran's large fossil fuel resources of natural gas and crude oil. The situation is changing however, and in 2007, various policy initiatives were established to improve conditions for renewables.

The Iranian government is considering ways in which renewable energies could contribute to the country's energy mix, and the government's Fourth Five-Year Development Plan for 2005-2010 set a target of 500 MW of installed wind power generation capacity by 2010. Progress in research and development activities for identification of suitable areas to exploit these resources has been set as one of the government's targets.

These measures also include the establishment of SUNA in 1999. Since then, SUNA has commissioned resource assessments and set up pilot wind farms to test the technical feasibility of wind energy in Iran. Given the viability of wind energy, the government of Iran plans to invest more resources in developing it further.

Policy Support Mechanisms

With government support, SUNA not only hopes to increase incentives for wind energy development but also aims to invest in research and development to make wind power commercially viable in Iran.

An article on financing regulations has been introduced into the government's National Development program, whereby the government will purchase a certain amount of electricity produced by renewables from state owned or private source at guaranteed prices.

The government's main focus has been on assigning purchase guarantees for renewable electricity. Prices have been set at 650 Rials (4.7 Euro cents) for each kilowatt-hour of generated electricity at the peak hours and 450 Rials (3.3 Euro cents) at the low consuming hours of the day (maximum four hours in one day).

TOTAL INSTALLED CAPACITY

year	2002	2003	2004	2005	2006	2007
MW	12	15	21	22	48	67

The low price assigned to wind energy deters private investment. Therefore, the Ministry of Energy is reported to intend to increase price of wind energy to equal the price paid for fossil fuel, which is 7.3 Euro cents/kWh.

Research and Development Programmes

Several research and development projects in the design and manufacturing of large capacity wind turbines have been funded by the Ministry of Energy, Iran's Power Generation and Transmission Management Organization (TAVANIR), and the Deputy of Strategic Planning and Control.

Manufacturing Base

Iran hopes to establish a sturdy design and manufacturing base in order to export wind turbines to overseas markets.

Saba Niroo is the first and only wind turbine manufacturer in Iran. The company, founded in 2003 by the Energy Industry & Mines Ministry, aims to design, develop and manufacture wind turbines for international export. Saba Niroo's customers and upcoming installations include:

- SUNA: Contract for manufacture, installation and commissioning of 143 units of 300, 550 and 660 KW wind turbines for 90 megawatts of wind farms in Manjil, Harzevil and Siahpoosh (Guillan province). These projects will be completed in March 2009.
- SUNA: Contract for manufacture, installation and commissioning of 43 units of 660 KW wind turbines at the 28.4 MW wind farm in Binalood region-Khorasan Razavi province. (This contract was transferred from Tavanir Co. to SUNA in 2006). This project will be completed in Jan 2008.
- SUNIR: Contract for manufacture, installation and commissioning of 4 units of 660KW wind turbines in Armenia. This project has been completed.

Moreover, the Iranian government has been reported to plan the development the country's first privately financed wind farm with a capacity of 200 MW.

Wind Farms in Iran

Total installed capacity by the end of 2007: 67.36 MW

- Manjil, Siahpoosh and Harzevil sites in Manjil region (north of Iran): 46.24 MW
- Binalood site (north-east of Iran): 21.12 MW

Outlook for 2008/2009

11 units 660kW-wind turbines with a total capacity of 7.26 MW in Binalood region will be commissioned by the end of January 2008

Manufacturing of 84 units 660kW-wind turbines with a total capacity of 55.44 MW will be finished by the first half of 2009 to be installed in Manjil region.

With input from SUNA and Saba Niroo Co.

Manjil wind farm, Guillan

© Saba Niroo Co. Wind Turbines & Power Plants

Italy

Troia San Cireo wind farm, (FG), Apulia
© Vestas

In its Renewable Energy Directive, the European Commission in 2001 set what seemed like an ambitious target for Italy: at least 25% of Italy's gross electricity consumption should come from renewable sources by 2010. While at the time, the availability of financial incentives was uncertain, the introduction of a green certificate system and other measures to support renewables have since created more stability.

Both geothermal and hydroelectric energy are widespread in Italy, but they have reached their saturation levels and have limited possibilities for further development. The photovoltaic market is emerging fast thanks to a good feed-in tariff system and new targets.

Wind and biomass energy are the two principal 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 2007, Italy had reached a level of more than 2,700 MW of installed capacity, taking it to fourth position in Europe.

Further development of wind energy will be vital in order to reach the 25% target of the RES Directive by 2010. The Italian Wind Energy Association (ANEV) estimates that the wind capacity required for this would be in the region of 8,000 MW. By 2020 the electricity produced by wind could be 27.37 TWh with 16,100 MW of installed capacity. This figure anticipates a 2020 target of 30%.

The year 2007 fulfilled the wind energy industry's expectations with a growth rate of 30 %. The prospects for 2008 are even higher and if the present trend continues in the next years, the target of 12,000 MW by 2020 will be met by 2015.

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007
MW	427	690	797	913	1,255	1,718	2,123	2,726

Legislative framework

The 1999 Italian 'White Book' defined renewables targets for the year 2010, including a target of 2,500 MW for wind installations, which was already exceeded 3 years ahead of time. A paper of the Italian government defined a target of 12,000 MW by 2020 for wind power. The government also confirmed its commitment to the Kyoto Protocol by setting a target for reducing CO_2 emissions by 6.5% by 2010.

The first important opening for renewable energy in Italy came with the introduction of 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 2002, however, the support system was changed from a feed-in price mechanism to a renewable energy quota system, obliging power producers and importers to produce a certain percentage of electricity from renewable sources, with the condition that it must come from new or repowered plants which came into operation after 1 April 1999. Green certificates are used to fulfill this obligation.

Another fundamental step took place in December 2003 with the adoption of the national decree implementing the EU Renewables Directive, which required an increase of the quota of renewable power by 0.35 % per year in the period 2004-2006, and by 0.75 % per year in the period 2007-2012. The target was 3.05% in 2006 and 3.8% in 2007. The Italian Government will define the increase for the years after 2012. While fines are applicable if this rule is not complied with, ambiguities in the legislation make enforcement difficult in practice.

In 2007, the Italian government introduced a Financial Law which will require the individual regions to produce a share of total power consumption by renewable energies.

Other measures to promote the deployment of renewable energies for power production include priority access to the grid, as well as a feed-in tariff for solar PV.

Factors hampering the growth of renewable energies in Italy are investor uncertainty due to political changes and the lack of clarity in the current policy design. In addition, administrative constraints such as complicated authorisation procedures at local level as well as high grid connection costs represent further obstacles.

Development trends

The growing Italian market has seen the arrival of several new domestic players as well as growing interest from foreign developers, even if the wind resource is rather limited. The involvement of these new investors and an increase in competition has in turn led to the search for potential sites outside the traditional areas in the Southern Italian mainland. In 1998, just two regions represented 78 % of the total market in Italy; today all the Southern Italian regions are involved in wind development. The acceptance of wind farms by the local population has been further encouraged in some areas by using the local workforce for both on site construction and maintenance activities.

The Italian wind industry today employs about 7,500 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 medium-sized, with capacities ranging from 600 KW to 3 MW. The trend is now moving towards larger MW-scale turbines, despite the fact that installations of this size can be difficult to construct. Many sites are located in complex and hilly terrain, where both transportation and access can be difficult.

In 2007, more than 64 % of the total installed capacity in Italy consisted of large turbines (over 1 MW). To counteract local opposition to wind farms for reasons of visual impact, the Italian association ANEV has developed best practice siting guidelines with the main environmental associations, WWF, Legambiente and Greenpeace.

The main barriers to the development of the wind sector remain the regional authorization hurdle, and grid connection difficulties. The government's recently introduced financial law should help clarify the situation, and assist the further development of the wind sector in the next few years. Other aspects should be reinforced in future, such as the implementation of the renewables sector guidelines, better coordination between the central government and the regions, an increasing compulsory renewable energy quota and defining clear grid connection rules.

With input from the Italian Wind Energy Association (ANEV).

Japan

Azuchi Oshima wind farm, Nagasaki Prefecture
© M&D Greenenergy Co. Ltd

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 136 MW at the end of 2000 to 1,538 MW at the end of 2007.

The policy framework

In pursuit of its Kyoto Protocol objectives, Japan has a target to reduce the level of its greenhouse gas emissions by 6% (compared with 1990 levels) in the period 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. The official government target for wind power in Japan by 2010 is 3,000 MW.

However, the law has a number of weaknesses, including a very low target, 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 market

Wind power capacity has increased very fast in the past ten years. However, the sector has experienced a slowdown recently, mainly due to Japan's severe weather conditions and the reform of Japan Building Code. The country has a history of typhoon attacks that blew down turbines, coupled with lightning incidents, strong gusts and high turbulence. A number of turbines were severely damaged during 2007.

Therefore, a safety standard designed for Japanese meteorological and geographical conditions is being developed to provide technical measures against typhoons and lightning strikes and to help future wind turbine developments.

Improving the integration between the International Electro Technical 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

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007
MW	136	302	338	580	809	1,049	1,394	1,538

which any manufacturer can design a turbine at any place in Japan.

According to the new Japanese Building Code, a wind turbine of 60m height or more shall be considered as a building, and its height is defined as the top height of a blade from the ground level. Under this revised code, the installation of wind turbines needs the government's authorisation. The application procedure for planning permission is very complicated, time consuming and expensive. However, there are still some open questions regarding the legal application of this code for wind farms, and many developers are awaiting a final decision on this. As a result, the net increase of wind power capacity since April 2007 was very small.

Other issues which have created challenges for Japanese wind developers concern grid infrastructure and security of electricity supply. The leading regions for wind power development in Japan are Tohoku and Hokkaido in the north of the country and Kyushu in the south. The greatest 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 access and the monopolistic hold over the power grids by regional electricity companies, who use variability issues as an excuse for not investing in more capacity, have also hampered the development of wind generation. Both the Japanese Wind Energy Association (JWEA) and the Japanese Wind Power Association (JWPA) have therefore been supporting further R&D activity in the areas of grid stability, technical safety, lightning protection and generation output prediction.

Azuchi Oshima wind farm, Nagasaki Prefecture
© M&D Greenenergy Co.Ltd

Azuchi Oshima wind farm, Nagasaki Prefecture
© M&D Greenenergy Co. Ltd

Despite its significant offshore wind energy potential, Japan has so far only developed 11 MW. The government has, in the last couple of years, investigated the feasibility of offshore projects, and an R&D project is expected to start in 2008. The main present hurdles to the development of offshore wind farms in Japan are social issues, especially public acceptance and compensation for the fishery industry. There are also plans to start R&D for deep offshore wind technology in order to capture the huge potential of wind energy in deep offshore areas around Japan.

With input from the Japanese Wind Power Association.

Mexico

Despite the country's tremendous potential, the uptake of wind energy in Mexico has been slow, mainly due to the lack of government incentives for the use of renewable energy, and the lack of a clear regulatory framework that would allow for private sector participation in the development of wind facilities. At present, Mexico has a total installed capacity of 87 MW.

Great potential for wind energy development

Among Latin American nations, Mexico is one of the most promising areas for wind energy development. The Mexican Wind Energy Association (AMDEE) has identified 4600 MW of resource potential at the following sites: 2600 MW at "La Ventosa" (State of Oaxaca); 1,000 MW at "La Rumorosa" (State of Baja California); and another 1,000 MW among other identified sites in the States of Zacatecas, Hidalgo, Veracruz, Sinaloa and Yucatan. Other experts speak of a total potential of as much as 7,000 MW, using only the best locations, and AMDEE estimates that a further 10,000 MW could be installed at as yet unidentified sites.

Political framework conditions

The Mexican energy market is not liberalized. The state owned company Comisión Federal de Electricidad (CFE) has historically been the sole supplier of electricity. Transmission, distribution and sale of electricity to final consumers have also been reserved for the two state owned suppliers.

In 1992, the legislation was amended to allow private sector participation in self-supply, cogeneration, independent power production (IPP), exports of electricity and imports for their own use. Since 2000, IPPs have also been allowed to run publicly financed power stations and to build and operate privately financed power stations.

Foreign investors can assume full ownership in companies that do not contribute directly to public power supply. For a share greater than 49%, however, they need the approval of the Comisión Nacional de Inversiones Extranjeras (National Commission for Foreign Investments).

La Venta II wind farm
© Comisión Federal de Electricidad "CFE"

In 2001, the regulatory authority CRE implemented a regulatory instrument to promote power generation from wind and small hydro, the so-called 'Interconnection Contract' for renewable energy. This established special rules on setting transmission charges and other issues relating to variable power from renewable sources. Self-supply projects under this contract were initially charged for capacity backup, making them uneconomical. This was remedied in 2006.

In 2005, a new provision was added to the Federal Tax Laws allowing for 100% depreciation on capital in the first year for all investments made in renewable energy.

Moreover, in December 2005, the lower chamber of the Mexican Congress adopted the initiative for the Renewable Energy Utilization Law (LAFRE), which aims to establish a programme for renewables and sets a target of 8% of national power production to come from 'new' renewable energy by 2012 (excluding large hydro), up from 2% in 2007. In order to achieve this target, renewable power is to be given priority access to the grid, and a special financing mechanism ('Fondo Verde') is to be set up to provide a premium on top of the electricity tariff. Since 2005, this proposal has seen a variety of changes, and it is still waiting for approval from the Mexican Senate.

In February 2008, the Mexican President Felipe Calderòn approved a national power sector programme for 2007-2012,

TOTAL INSTALLED CAPACITY

year	2005	2006	2007
MW	3	87	87

which aims at enhancing the country's energy security. While this mainly focuses on conventional energy sources, it also includes provisions for renewable energy development, notably the goal of increasing the share of total renewable electricity.

Proposed actions towards achieving this include the development of a national renewable energy programme, the establishment of institutions to coordinate initiatives, and new financing mechanisms to support entrepreneurs.

Obstacles

The monopolistic position of the state suppliers is the main obstacle for more wide-spread renewable energy use in Mexico. In addition, larger projects have failed to materialise due to the lack of favourable building and planning legislation, as well the lack of experienced developers and officials. Moreover, strong pressure to provide electricity at very low prices has failed to make wind energy installations economically viable.

Industry

In terms of private sector involvement, a number of companies have participated in wind energy development in Mexico, including major players such as Cisa-Gamesa, Demex, EDF-EN, Eoliatec, Fuerza Eólica, Iberdrola, Preneal, and Unión Fenosa. The combined development portfolio in private wind energy facilities could reach 2,600 MW in Oaxaca and 1,000 MW in Baja California for the period from 2008-2010.

Projects

In 1984, CFE built the demonstration project La Venta I with seven wind turbines and a total capacity of 1.6 MW, located south of the Isthmus of Tehuantepec, 30 km northeast of Juchitán in the state of Oaxaca.

Another individual 600 kW plant was put into operation by CFE at the end of 1998 near Guerrero Negro in the federal state of Baja California Sur, operating in an isolated urban grid.

In October 2006, a bid for an 83.3 MW wind facility, La Venta II, at the same site as the demonstration project, was granted to the Spanish consortium Iberdrola-Gamesa, for 98 turbines of 850 kW each. The Global Environment Facility (GEF) launched a programme to subsidise the cost per kWh of electricity produced at La Venta II in order to allow CFE to comply with its legal obligation to purchase power at the lowest cost. This programme is implemented by the World Bank.

Planned wind farms

CFE has agreed several other 20-year power purchase agreements with private investors for a further five wind farms (La Venta III and Oaxaca I-IV), each with an output of about 100 MW from 2008 to 2012, generating electricity for public supply. The establishment of the planned national fund ('Fondo Verde') to cover the additional cost of wind generation will be central to the realisation of these wind farms. Without this, continuing buy-down like that provided by the GEF will be needed.

As a result, the GEF, intends to develop a number of large scale renewables projects through a 70 million US$ donation through its Large-Scale Renewable Energies Project (PERGE), implemented by the World Bank. This funding would be used to provide an incentive to the electricity produced during the first five years of each project. La Venta III will be the first one of these projects, with 101 MW, set to become operational in 2009. Oaxaca I-IV are expected to come online in 2010 with 406 MW.

With input from the Mexican Wind Energy Association (AMDEE).

Morocco

Existing wind farms in Morocco

In April 2007, Morocco's new wind farm "Amogdoul", situated on Cap Sim 15km south of Essaouira, started operations, thereby bringing the country's total installed capacity up to 124 MW. The annual electricity production from wind energy now stands at 450 GWh, accounting for around 2% of Morocco's power consumption.

The site of the Amogdoul wind farm is famous for its strong and regular wind with an average annual wind speed of 9,45 m/s at 40 metres. The 60 MW farm was realised by the ONE (National Power Company), using 71 wind turbines 850 kW turbines by Gamesa. The estimated production is about 200 GWh/year.

This project also benefited from financing through the German bank KfW, and it 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, contributing to a reduction of greenhouse gas emission of 156,000 tons of CO_2 per year.

Other wind farms in Morocco include a 50 MW project in El Koudia El Baida (Tlat Taghramt - Province of Tetouan) built in 2000, followed by a 3.5 MW project at the same site in 2001. The site is located 17 km of the town of Fnidek. The mean wind speed in the site, at 10 meters height, is about 10,94 m/s and the maximum 36,5 m/s, and the annual production is about 200 GWh.

Another project of 10.2 MW was carried out by the cement company Lafarge for the electricity supply of its factory near Tetouan in 2005. This wind farm is composed of 12 turbines of 850 kW each. The project started operations in September 2005, and its annual production is estimated at 38 GWh/year, about 40% of the total consumption of the factory. Any excess power is fed into the Moroccan grid.

Policy developments – the 1,000 MW initiative

Morocco is a country relying heavily on oil and coal imports and has an expanding economy which contributes to an annual increase in electricity demand of about 8.5%. In order to ensure its security of energy supply and diversify its energy sources, the government is pursuing a strategy of developing renewable energy as well as liberalising the energy sector to open up its market to international players.

Elkoudia Baida wind farm, Tetouan
© CDER

The Moroccan National Programme for Development of Renewable Energies and Energy Efficiency (PNDEREE), is to raise the contribution of renewable energies to reach 20% of the national electricity consumption and 10% of primary energy by 2012 (currently 7,9% and 3,4 % respectively, including large hydro power installations).

With 3000 km of coast line and high average wind speeds (7.5-9.5 m/s in the south and 9.5-11 m/s in the north), wind power is one of the most promising sectors for renewable energy generation in Morocco. The data gathered by the German GTZ and the CDER confirms that Morocco has several areas with excellent potential for exploiting wind energy, particularly in the greater Tangier, Ksar Sghir and Tétouan areas (with average annual wind speeds of 8 m/s to 11 m/s at a height of 10 m) and in the Dakhla, Laâyoune, Tarfaya and Essaouira areas (7 m/s to 8.5 m/s).

Taking into account this vast potential, the Moroccan government decided to tap the country's wind resources by raising the wind energy capacity from the current 124 MW to 1,000 MW by 2012. The main scope of the programme is to support the growth of renewable energy in the Moroccan energy context and to encourage participation of the private sector in the development of the power sector.

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007
MW	**54**	**54**	**54**	**54**	**54**	**64**	**64**	**124**

Moreover, the Moroccan government launched the so-called "EnergiPro" initiative, encouraging industrial players to reduce their production costs by producing their own energy for up to 10 MW of installed capacity. This cap on installed capacity is expected to increase to 50 MW.

Through this initiative, the national electricity authority ONE ensures the transit of all electricity produced to the national high voltage grid, as well as the guaranteed purchase of the excess electricity produced and not consumed by the producers at an incentive tariff.

Future projects

Between 2008 and 2010, the Moroccan government is planning an addition of 600 MW of installed wind energy capacity, in order to reach its objective of 1,000 MW by 2012.

Allak, El Haoud and Beni Mejmel (near Tangier and Tetouan) - 140 MW
165 Gamesa turbines of 850 kW will be installed in the sites of Allak, El Haoud and Beni Mejmel near Tangier and Tetouan. With average annual wind speed of 9 m/s at 40 meters, the annual production estimated at around 526 GWh/year.

Tarfaya – 200-300 MW
The site of this project is located 2 km south of Tarfaya, along the coastal highway Tarfaya – Laayoune. The wind farm, which will be developed under the Independent Power Production (IPP) framework, 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 850kW turbines.

A call for expressions of interest was launched in March 2007 and the project is planned to be operational in 2010.

Taza – 100 MW
The site for this project is located approximately 12 km north-west of Taza (at Bab Laaricha and Boujerid), with average annual wind speeds of around 8 m/s at 40 meters. The wind farm will have a capacity of 100 MW, which is estimated to produce around 290 GWh of electricity. This project was set up under the Clean Development Mechanism (CDM).

A recent study by the CDER has identified at least eight additional concrete wind farm sites with a total potential capacity of 1,500 MW.

With input from the Centre du Développement des Energies Renouvelables (CDER).

Cap Sim wind farm, Essaouira
© CDER

New Zealand

New Zealand's wind energy industry is small, but it is growing steadily. Wind energy capacity almost doubled in 2007, increasing from 170.8 MW to 321.8 MW. New Zealand's exceptional wind resource results in a high capacity factor by international standards. In 2006 the average capacity factor for New Zealand's wind farms was 41%. The estimate for 2007 is 45%, with turbines in some wind farms achieving up to 70% capacity in the windier months.

New Zealand's wind industry does not receive direct financial support or subsidies from the government. Nonetheless, the development of a new wind farm near Wellington, West Wind, and ongoing investigations at other sites shows that with the right conditions, wind energy is competitive with other forms of electricity generation.

Growing industry

Two new wind farms were commissioned in 2007, and construction commenced on two other sites. Stage 3 of TrustPower's Tararua Wind Farm, in the Manawatu (north of Wellington), has the capacity to generate 93 MW, making Tararua Wind Farm the largest in New Zealand, with at total capacity of 161 MW.

Meridian's White Hill wind farm (29 turbines with a capacity of 58 MW) is the first wind farm with more than one turbine on New Zealand's South Island, signalling the expansion of the industry from the North Island's Manawatu region. The growing diversity of wind farm sites enables the use of the excellent wind resource across the country and will increase the industry's ability to provide a greater proportion of NZ's electricity.

Construction began in 2007 on Meridian's West Wind Project, near New Zealand's capital city Wellington, and Stage 2 of New Zealand Windfarm's Te Rere Hau Wind Farm, in the Manawatu. Meridian expects West Wind to have a capacity factor of 47%. Stage 2 of Te Rere Hau (up to 14 MW) is the only wind farm expected to be commissioned in 2008, as West Wind (143 MW) will not be commissioned until 2009.

In 2007 the government announced its target for New Zealand to generate 90% of its electricity from renewable sources by 2025. New Zealand currently generates about 65% of its electricity from renewable sources, primarily from hydro. To reach 90%, renewable energy capacity needs to grow by about 200 MW each year.

Tararua Windfarm, Manawatu
© NZWEA

Wind provides about 1.5% of New Zealand's current electricity needs. With limited opportunities for the expansion of hydro and geothermal generation, the renewable energy target gives added impetus to New Zealand's wind industry. Wind energy's contribution is set to grow over the coming years and developers are currently seeking consent to build projects with a combined capacity of more than 1,800 MW.

Proposed climate change legislation helpful to wind

Proposed legislation and policy developments aimed at addressing climate change are creating an environment that is supportive of wind energy. The renewable energy target is not legislated, but the wind industry will benefit from proposed legislation that introduces an emissions trading scheme and restricts building new base-load fossil-fuelled thermal generation.

Under the proposed legislation, the electricity sector will enter the emissions trading scheme in 2010. Thermal generators will not receive any free allocation of carbon credits, and so will face the full cost of their emissions. Increasing costs of electricity from non-renewable sources, combined with the restricted thermal generation, will make wind energy more competitive.

2008 is an election year in New Zealand. The opposition National Party is currently leading in the polls. While the National Party has indicated that it is broadly supportive of the climate change policies developed by the Labour government, a change of government has the potential to result in changes to policy.

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007
MW	36	36	36	36	168	168	171	322

Measures to ease consenting issues

Obtaining resource consent for wind farms under New Zealand's Resource Management Act (RMA) continues to be a major obstacle for developers. Developers need to apply for resource consent from the local council to build a wind farm. Once consent is granted, anyone who objects to the consent conditions can lodge an appeal with the Environment Court. Environment Court decisions can be appealed to the High Court only on a point of law.

In recent years, all significant wind farm projects that have been granted consent by local councils have been appealed to the Environment Court. The government is developing a National Policy Statement on renewable energy, which should be in place by the end of 2008. The Statement will require local authorities to more fully recognise the benefits of wind energy when considering the positive and negative impacts of a project.

In addition, the government has indicated that it intends to make greater use of the RMA's 'call-in' provisions. These provisions can be used to reduce the time involved in obtaining consent by calling a project directly into the Environment Court rather than having the project progress through normal local council processes. The first wind farm to be called into the Environment Court will be Unison and Roaring 40s Te Waka project in Hawkes Bay. The industry is waiting with interest to see what precedents this call-in sets.

Overcoming connection and transmission constraints

The Electricity Commission (the regulator of the energy market) is examining the implications of a significant increase in the amount of wind energy generation and how any issues can be resolved. Indications are that issues can be resolved without significant cost, and solutions are likely to include the development of a forecasting system and establishing minimum performance standards for issues such as fault-ride through.

The Electricity Commission and Transpower (the transmission system operator) are investigating options to improve the planning of investment in transmission in order to enable renewable energy. The project should result in a better understanding of where wind farm developments are likely to occur and the investment required in the transmission system to enable new developments to be easily linked into the national grid.

Combined, the results of the two projects should enable wind energy to be developed on a level playing field with other generation sources.

WIND FARMS IN NEW ZEALAND

	Region	Operator	Year commissioned	Capacity
In operation (with more than one turbine)				
White Hill	Southland	Meridian	2007	58.0 MW
Tararua	Manawatu	TrustPower	Stage 3: 2007 Stage 2: 2004 Stage 1: 1999	161 MW
Te Rere Hau	Manawatu	NZ Windfarms	Stage 1: 2006	2.5 MW
Te Apiti	Manawatu	Meridian	2004	90.8 MW
Hau Nui	Wairarapa	Genesis	Stage 2: 2004 Stage 1: 1996	8.7 MW
Under construction				
Te Rere Hau	Manawatu	NZ Windfarms	Stage 2: 2008	Up to 14 MW
West Wind	Wellington	Meridian	2009	142.6 MW

With input from the New Zealand Wind Energy Association (NZWea)

Poland

Zagórze wind farm
@PWEA

The Polish wind market

Although the rate of wind energy market growth in Poland has been very high in the last few years, the total installed capacity is still rather modest at 275.6 MW, especially when compared to the country's potential.

According to the European Bank for Reconstruction and Development (EBRD), Poland is one of the most promising wind energy markets in Europe. Large areas of the country have favourable conditions for wind power generation, with average wind speeds between 5.5 and 7.0 m/s (at 50 meters). The onshore potential is 13,500 MW by 2020, according to the Polish Wind Energy Association. Given the consistent elimination of barriers to wind energy development and stable long-term supporting scheme, the perspectives for the sector are quite positive.

In 2007, Poland's wind energy market experienced 81% growth with 123 MW of new installed capacity. Three wind parks were constructed in 2007 in Kisielice, Kamiensk and Jagniatkowo and several single turbines or groups of small turbines were erected throughout the country. The amount of electricity produced by wind turbines during the first six months of 2007 amounted to 196,9 GWh, compared to just 196,3 GWh for the whole of 2006.

There are four wind parks under construction that will be completed in 2008 with a total capacity of 185 MW. Additionally, construction of several new projects is expected to start in 2008. Projects are being developed not only along the coast, but also in central and southern Poland.

The Polish Wind Energy Association (PWEA) estimates that the development for onshore wind energy capacity will reach

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007
MW	**4**	**18**	**59**	**60**	**65**	**84**	**153**	**276**

2,500 MW by 2010; 5,000 MW by 2015 and 12,000 MW by 2020.

While onshore wind energy is progressing at a healthy rate, there is no offshore capacity in Poland at this stage. Poland is expected to follow the general trend in Europe and develop offshore wind projects, but this is not likely to happen any sooner than from 2015 onwards, when around 500 MW of offshore wind capacity are forecast to be developed. By 2020, this could reach 1,500 MW. It is important to note that Poland's offshore potential is limited by protected nature reserve areas, weak grid infrastructure in the north of the country as well as numerous administrative barriers.

Policy background

Poland depends on coal for 95% of its electricity production, and has some way to go to meet its target of producing 7.5% of its electricity from renewable energy sources by 2010 (up from 2.6% in 2005). In 2000, the government introduced a power purchase obligation for renewable energy sources (amended in 2003), requiring energy suppliers to provide a certain minimum share of power generated by renewable sources (3.1% in 2005, 3.6% in 2006, 4.8% in 2007 and 7.5% in 2010). While failure to comply with this legislation in theory leads to penalties, the 2007 European Commission progress report found that these fines were not enforced.

Zagórze wind farm
@PWEA

Zagórze wind farm
@PWEA

In 2005, the Polish Law on Energy (1997) was amended to introduce an obligation for all producers of energy from renewable energy sources to obtain a licence from the Energy Regulation Authority. Previously, this obligation existed only for those energy producers using generation facilities of 5 MW or more, regardless of their origin. Following this new requirement, 621 producers of renewable energy applied for and received licenses for producing electricity from renewable sources.

Moreover, an excise tax exemption on renewable power was introduced in 2002.

The new draft European Directive proposes an overall renewable energy target of 15% for Poland by 2020.

With input from the Polish Wind Energy Association (PWEA).

Republic of Korea

Wind power target: 2,250 by 2012

South Korea is the world's forth-largest oil importing country, with 97% of its energy consumption provided for by fossil fuel imports. In order to diversify its energy supply, the Korean government in 2003 established its Second Basic Plan for New & Renewable Energy Technology Development and Dissemination, setting a goal of increasing the country's share of total primary energy supply from 1.4% to 5% by 2011, which was later extended to 10% by 2020.

The priority areas for achieving these objectives are wind energy and solar photovoltaics, and a target for wind energy was set at 2,250 MW by 2012. A report by the International Energy Agency concluded that the country could generate as much as 30% of its electricity from renewable energy sources. However, the proportion of renewable power stood at only 2.3% in 2007.

Since the feed-in-tariff system for RE-generated electricity took effect in May 2002, private investors have been the driving force behind installation of commercial wind power generators. In order to secure private investment, an application period for the base price was established as a guarantee.

There are currently 12 wind farms in Korea, made up of more than 120 commercial turbines. The total installed capacity increased by 18 MW in 2007, down from 77 MW in the previous year, and the total now stands at 191 MW.

Constraints to market development

Barriers to market development in Korea are public opposition and the geographic characteristics of onshore sites, where suitable locations are relatively scarce despite the great wind resource potential. Most areas outside population centers are mountainous, so the infrastructure (road, power grid, etc) necessary for installing wind farms is inadequate. In addition, these areas are usually designated as nature preserves, 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 several 10s of MWs.

The Hyosung's HS90 2MW wind turbine

Various measures are being taken to overcome these geographical limitations, such as the construction of offshore wind farms. In order to secure off-shore wind power technology, Korea constructed a demonstration site in Jeju island with 4 MW of power capacity.

Creation of a domestic industry

The Korean government is promoting research and development in renewable energy technologies to create a new hi-tech sector of the economy.

At present, four domestic manufacturers are developing MW-class wind power generators with capacities of 2 ~ 3 MW. The fabrications of 2MW-class wind turbines have been completed in 2007, and the prototypes will be tested for the type certification during 2008.

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.

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007
MW	8	8	13	18	68	98	173	191

Wind energy projects in Korea

As a non-annex 1 party to the Kyoto Protocol, Korea can host Clean Development Mechanism (CDM) projects. The list below gives some examples of the largest and the most recent wind farms, all of which are registered under the CDM.

Pyeongchang wind farm (Gangwon province)
The Pyeongchang wind farm is the largest wind energy project in Korea with 98 MW of installed capacity, made up of 49 2MW Vestas turbines. It became operational at the end of 2006 and generated around 231 GWh in 2007, cutting CO_2 emissions by 141,000 tons. The annual wind speeds for the site are in the range of 7.65 m/s at 60m above the ground.

Youngduk wind farm (39.6 MW)
The Youngduk project is located on the east coast of Korea, where average wind speeds reach 7.1 m/s at a hub height of 80m. It started operations in June 2006, and it has an installed capacity of 39.6 MW, made up of 24 turbines with a nominal installed capacity of 1.65 MW each. In 2007, the project provided close to 74 GWh of electricity to the grid, reducing CO_2 emissions by 45,000 tons.

Hangyeong wind farm (6 MW + 15 MW)
The Hangyeong wind farm added 15 MW to the Korean wind capacity on the southern island of Jeju, where annual wind speeds are in the range of 7.5 m/s at 60m above the ground, accounting for capacity factors above 30%. In 2007, five 3 MW turbines were set up at the wind farm to add to the four 1.5 MW units built in 2004. The addition is expected to generate around 40 GWh of electricity per year, reducing CO_2 emissions by close to 30,000 tons. According to the Korean government, the new turbines will fulfill the power demands of 126,000 households in Goyang City, northwest of Seoul.

Yangyang wind farm (3 MW)
The Yangyang wind farm is part of a larger renewable energy project, located in the north eastern region. It is composed of a 3MW wind power plant and a 1.4MW small hydroelectric power plant. The annual power generation of the two wind turbines (1.5MW each) and two small hydroelectric turbines (0.7MW each) is estimated to be 14 MWh per year, abating 8,620 tons of CO_2.

Spain

The strongest growth market in Europe in 2007

The Spanish wind energy market saw spectacular growth in 2007, partly spurred by new legislation which foresees transitional arrangements for wind farms that started operations before the end of the year. A record 3,522 MW of new capacity were installed in Spain in 2007, more than doubling the 2006 increase, bringing the total up to 15,145 MW.

Wind energy now supplies 10% of total power demand in Spain, with 26,000 GWh produced in 2007, forecast to increase to around 29,000 GWh for 2008.

The Spanish feed-in tariff

Support for renewable technologies began in 1980 with the "Law for Energy Conservation". Since then, various instruments have been applied to encourage the deployment of renewable energies, mainly legislative measures and financial support.

Higueruela wind farm, Albacete
© R.MURAD/AEE

Cerro Vicente wind farm, Albacete
© GAMESA

In 1999, the Spanish government set a target of achieving 12% of total energy consumption and 29% of electricity from RES by the year 2010. The EU RES Directive of 2001 stipulates that by 2010, at least 29.4% of gross electricity consumption should be met by renewable sources. In 2005, the Spanish government also set a goal for the country's installed wind power capacity to reach 20,000 MW by 2010.

The current tariff system entered into force in 1997, through the Electric Power Act 54/1997, subsequently modified by Royal Decrees 436/2004 and 1634/2006. These laws define a feed-in mechanism for renewable power. There are different levels of tariffs depending on the technology and on the size of the installation.

According to the law, the power producer can choose between a fixed price and a premium added to the market price. The choice is made for the duration of one year, after which the producer can decide to maintain the formula or change to the other option.

The electricity distributor has an obligation to buy electricity produced by renewable sources at the defined price and the National Commission of Energy (CNE) performs the settlement of costs incurred by distributors. The costs of RE electricity generation are taken into account for the annual calculation of the electricity price, thereby ensuring that the additional cost to consumers is proportional to their electricity consumption.

Policy developments in 2007: RD 661/2007

In 2007, the existing law was reformed, and this process created significant uncertainty in the Spanish market. Finally, at the end of May, the new law (RD 661/2007) was published, revealing a similar structure to the old system but with less favourable tariffs and a cap and floor mechanism for the fixed premium option.

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007
MW	2,235	3,337	4,825	6,203	8,263	10,027	11,623	15,145

The new legislation met key demands of the wind sector. An important feature of the new law is that fixed tariff and market tariff options remain and that a transition period of 5 years applies to operating wind farms, allowing owners of facilities operating before January 2008 to choose between the transitional system and make a permanent choice before 1 January 2009 to sell at a fixed tariff or at market price plus a premium, or to fully accept RD 661/2007.

Masgalan-Campo Do Coco wind farm, Pontevedra
© GAMESA

Wind farm operators which remain under the transitional system and elect to sell at a fixed tariff will be subject to the tariffs under RD 436/2004 for the operating life of the wind farm. Operators choosing to sell at the market price plus a premium will receive the premiums and incentives established in the RD 436/2004 until 31 December 2012 and will then be transferred to the new regime.

Wind farm operators that fully accept RD 661/2007 may not return to the pricing system established under the transitional system.

For wind farms starting operations after 31 December 2007, the fixed tariff option will be 7.32 €cents/kWh, which will be reduced to 6.12 €cents/kWh after 20 years of operation.

A new feature was introduced in the fixed premium option: for wind farms starting operations from 2008 and for wind farms after the transition period, the fixed premium is 2.93 €cents/kWh, but this is now combined with a cap and floor mechanism, limiting the range of the tariff at between 7.13 and 8.49 €cents/kWh. This new system aims to protect operators of RE installations from excessively low market prices, and, on the other hand, eliminate the premium when market prices are deemed high enough to cover generation costs.

The decree foresees a new general review of the compensatory scheme in 2010 and every four years thereafter.

Industry in Spain

Spain hosts the world's biggest wind farm owner, Iberdrola, as well as some of the most important turbine manufacturers and developers, including Gamesa Eólica, Acciona Energy and Ecotecnia. Spanish companies are now involved in wind energy operations around the globe.

Future outlook: 40 GW by 2020

The Spanish wind energy sector is on course to meet the government's target of installing 20,000 MW of wind energy capacity by 2010. Moreover, the Spanish Wind Energy Association (AEEolica) estimates that 40,000 MW of onshore and 5,000 MW of offshore wind capacity could be operating by 2020, providing close to 30% of Spain's electricity demand.

With input from the Spanish Wind Energy Association (AEEolica)

Turkey

Wind energy has had a slow start in Turkey. However, as the country is preparing to join the European Union and considering ratifying the Kyoto Protocol (as an Annex I country), there are early indications of promising future developments.

Turkey is a country with very limited gas and oil reserves and is therefore looking at renewable energies as a means to improve its energy security in order to gain some independence from imported gas from Russia and Iran. In addition, Turkish electricity demand is expected to increase by 7-8% annually, and power shortages are already widespread. In this context, policy makers increasingly recognise the potential role of wind power as part of the country's future energy mix.

Policy

Turkey introduced its first law on the Use of Renewable Energy Resources for the Generation of Electrical Energy in May 2005, introducing tariff support for electricity produced by renewable sources. This tariff was increased slightly to 5 – 5.5 Euro ct/kWh by a revision of the law in May 2007. The support was set out to last for seven years.

While the level of support is low in comparison with other European countries, wind power producers are also free to sell to the national power pool or engage directly with eligible customers in bilateral agreements where prices are much higher than the guaranteed price.

Bandirma Bares wind farm
© TWEA

Bandirma Bares wind farm
© TWEA

A number of additional policy measures have helped to increase renewables production in Turkey in recent years. These include the obligation of the national transmission company to provide grid connection to all renewable power projects, and improved transmission links with the EU, which stabilise the power system. Furthermore, most restrictions on foreign investment in the Turkish power sector have been lifted.

Wind resource

Turkey has a large renewable energy potential. *A Wind Atlas of Turkey* by the Turkish Energy Market Regulatory Agency (EMRA/EPDK) in May 2002 indicates that the regions with the highest potential for wind speeds at heights of 50 m are the Aegean, Marmara, and Eastern Mediterranean Regions of Turkey, as well as some mountainous regions of central Anatolia.

Market outlook

Turkey installed 97 MW of new wind energy capacity in 2007, thereby nearly trebling its market to reach a total of 146 MW, mostly located in the North-West of the country.

A further 12 licensed projects with a capacity of over 600 MW have signed construction agreements and are expected to be finalised by the end of 2009, while an additional 29 projects totaling 982 MW are reported to have been granted licenses.

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007
MW	19	19	19	20	20	20	50	146

In 2006, EMRA stopped accepting applications for new wind power projects without explanation. This trend was reversed by a call for wind and solar projects in the autumn of 2007. As a result, EMRA received applications for 751 projects for a capacity of 78,151 MW, including 3,791 MW offshore, from over 380 companies. This number greatly exceeded all previous estimates. It has to be pointed out, however, that many of these applications compete for the same sites. Nearly half of the applications were for projects of under 50 MW.

In addition to local companies including Sayres Elektrik, Akyelres Elektrik, Guneyres Elektrik and Uzay Enerji, major international players such as Iberdrola, BP and Westwind have submitted applications. EMRA is expected to offer licenses for up to 10,000 MW of wind energy, while saying that 30,000 MW would be feasible.

However, experts have cautioned that only a small share of this capacity would be able to be connected to the power grid without major investments in upgrading the country's transmission infrastructure.

Cesme ARES windfarm
© TWEA

CAPACITY UNDER OPERATION – 146.25 MW

Location	*Comm. Date*	*MW*	*Turbine manufacturer*
İzmir-Çeşme	1998	1.5	Enercon
İzmir-Çeşme	1998	7.2	Vestas
Çanakkale-Bozcaada	2000	10.2	Enercon
İstanbul-Hadımköy	2003	1.2	Enercon
Balıkesir-Bandırma	2006	30	GE
İstanbul-Silivri	2007	0.85	Vestas
İzmir-Çeşme	2007	39.2	Enercon
Manisa-Akhisar	2007	10.8	Vestas
Çanakkale-İntepe	2007	30.4	Enercon
Çanakkale-Gelibolu	2007	14.9	Enercon

CAPACITY UNDER CONSTRUCTION - 276.9 MW

Location	*Comm. Date*	*MW*	*Turbine manufacturer*
Hatay-Samandağ	2008	30	Vestas
Manisa-Sayalar	2008	30.4	Enercon
İstanbul-Gaziosmanpaşa	2008	24	Enercon
İstanbul-Çatalca	2008	60	Vestas
İzmir-Aliağa	2008	42.5	Nordex
Balıkesir-Şamlı	2008	90	Vestas

CONTRACTED PROJECTS - 558.2 MW

Location	*Comm. Date*	*MW*	*Turbine manufacturer*
Muğla-Datça	2008	28.8	Enercon
Aydın-Çine	2008	19.5	Vensys
Bilecik	2008	66.6	Conergy AG
Hatay-Samandağ	2008	35.1	Nordex
Hatay-Samandağ	2008	22.5	Nordex
Osmaniye-Bahçe	2009	130	GE
Manisa-Soma	2009	140.8	Enercon
Balıkesir-Kepsut	2009	54.9	Enercon
İzmir-Aliağa	2009	30	Enercon

With input from the Turkish Wind Energy Association

United Kingdom

The January 2008 EU renewable energy allocations require Britain to source 15% of its energy from renewables by 2020. As this is 15% of all energy - heat, electricity and transport - BWEA estimates that one of the most expedient ways to achieve this target would be to have 13 GW onshore wind generating capacity, producing 34 TWh of electricity per year (10% of supply) and 20 GW offshore installations generating 61 TWh (17% of supply). Other sources such as wave & tidal, hydro and biomass should provide an additional 8-10%. In this way, 37% of all electricity could be produced from renewables, accounting for 15% of all energy.

The UK government also has an intermediate 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 21 TWh could be supplied by the end of the decade, with a generating capacity of 8.000 MW. This would meet more than three-quarters of the national target.

Britain has the best wind regime of any country in Europe, with average load factors for large scale wind turbines showing a 9 year average of 28.3%. 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. Recently, however, following a string of Government announcements, things have started to change.

In November of 2007, John Hutton, Secretary of State for Business, Enterprise and Regulatory Reform, announced that the Government is ready to set aside large parts of the sea bed in English and Welsh territorial waters for the development of wind energy. Following a strong campaign by the BWEA to promote the benefits of wind power, Mr. Hutton announced there was a potential to build 30 GW of capacity offshore.

The Renewable Obligation Certificate scheme, guaranteeing a premium for bulk electricity generated by large scale operators, has encouraged investment in the sector and will continue until 2027. Given the positive impact the scheme has had on the development of renewables in the UK, BWEA is campaigning for it to be extended beyond 2027.

Red Tile wind farm
© Windprospect

In 2007 a total of 427 MW was commissioned in the UK, taking the total of installed capacity to 2,389 MW. A further 1,373 MW is under construction. Out of the large approved offshore projects, London Array with 271 turbines will provide 1 GW of capacity, Greater Gabbard 500 MW and Walney 450 MW. Given average UK domestic electricity consumption, these 3 projects alone could power 1.1 million homes.

At the end of 2007 a total of 1,974 MW of capacity was consented, and 7,579 MW was in the planning system.

Wind energy in the UK in numbers 2007

Onshore number of operational turbines: 1795
Offshore number of operational turbines: 149

Delivery to date Onshore in MW
Operational: 1,914 MW
Under Construction: 909 MW
Approved & awaiting construction: 2,017 MW
In Planning: 7,468 MW

Delivery to date Offshore in MW
Operational: 404 MW
Under Construction: 464 MW
Approved & awaiting construction: 2,556 MW
In Planning: 2,149 MW
Site awarded, applications to be submitted: 3,040 MW

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007
MW	**406**	**474**	**552**	**648**	**888**	**1,353**	**1,962**	**2,389**

Planning issues

According to BWEA's latest annual survey the time from filing an application to planning decision is 24 months. There is 7,468 MW onshore in the planning system and 2,149 MW offshore, against a total UK electricity generating capacity of 83 GW.

Partly to address issues arising out of growing electricity demand and the need for more domestically produced and renewable energy – as opposed from energy from imported gas and oil – the UK Parliament has started work in 2007 on 3 major pieces of legislation of interest to the sector: The Energy Bill, The Planning Reform Bill and The Climate Change Bill.

BWEA hopes that this legislation will help resolve some of the planning issues such as length of determination, access to grid and waiting times for grid connections. BWEA has supported the creation of the Infrastructure Planning Commission (IPC) which would take decisions on projects over 50 MW; and it has also successfully campaigned for wording in the Planning Reform Bill which gives the Secretary of State the option to refer projects of less than 50 MW directly to the IPC.

Offshore development

BWEA sees UK offshore wind as rapidly becoming one of the most exciting sectors in the global renewable energy industry. Britain is set to overtake Denmark as leader in the field, with projects now in construction approaching half of the current global installed offshore capacity.

The UK's fifth offshore Round 1 project, Burbo Bank (90 MW), is in commissioning, and offshore construction work has started on three other sites. These are Robin Rigg (180 MW), Rhyl Flats (90 MW) and Lynn and Inner Dowsing (194 MW) which, when completed, will become the world's most powerful offshore wind farm,

Also, the deeper water Beatrice demonstration project (10 MW) will reach full operation this year.

The increase in offshore wind ROC multiple to 1.5, coupled with continuity in the onshore wind ROC multiple, has been accepted positively, though many advise that the improvement in offshore project economics is not as significant as might be expected.

Though the multiple is higher than generally expected, most developers advised significant supply chain cost increases within the last 18 months, partly in response to new market conditions as well as increased commodity prices. In general, the mood of developers of UK offshore sites is more upbeat than 18 months ago.

With input from the British Wind Energy Association (BWEA).

Whitelee wind farm
© Scottish Power

UK PLANNING AVERAGES 2004-2007	2004	2005	2006	2007
Number of applications (MW)	2,934	2,709	2,330	1,022
Number of decisions (MW)	787	1,121	1,321	1,722
Number of approvals (MW)	613	695	838	1,070
Time to decision (months)	18	17	22	24
Approval rate (%)	82	71	67	62

United States

Wild Horse Wind Power Project, Kittitas County, Washington
© Power Climber Wind

U.S. wind power surges 45% in 2007

The U.S. wind energy industry shattered all previous records in 2007, installing 5,244 megawatts (MW) and expanding U.S. wind power generating capacity by 45%.

U.S. wind power capacity now stands at 16,818 MW and spans 34 states, with Texas clearly in the lead. American wind farms will generate an estimated 48 billion kilowatthours (kWh) in 2008, just over 1% of U.S. electricity supply. The current U.S. electricity mix consists of about 50 % coal, 20% nuclear, 20 % natural gas, 6 % hydropower, with the rest generated from oil and non-hydro renewables, according to the U.S. Energy Information Administration.

Most interestingly, perhaps, is how quickly wind is growing as a share of current investment: new wind projects account for about 30% of the entire new power-producing capacity added in the U.S. in 2007, establishing wind power as a mainstream option for new electricity generation.

2007 was the third consecutive year of record-setting growth, establishing wind power as one of the largest sources of new electricity supply for the country. This remarkable and accelerating growth is driven by strong demand, favorable economics, and a period of welcome relief from the on-again, off-again, boom-and-bust, cycle of the federal production tax credit (PTC) for wind power.

But the PTC and tax incentives for other renewable energy sources will expire at the end of 2008, and if an extension does not occur early in the year, the U.S. wind industry could see installations plummet in 2009. Previously, when the credit was not extended well before its expiration date, installations have fallen by 93% (2000), 73% (2002) and 77% (2004).

The U.S. wind industry is urging Congress and the President to quickly extend the PTC—the primary U.S. incentive for wind power—in order to sustain this remarkable growth along with the manufacturing jobs, fresh economic opportunities, and reduction of global warming pollution that it provides.

The PTC provides a 2 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 this incentive is needed to help level the playing field for wind and other renewable energy sources.

The industry is also calling for long-term support, including a national renewable electricity standard requiring that utilities generate more of their power from renewable sources.

TOP TEN STATES BY MEGAWATTS OF WIND POWER GENERATING CAPACITY, AS OF 31 DECEMBER 2007

State	Existing	Under Construc-tion	% of total instal-lations (Existing)	Rank (Existing)
Texas	4,356.35	1,238.28	25.9%	1
California	2,438.83	45	14.5%	2
Minnesota	1,299.75	46.4	7.7%	3
Iowa	1,273.08	116.7	7.6%	4
Washington	1,163.18	126.2	6.9%	5
Colorado	1,066.75	0	6.3%	6
Oregon	885.39	15	5.3%	7
Illinois	699.36	108.3	4.2%	8
Oklahoma	689	0	4.1%	9
New Mexico	495.98	0	2.9%	10

Texas consolidates lead

Texas again provided the lion's share of new installations in 2007. The state is in effect providing a model for what could happen at the national level in the country: it has a vast wind resource, it has enacted a renewable electricity portfolio standard that jump-started the wind power market in the state, it has a large, competitive market that helps remove barriers to market access for new technologies like wind, and, most importantly perhaps today, it is resolving the transmission challenge.

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007
MW	2,578	4,275	4,685	6,372	6,725	9,149	11,575	16,818

The need for transmission line upgrades and for investment in new transmission lines to tap the country's vast, but stranded, wind resources is indeed one of the major constraints on large-scale wind power development in the U.S. today. To resolve the "chicken or egg" problem (no wind farms will be proposed or built in a wind-rich but transmission–poor area unless there is a definite plan for new transmission; conversely, no transmission will be planned or built unless there are wind farms built in the area), Texas and several other states such as California, Colorado, Minnesota and New Mexico are putting in place a process that facilitates transmission planning for wind and other renewable energy sources, and essentially builds some transmission first.

Investment in manufacturing picks up

The strong demand for wind power 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.

In 2007, six new manufacturing plants for wind turbine elements such as blades and towers, came online, creating over 775 jobs:

- Trinity Structural Towers (towers): Clinton, Illinois
- Knight & Carver (blades): Howard, South Dakota
- Tower Tech (towers): Manitowoc, Wisconsin
- Siemens (blades): Fort Madison, Iowa
- Acciona (turbines): West Branch, Iowa
- Composite Technology/DeWind (assembly) Round Rock, Texas

Eight new manufacturing plants have also been announced in 2007, including some very large plants, which are together expected to create over 5,000 jobs:

- Vestas (blades): Windsor, Colorado
- TPI Composites (blades): Newton, Iowa
- LM Glasfiber (blades): Little Rock, Arkansas
- GE Energy (service): Schenectady, New York
- DMI (towers): Tulsa, Oklahoma
- Molded Fiberglass (blades): Aberdeen, South Dakota
- Hendricks Industries (towers): Keokuk, Iowa
- PPG Industries (fiberglass): Shelby, North Carolina

20% wind by 2030?

The American Wind Energy Association (AWEA) believes that producing 20% of the nation's electricity from wind by 2030 is feasible with strong policy support, 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.

The U.S. Department of Energy, National Renewable Energy Laboratory, AWEA, and utilities, environmental organizations, technology companies, foundations and other stakeholder groups are completing a study evaluating the feasibility of supplying 20% of the nation's electricity with wind. Initial findings from the study have been previewed at AWEA events, and the full study will be released later in 2008.

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

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

Indeed, in order for wind to expand from just over 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.

Economic benefits would be substantial. For example, if wind were to generate 20% of U.S. electricity supply, the U.S wind energy industry would create 150,000 direct jobs in manufacturing, construction, and operation of wind power plants and equipment. An additional 300,000 jobs would be supported in supply chain and services, and related local economic activity.

With input from the American Wind Energy Association (AWEA).

Conclusion

The Global Wind 2007 Report is a snapshot of the dynamic wind energy industry at a particular moment in time. Like most reports about this industry, by the time it is printed it will be out of date. In this case, the publication of the report will coincide roughly with the installation of the 100,000th megawatt of clean, emissions-free wind power, and we're projecting that we'll reach the 200,000th MW by sometime in late 2011. But if the past is in fact a guide to the future, we will reach that next milestone well ahead of time.

Prognostication is a dangerous business. The failure to reauthorize the US Production Tax Credit in the first half of this year, the global credit crisis and creeping recession or other unforeseen events will undoubtedly mean that we will continue to live in 'interesting times', in the Chinese sense, with rapid changes and discontinuities that no one could predict from this vantage point.

However, it is clear that wind energy has hit the mainstream, and that it is an increasingly mature and global industry, destined to play a major role in meeting the electric power needs of a world undergoing rapid economic, social, political and environmental change.

The actors are changing as well as the scenery. There were many 'firsts' in 2007: this was the first year in decades that the majority of the annual installations of wind power were outside of Europe; at the same time, this was the first year that wind power was the largest net supplier of new power generating capacity in Europe. This was the first year that domestic Chinese turbine manufacturers supplied the majority of turbines in the world's most dynamic market; and it was the first year in which the majority of the top ten owners of wind (including #s 1-3) were utilities.

But wind power, just like any other form of generation, is radically dependent upon the right policy frameworks; and those policy frameworks are a reflection of the desires of governments and energy planners at the time. Just as the drive for electrification in the early part of the last century saw the creation of government-funded hydroelectric projects, and led to hundreds of billions of dollars per year in subsidies for the fossil fuel industry, all in search of cheap electricity to power their rapid industrialization; just as the victors of World War II, having unleashed the nuclear genie sought to tame it to their uses, spending untold billions to develop electricity that would be 'too cheap to meter', so policymakers today are turning elsewhere.

They increasingly seek energy sources that provide security of supply, local industrial development and re-development, and for energy sources that avoid the 'external' costs of power generation, whether they be the costs of increased health care, lost productivity and damage to ecosystems and infrastructure through air pollution, or costs associated with the control and avoidance of that new commodity, 'carbon', which is unique in that its value is in its absence. They seek energy sources which decrease the vulnerability from dependence upon imported fuels, and which ease the economic insecurity when the engine of their economy is exposed to the wild swings and inexorable rise of fossil fuel prices on international commodity markets.

Wind power fits the bill in all cases.

The next two years are critical for our energy future. During this period, the EU will enact the legislation which enshrines the 20% by 2020 target into law, and along with it pledge to reduce greenhouse gas emissions by 20%, 30%, or more by that same deadline. A new US administration will be under immense pressure to not only grapple with limiting US greenhouse gas emissions, but also to lend some long term stability to the federal support measures for wind power and other renewable sources. China's wind industry will emerge from its dynamic local markets to become a major player on the global stage. Brazil, Mexico, Argentina and other Latin American economies will make fundamental energy choices of their own in the face of looming crises, and one or more of them may host the next major wind boom. The same could be said of the Middle East/North Africa region.

The backdrop to all of this will be the development and conclusion of the multilateral climate change negotiations that were begun in Bali last December, and which are set to conclude in Copenhagen at the end of 2009. While it is still the case that energy policy is largely determined nationally, the global climate regime has begun to play a part, and that role is set to increase dramatically as the world agrees

arrangements for the period after 2012, when the first commitment period under the Kyoto Protocol has expired.

In direct terms, Kyoto has not done as much as hoped to foster the renewables industry. But energy policies in Europe, North America, and Asia have all responded, albeit in different ways, to the first attempts to control greenhouse gases globally. Europe, Japan, and New Zealand have responded with support measures directly designed to assist in reaching emission reduction goals. US and Australian states and Canadian provinces have responded to the failure of their federal governments to live up to their commitments. With overwhelming public support, they have taken matters into their own hands and taken bold steps in the arena usually reserved for federal governments. In China and India, Kyoto's Clean Development Mechanism (CDM) has provided a boost to renewable energy in general and to wind power in particular. There are now more than 15,000 megawatts of wind power in the CDM 'pipeline', mostly in China and India.

But all of this is just a prelude to the much greater effort that will almost inevitably result from the current round of climate negotiations. The Kyoto reduction targets were an aggregate reduction of 5.2% for industrialized countries. The 'indicative range' being discussed now is an order of magnitude larger, from 25-40% by 2020. New mechanisms will build upon the successes and learn from the failures of the CDM, seeking to broaden the reach of the carbon markets to all emerging economies, as well as to help provide funding to assist the victims of the early ravages of climate change, most of whom are among the poorest of the poor.

The power sector has a crucial role to play in reducing CO_2 emissions, and the large-scale deployment of renewable energy is the only way to make substantial reductions on the supply side in the short to medium term. Wind energy is the one technology with the maturity and global reach to achieve massive cuts in power sector emissions when we need it: now.

La Venta II wind farm, Mexico
© Comisión Federal de Electricidad "CFE"

About GWEC

GWEC
GLOBAL WIND ENERGY COUNCIL

The Global Wind Energy Council is the voice of the global wind energy sector.

GWEC brings together the major national and regional associations representing the wind energy sector, and the leading international wind energy companies and institutions to provide a credible and representative forum for the entire wind energy sector at the international level.

Our mission is to ensure that wind power establishes itself as one of the world's leading energy sources, providing substantial environmental and economic benefits. We promote the development and growth of wind energy around the world through:

Policy development
To participate in policy and regulatory forums that help create frameworks for wind power development.

Business leadership
To provide the strategic and business leadership needed to engage external stakeholders.

Global outreach
To work with emerging markets to transfer know-how and strengthen the development of wind energy world-wide.

Information and education
To serve as a platform for providing quality information, expertise, analysis and data about wind energy.

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 members 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 94 GW of installed wind power capacity

Join GWEC today.

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