GLOBAL WIND **2009** REPORT

GWEC
GLOBAL WIND ENERGY COUNCIL

Foreword

The continued growth and expansion of the wind power industry in the face of a global recession *and* a financial crisis is a testament to the inherent attractiveness of the technology. Wind power is clean, reliable, and quick to install; it's the leading electricity generation technology in the fight against climate change, enhancing energy security, stabilising electricity prices, cleaning up our air and creating thousands of quality jobs in the manufacturing sector when they're particularly hard to come by.

Early 2009, when we published our last set of five year projections, was the absolute low point of the financial crisis. Capital was largely unavailable in most OECD countries, and bankers and consultancies were all predicting a dramatic drop in the renewable energy sector in general and in wind power in particular. GWEC's prediction of 12% growth in the wind sector was generally greeted with disbelief and derision, figuring we were just trying to put a brave face on disaster

Yes, we were wrong. But a lot less wrong than everyone else, as the global market grew by 41%, demonstrating that wind power is increasingly the power technology of choice, leading all others by a substantial margin in the US and Europe, and with another fantastic year of more than 100% growth in China.

But we're not out of the woods yet. The capital markets have eased somewhat, although loans are still harder to come by and more expensive than before the crisis. The interventions of financial institutions such as the European Investment Bank, Germany's KfW, and the BNDES of Brazil have helped, as have the various government stimulus packages which will continue to inject finance into the sector for the next four years. But these are not permanent solutions.

Electrical demand is shrinking in most OECD countries, and although there are signs of economic recovery, it is slower than expected. We were also looking for a boost from the Copenhagen climate summit, but we are no closer to a global price on carbon pollution than we were twelve months ago, and the future of the UNFCCC's Clean Development Mechanism (CDM) remains uncertain.

So 2010 is going to be another extremely challenging year, perhaps even more so in some ways than 2009, and with increasing geopolitical uncertainty, weak power demand in the OECD and tight financing, there is still some belt-tightening to do across the industry.

Our short term projections are once again cautious, but will still get us to 200 GW of installed wind power capacity at the end of 2010, doubling to 400 GW by the end of 2014. That is the growth we can see with a cloudy crystal ball from our vantage point here in March 2010, but the industry will no doubt continue to exceed expectations…it always has!

This is the fifth annual report on the status of the global wind industry by the Global Wind Energy Council. It provides a comprehensive snapshot of this global industry, now present in more than 70 countries. The data and country profiles for this report have been collected through GWEC's member associations and companies around the world, as well as from other analysts and government contacts. We thank our contributors and look forward to continued close cooperation for future editions.

March 2010

Steve Sawyer
Secretary General
Global Wind Energy Council

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Renewable energy financing in a year of economic turmoil

Despite continuous growth in the sector, the 2009 economic and financial crisis represented a significant challenge for the wind power industry. Because renewable energy projects are very capital intensive, the availability and cost of financing is key for a project's economic viability. High interest rates, short maturities and changing debt-to-equity requirements have a direct impact of the price, and thus on the attractiveness of renewable energy projects compared to other types of power generation.

How exactly did the financial crisis impact on renewable energy financing, and what trends are we seeing? To answer these questions, we asked Virginia Sonntag-O'Brien, Executive Secretary of REN21, for her thoughts.

Since the financial debacle of 2008 and the subsequent economic crisis, the renewable energy industry has had to put up with a lot of knocks. Though the year 2008 ended with a record total of US$155 billion investment in clean energy, with more renewable power capacity added in the EU and US than fossil fuels and nuclear combined[1)], a downward spiral had already started in the last quarter.

By early 2009, investment in renewable energy (excluding government and corporate R&D) was down 50% from its peak a year earlier, according to Bloomberg New Energy Finance[2)]. The amount of capital available to finance projects shriveled to nearly nothing, as liquidity problems made banks either stop lending for infrastructure altogether or demand tougher terms, including shorter payback conditions. Any money still left became very expensive, with financiers becoming more risk averse than usual. The amount of equity a project developer had to provide to secure a loan increased dramatically in comparison with the pre-crisis days, when projects could be financed with as much as 90% debt. Stock markets plunged, closing off an important fund-raising channel. The recession was lowering the demand for power, natural gas prices dropped, interest rates rose. It was all looking as if these developments were going to make it harder for renewable energy to compete. And finally, the year ended with no multi-national agreement being reached in Copenhagen on carbon reduction targets, which many considered necessary to boost investor confidence and drive clean energy technologies forward.

A significant impact of the credit crisis on renewable energy projects in the US was the loss of "tax equity" investors, who invest in renewable energy projects in exchange for federal tax credits. These were typically large banks or corporations with significant tax burden. Many of them took major losses due to the financial crisis and were no longer able to commit to tax equity investments. This meant that wind energy project developers and owners could no longer 'monetise', i.e. make use of, the Production Tax Credit (PTC), which is the support instrument for wind energy projects at federal level in the US. The PTC was renewed through 2012, but it became useless for most investors.

In addition to project finance, investment in renewable energy technology companies also declined significantly in 2009. Investors were shying away from funding first-of-a-kind technologies because of the potential risk. Late-stage technology companies, who were no longer able to raise capital via the collapsed stock market, got help for a while from equity funds. But in the course of the year, venture capital and private equity investment together dropped by 44% compared to 2008, mainly due to lower financing of solar and biofuels companies, especially in the US.

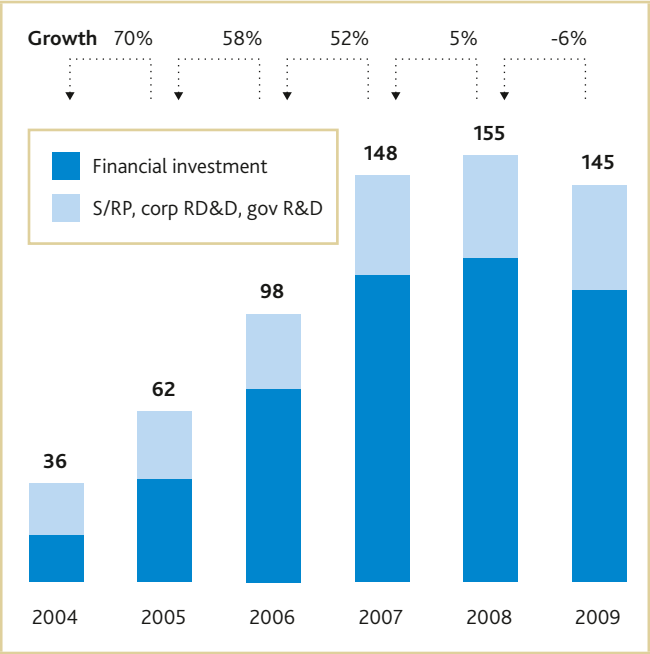
While investments in renewable energy were decreasing as a result of the economic crisis, so were the costs. Bloomberg New Energy Finance estimates that costs fell by an average of 10% across most sectors, including mature onshore wind, but especially solar PV (around 50%), where there was a significant oversupply in the market. But these reductions were offset by higher financing costs. And at the same time, the crisis also brought down the costs of oil and gas, making renewables less attractive.

Throughout most of 2009, it seemed that investment in renewable energy was going to be far lower than in the previous five years of meteoric growth. By the end of the year, however, the sector had come back, and Bloomberg New Energy Finance reported US$145 billion in total investment in clean energy, only a 6.5% drop from the record year 2008 (see graph). The world's wind industry defied the economic downturn and saw its annual market grow by 41.5% over 2008, and total global wind power capacity increased by 31.7% to 158 GW in 2009. More grid-connected solar PV capacity was added worldwide than in the boom year 2008.

1 REN21 Renewables Global Status Report 2009 Update, REN21 Secretariat. Paris
2 Bloomberg New Energy Finance 2010 Green Investing 2010. World Economic Forum. January 2010

What got the market moving again?

TOTAL GLOBAL ANNUAL INVESTMENT IN CLEAN ENERGY 2004 TO 2009, US$ BILLIONS



Note: S/RP = small/residential projects. New investment volume adjusts for re-invested equity. Total values include estimates for undisclosed deals.

Source: New Energy Finance

The public sector comes to the rescue

One reason for the signs of upturn is the fact that the general economy is gradually improving. But a major driver of the new momentum in renewables is also the large number of government stimulus packages, many of which contain a "green" component. In early 2009, the United Nations Environment Programme (UNEP) released a report recommending that one percent of global GDP (US$750 billion) be invested in green technologies over the next few years in order to revive the global economy and boost employment, while addressing the challenges of reducing greenhouse gas emissions and lifting people out of poverty. Government leaders are using the 'Global Green New Deal' argument that massive spending in response to the financial crisis must also shift economies onto a low-carbon development path[3]. In his recent State of the Union speech President Barack Obama said, "The nation that leads the clean energy economy will be the nation that leads the global economy." Based on their government spending, three Asian countries, China, Korea, and Japan, are positioning themselves to take that lead.

Definitions of "green" vary from country to country, as do estimates of the actual amount of global "green" spending. Based on a total estimate of about US$500 billion promised by governments in the past two years, China takes the lead (US$218bn), followed the US (US$118bn), South Korea (US$60bn), and EU Community level plus Members States ($US55bn). However, green stimulus to clean energy exclusively (energy efficiency, renewable, electricity grids, low-carbon cars) puts the US in first place with US$66bn (China US$47, EU US$31.1, Korea US$16)[4]. HSBC Holdings Plc predicts that global green stimulus spending on renewable energy and energy efficiency may triple in 2010.

The success of these stimulus programmes is difficult to measure, and analyses are currently being conducted on the role they are playing in reviving the world's economy, and in particular, creating a green economy[5]. But a recognized shortcoming is the speed at which the funds reach the projects in need. Bloomberg New Energy Finance estimates that only 14% of the total government stimulus allocated for clean energy was actually deployed in 2009 (though it expects 30% to be spent in 2010).

In the US the establishment of cash grants to replace tax equity credits has been helpful in partially filling the tax equity gap.

More and more public-sector institutions have come to the rescue to provide finance and help drive investment, such as Germany's KfW, the European Investment Bank, Asian Development Bank, and the BNDES in Brazil. The European Investment Bank is now a major provider of project finance, underwriting loans for large-scale renewable energy projects, especially offshore wind. The debt is less expensive, since EIB can access capital at favourable terms and pass on its low interest rate.

3 http://www.unep.org/greeneconomy/GlobalGreenNewDeal/tabid/1371/language/en-US/Default.aspx
4 Based on data from HSBC Global Research 2009 and Bloomberg New Energy Finance 2010
5 Sarah O. Ladislaw and Nitzan Goldberger, Assessing the Global Green Stimulus, Center for Strategic & International Studies, Washington, D.C., February 2010

China a driving force

Another factor behind the signs of recovery is China. The Chinese economy suffered badly in the recession, and to get it moving again, China committed the equivalent of three percent of its gross domestic product to stimulus spending. The government's many policies to promote renewable energy have made finance readily available. Bloomberg New Energy Finance reports "extraordinary investment activity" in China in the last quarter of 2009. China accounted for 72% of the US$4.7 billion raised through initial public offerings (IPOs) in the sector, for one third of the 31% increase in globally added wind capacity, and for about 30 percent of the global supply of solar panels. China also benefits from lower cost manufacturing.

Emerging trends

With the exception of the stock markets, which still look bleak, especially for solar stocks, the financial situation for renewables seems to be easing. Liquidity in debt markets is beginning to improve and commercial banks that had left the sector are now starting to return (with a nudge from their new public owners who bailed them out). But investors are now being very selective and are looking for quality and track record, a trend observed after the collapse of the IT bubble in the late 90s. That means small companies have a hard time securing finance, and consolidation will continue. Small projects, on the other hand, may find it easier to raise funds than large ones, because of the lack of capital currently available. Small, distributed wind projects also look more attractive to developers having to cope with siting, permitting and transmission access challenges. As long as developers can provide the increased amounts of equity required, they will be able to secure loans from local banks.

A key development since the financial crisis is that lenders, who in pre-crisis times operated independently, are starting to work together on smaller deals. Big, multi-bank consortia are less popular, since banks now want to work with the ones they know and trust.

New lenders and new capital are coming into the sector. Large corporations are starting to partner with small start-ups, providing capital in exchange for innovation and ideas. Utilities are bringing their capital and access to credit to the renewables sector, helping to get more projects off the ground. Offshore wind is creating some of the largest infrastructure projects in the world and the scale of investment is so massive that institutional investors like pension funds and sovereign wealth funds will have to be brought on board.

Short-term action to ensure the long term

It is too early to draw conclusions on how the renewable energy sector has survived the financial crisis and economic recession. Indications are that long-term prospects for renewables are good, given that the drivers that propelled the sector for the past five years are still at work – climate change, long term carbon price exposure, fuel-price risk, energy security, fossil fuel depletion, and energy access. Renewable energy is innovative, and innovation is a way out of a recession, because it drives economic growth. Short-term action, however, is necessary to break down barriers and mobilise the massive amounts of investment required to reach climate change and clean energy goals. The amount required to effectively mitigate climate change as estimated in the IEA's World Energy Outlook 2009 450 scenario is US$500 billion per annum by 2020, and US$270 billion per year until 2030 for the renewable power sector alone (including large hydro). Measures are needed that will push the industry to new levels of raising capital. Green stimulus and other public-backed funds as temporary measures used only to fill the gaps left by banks will not do the job. Public finance must play a more catalytic role by prompting substantially larger flows of private capital into renewable energy development, demonstration, and deployment, and by supporting capital market solutions to help permanently secure the financing options available to the industry.

The long-term success of renewable energy depends on carefully designed, consistent policies and regulatory frameworks. In the 2010 Investor Statement on Catalyzing Investment in a Low-Carbon Economy[6)], investors urged "policymakers" around the world to take rapid action at national, regional, and international levels" to enable the "necessary flows of private capital and allow us to fully assist in achieving a low-carbon and sustainable global economy."

6 2010 Investor Statement on Catalyzing Investment in a Low-Carbon Economy http://www.iigcc.org/docs/PDF/Public/2010InvestorStatement.pdf

The global status of wind power

Rio do Fogo wind farm, Brazil *© Wind Power Works*

Global wind power boom continues despite economic woes

The expectations for 2009 were dire for all industry sectors, and wind power was no exception. Both the economic and even more so the financial crisis hit the sector hard, and even GWEC's forecast of a 12.5% annual market growth seemed overly optimistic to many in March 2009.

In fact, the annual market grew a staggering 41.5% compared to 2008. More than 38 GW of new wind power capacity was installed around the world in 2009, bringing the total installed capacity up to 158.5 GW. This represents a year-on-year growth of 31.7%. A third of these additions were made in China, which doubled its installed capacity yet again.

Wind energy is now an important player in the world's energy markets. The 2009 market for turbine installations was worth about 45 bn € or 63 bn US$ and GWEC estimates that about half a million people are now employed by the wind industry around the world.

The main markets driving this growth continue to be Asia, North America and Europe, each of which installed more than 10 GW of new capacity in 2009.

Asia's development driven by booming Chinese market

For the first time, Asia was the world's largest regional market for wind energy, with capacity additions amounting to 15.4 GW.

China was the world's largest market in 2009, more than doubling its capacity from 12.1 GW in 2008 to 25.8 GW, adding a staggering 13.8 GW of capacity, and slipped past Germany to become the world's second largest wind power market by a very narrow margin.

Global installed wind power capacity 2008/2009 (MW)

		End 2008	New 2009	Total end 2009
AFRICA & MIDDLE EAST	Egypt	365	65	430
	Morocco	134	119	253
	Iran	85	7	91
	Tunisia	20	34	54
	Cap Verde	12	0	12
	South Africa	8	0	8
	Israel	8	0	8
	Kenya	0	5	5
	Other [1]	4	0	4
	Total	**635**	**230**	**865**
ASIA	PR China	12,020	13,803	25,805
	India	9,655	1,271	10,926
	Japan	1,880	178	2,056
	Taiwan	358	78	436
	South Korea	236	112	348
	Philippines	33	0	33
	Other [2]	6	0	6
	Total	**24,188**	**15,442**	**39,610**
EUROPE	Germany	23,903	1,917	25,777
	Spain	16,689	2,459	19,149
	Italy	3,736	1,114	4,850
	France	3,404	1,088	4,492
	UK	2,974	1,077	4,051
	Portugal	2,862	673	3,535
	Denmark	3,163	334	3,465
	Netherlands	2,225	39	2,229
	Sweden	1,048	512	1,560
	Ireland	1,027	233	1,260
	Greece	985	102	1,087
	Austria	995	0	995
	Turkey	458	343	801
	Poland	544	181	725
	Belgium	415	149	563
	Rest of Europe [3]	1,313	304	1,614
	Total Europe	**65,741**	**10,526**	**76,152**
	of which EU-27 [4]	*64,719*	*10,163*	*74,767*
LATIN AMERICA & CARIBBEAN	Brazil	341	264	606
	Mexico	85	117	202
	Chile	20	148	168
	Costa Rica	74	50	123
	Nicaragua	0	40	40
	Caribbean	35	0	35
	Argentina	29	2	31
	Uruguay	20	0	20
	Jamaica	22	1	23
	Colombia	20	0	20
	Others [5]	6	0	6
	Total	**653**	**622**	**1,274**
NORTH AMERICA	USA	25,068	9,996	35,064
	Canada	2,369	950	3,319
	Total	**27,437**	**10,946**	**38,383**
PACIFIC REGION	Australia	1,306	406	1,712
	New Zealand	325	171	497
	Pacific Islands	12	0	12
	Total	**1,643**	**577**	**2,221**
	World total	**120,297**	**38,343**	**158,505**

Source:GWEC

1 Lebanon, Nigeria, Jordan

2 Thailand, Bangladesh, Indonesia, Sri Lanka

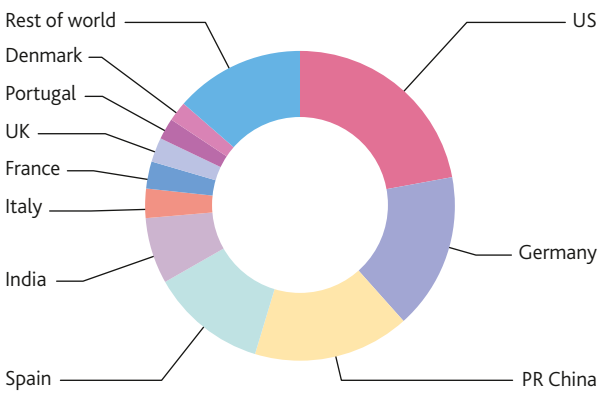
3 Bulgaria, Croatia, Czech Republic, Estonia, Faroe Islands, Finland, Hungary, Latvia, Lithuania, Luxembourg, Norway, Romania, Russia, Slovakia, Slovenia, Switzerland, Ukraine

4 Austria, Belgium, Bulgaria, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Ireland, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, UK

5 Cuba, Peru

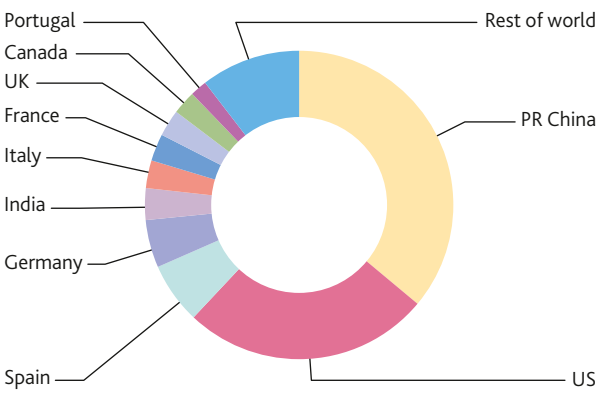
Please note:
project decommissioning of 134.3 MW and rounding affect the final sums

TOP 10 CUMULATIVE INSTALLED CAPACITY 2009



	MW	%
US	35,064	22.1
PR China	25,805	16.3
Germany	25,777	16.3
Spain	19,149	12.1
India	10,926	6.9
Italy	4,850	3.1
France	4,492	2.8
UK	4,051	2.6
Portugal	3,535	2.2
Denmark	3,465	2.2
Rest of world	21,391	13.5
Total top 10	**137,114**	**86.5**
World total	**158,505**	**100.0**

TOP 10 NEW INSTALLED CAPACITY 2009



	MW	%
PR China	13,803	36.0
US	9,996	26.1
Spain	2,459	6.4
Germany	1,917	5.0
India	1,271	3.3
Italy	1,114	2.9
France	1,088	2.8
UK	1,077	2.8
Canada	950	2.5
Portugal	673	1.8
Rest of world	3,994	10.4
Total top 10	**34,349**	**89.6**
World total	**38,343**	**100.0**

The growing wind power market in China has encouraged domestic production of wind turbines and components, and the Chinese manufacturing industry is becoming increasingly mature, stretching over the whole supply chain. According to the Chinese Renewable Energy Industry Association (CREIA), the supply is starting to not only satisfy domestic demand, but also meet international needs, especially for components. Two Chinese companies, Sinovel and Goldwind, are now among the world's top five turbine manufacturers, and there are first moves by Chinese manufacturers to enter the international markets.

The planning and development for the 'Wind Base' programme, which aims to build 127.5 GW of wind capacity in six Chinese provinces, is well underway, and construction has started on some projects. Given the current size of the market, it is expected that the even the unofficial target of 150 GW will be met well ahead of 2020.

India also continued growing its wind market with 1.3 GW of new installed capacity, bringing its total up to 10.9 GW. The leading wind power state remains Tamil Nadu with 4.3 GW installed, followed by Maharashtra and Karnataka.

With the introduction of a national Generation Based Incentive at the end of 2009, and a real push by the government to support renewable energy development, substantial growth is expected in the near future, and the industry forecasts additions of at least 2.2 GW for 2010.

Other Asian countries with new capacity additions in 2009 include **Japan** (178 MW, taking the total to 2.1 GW), **South Korea** (112 MW for a total of 348 MW) and **Taiwan** (78 MW for a total of 436 MW).

Horse Hollow wind farm, Texas, USA *© Wind Power Works*

North America: US boom continues

Against all expectations, the US wind energy market installed nearly 10 GW in 2009, maintaining its global leadership in installed capacity, increasing the country's installed capacity by 39% and bringing the total installed grid-connected capacity to 35 GW. The new wind energy projects completed in 2009 accounted for about 40% of the new power generation capacity added in the US during the year, and wind power now covers 2% of the country's total electricity demand.

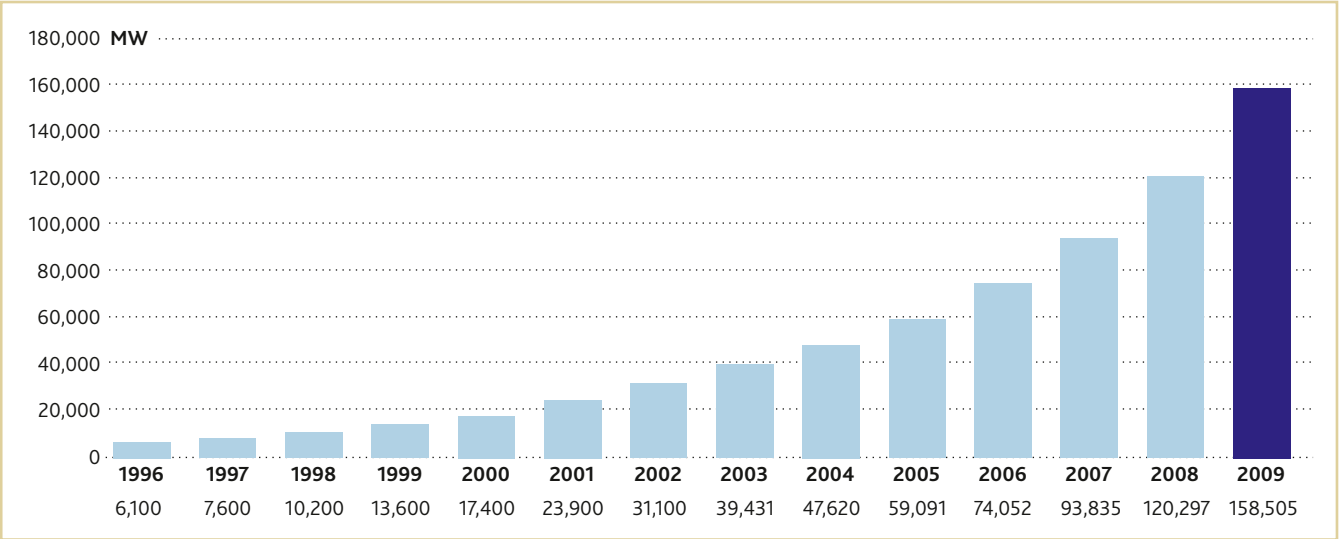
In early 2009, some analysts had foreseen a drop in wind power development of as much as 50%, but the implementation of the US Recovery Act with its strong focus on wind energy development in the summer reversed this trend.

36 of the 50 US states now have utility-scale wind installations and 14 states have more than 1,000 MW installed. Texas remains the leading state with more than 9 GW of total installed capacity, with Iowa in second place with 3,670 MW, followed by California, Washington state and Minnesota.

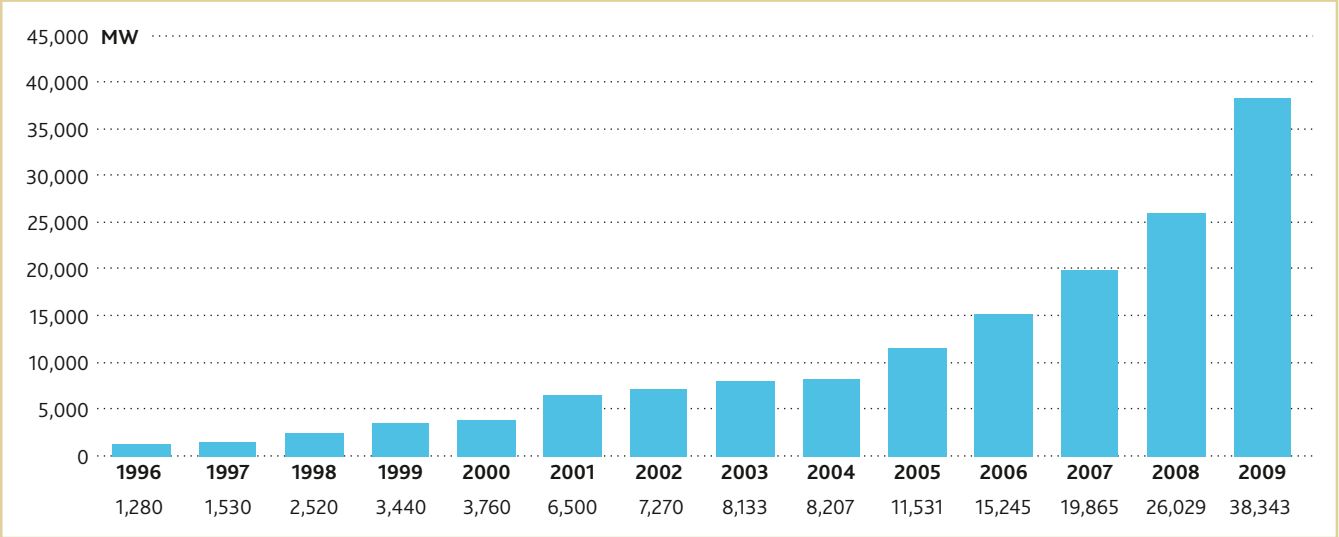
In terms of new capacity added in 2009, Texas again led the pack with 2,300 MW, followed by Indiana, which got started in wind late in 2008, and installed more than 900 MW in 2009. Oregon, Iowa and Illinois round out the top five in new capacity added in 2009.

Canada also experienced a record year with 950 MW of new capacity additions, bringing its total up to 3.3 GW. For the first time, every province now has an operating wind farm, collectively generating enough electricity to power more than one million Canadian homes, or about 1.1% of Canada's total electricity production.

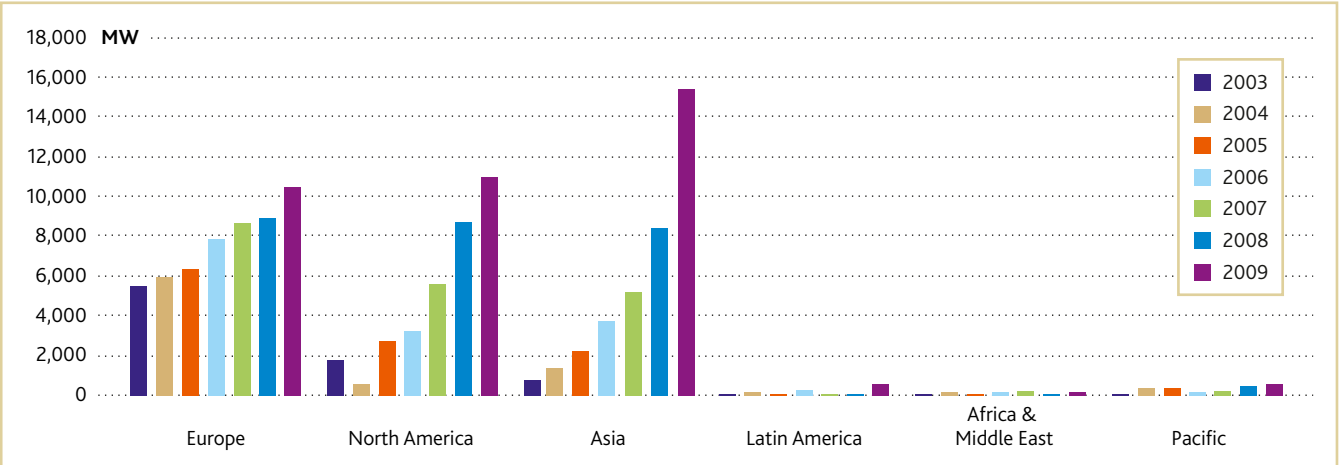
GLOBAL CUMULATIVE INSTALLED CAPACITY 1996-2009



GLOBAL ANNUAL INSTALLED CAPACITY 1996-2009



ANNUAL INSTALLED CAPACITY BY REGION 2003-2009



Horns Rev II, North Sea wind farm, Denmark *© Wind Power Works*

Ontario leads Canada's wind energy development with 1.2 GW of installed wind capacity. The province introduced its Green Energy Act in 2009, which introduced a feed-in tariff for wind power, and this is set to substantially boost wind power development in the province. Other leading wind energy provinces include Quebec (659 MW) and Alberta (590 MW).

Wind again fastest growing power technology in Europe

Europe, which has traditionally been the world's largest market for wind energy development, continued to see strong growth, also exceeding expectations. Once again, more wind power was installed than any other power technology, accounting for 39% of the total new generation capacity. Taken together, renewable energy technologies accounted for 61% of new power generating capacity in 2009.

10.5 GW were installed in Europe last year, including 582 MW offshore, taking the total wind power capacity up to 76.2 GW. While the traditional wind markets in Germany and Spain continue to drive investment, other 'second wave' countries are now firmly established, with new capacity additions of over 1,000 MW in 2009 in Italy, France and the UK. 11 out of the EU's 25 member states now have more than 1 GW of wind power capacity.

Investment in new European wind farms in 2009 reached €13 billion, including €1.5 billion offshore. The wind capacity installed by the end of 2009 will in a normal year produce 163 TWh of electricity, meeting 4.8% of total EU power demand.

Germany continues to lead Europe, adding 1.9 GW in 2009 for a total capacity of 25,777 MW. 38 TWh of wind-generated electricity was generated in Germany in 2009, in a wind year that was below average, accounting for about 7% of the country's total power consumption. The German wind power sector now employs around 100,000 people.

The leading federal state in Germany in terms of installed capacity is Lower Saxony with 6.4 GW. A number of states now receive 40% or more of their electricity from wind energy, including Saxony-Anhalt (47%), Mecklenburg-Vorpommern (41%) and Schleswig-Holstein (40%).

Marienkoog wind farm, Niebüll, Germany *© Wind Power Works*

Spain led the European league tables for new installed capacity, with additions of 2.5 GW of wind power, bringing its total up to 19.1 GW.

Wind energy now represents Spain's third largest power generation source with a production of 36.2 TWh in 2009, covering 14.5% of the country's electricity demand, compared to 11.5% in 2008.

Wind power installations in Spain are concentrated in four regions, which account for 70% of the country's total installed capacity. Castilla y Leon (3.9 GW) overtook Castilla-La Mancha (3.7 GW) as the region with the most wind power, followed by Galicia (3.2 GW). However, the greatest growth was in Andalusia, which added 1.1 GW of wind capacity, bringing its total up to 2.8 GW, and putting it in fourth place.

Italy, France and the **UK** all continued to show strong growth and added 1.1 GW each to their wind power capacity.

Italy now has a total installed capacity of 4.9 GW. The regions which added the most new capacity were Sicily, Puglia and Calabria, followed by Campania and Sardinia, but developments are also taking place in central and northern Italy, in regions such as Liguria, Piedmont, Veneto, Emilia Romagna and Tuscany. The Italian wind power sector now employs around 15,000 people.

France's wind capacity is also growing steadily and has now reached 4.5 GW, up from only 30 MW in 2000. In 2009 again, wind power was France's fastest growing power generation technology, accounting for 41% of all new capacity. In 2009, wind turbines generated 7.8 TWh of electricity, a 40% increase from 2008, but still only 1.6% of total power consumption.

In December 2009, the French government set itself a target for achieving 11.5 GW of installed wind energy capacity by 2012, 1.5 GW of which should be offshore, and 20 GW by 2020, including 6 GW offshore.

The **United Kingdom** also experienced a record year, and is now host to over 4 GW of wind power. The UK government launched its 'Renewable Energy Strategy' in July 2009, which includes a target of 15 % of final energy consumption from renewable sources by 2020 (up from 2% in 2008). The UK government would like see onshore wind grow from around 3.4 GW today to at least 13-14 GW by 2020, and suitable sites for up to 50 GW of offshore wind power development have been identified for this timeframe.

Latin America: new wind capacity in five countries

The Latin American market seems to be waking up to the opportunity of utilising its enormous wind power potential.

While growth in 2009 was still small in absolute terms, with 622 MW installed across the continent, this represented a doubling of the total installed capacity. In addition, the pipeline for new developments is substantial, with numerous large scale wind farms set to become operational in the coming years.

Brazil added 264 MW of new capacity, compared to only 94 MW in 2008, and is now host to 606 MW of wind farms.

Brazil's PROINFA program was initially passed by the Brazilian Congress in 2002 in order to stimulate the addition of over 1,100 MW of wind energy capacity, which was later expanded to 1,400 MW. It looks increasingly likely that the 1,100 MW target will be met, if not necessarily the full 1,400 MW. Currently, 154.4 MW of PROINFA projects are still under construction, and nearly 560 MW remain under development. Wind projects awarded through the PROINFA programme account for over 95% of wind power installations in Brazil.

Traditionally dominated by just one turbine manufacturer, Wobben Enercon, several other international players have now entered the Brazilian market, including Vestas, Suzlon and IMPSA.

In December 2009, the Brazilian energy regulator, Agencia Nacional de Energia Eletrica (ANEEL), hosted the country's first wind-only auction. Through that auction, 71 wind energy projects were contracted for a total capacity of 1,800 MW.

In 2009, **Mexico's** installed wind capacity more than doubled with 117 MW of new capacity added to the existing 85 MW operating at the end of 2008. The total installed wind power capacity now amounts to 202 MW. This increase was the result of two private self-supply projects brought online in 2009, "Parques Ecológicos de México" (79.9 MW) and the first phase of the "Eurus" project (37.5 MW).

Pacific region adds almost 500 MW

Australia's wind market had stagnated for several years, but started growing again in 2008 and continued this trend by adding a record 406 MW in 2009. This takes the total up to 1.7 GW, a doubling of the installed capacity in just two years. Australia is now home to 51 wind farms, with an annual wind generation output of around 4.3 TWh or 1.6% of Australia's national electricity demand. Southern Australia (740 MW) and Victoria (201.5 MW) are leading the Australian market.

Australia's expanded Renewable Energy Target (RET) Scheme was passed by the federal parliament in August 2009, mandating that 45 TWh or 20% of Australia's electricity supply to be sourced from renewable energy by 2020. The expanded target commenced on 1 January 2010 with an initial annual target of 12.5 TWh which will be gradually increased until 2020.

Following a disappointing year in 2008, the speed of development in **New Zealand** has picked up again with 171 MW of new wind capacity added in 2009, taking the total up to close to 500 MW. Wind energy now supplies just over 3% of New Zealand's annual electricity demand.

230 MW installed in Africa and Middle East

In North Africa, the expansion of wind power continues in **Morocco, Egypt, Tunisia** and **Kenya**. Morocco saw the largest addition of new capacity in 2009 (119 MW), bringing its total up to 253 MW, while Egypt continues to lead the region with a cumulative capacity of 430 MW, 65 MW of which were added in 2009. Other promising African countries include Kenya, where a 300 MW wind development is under way.

In the Middle East, Iran installed 7 MW of new capacity.

Wind power is the technology of choice

The continued rapid growth of wind power despite the financial crisis and economic downturn is testament to the inherent attractiveness of the technology. The drivers for wind power development still hold, and there is a need around the world for power generation which is clean, reliable and quick to install.

Although Copenhagen did not move us much closer to a global price on carbon, wind energy continued to grow due to national energy policy in the key markets. Many governments have realised the strategic long-term importance of renewable power generation and put it at the core of their economic recovery plans.

Market forecast for 2010-2014

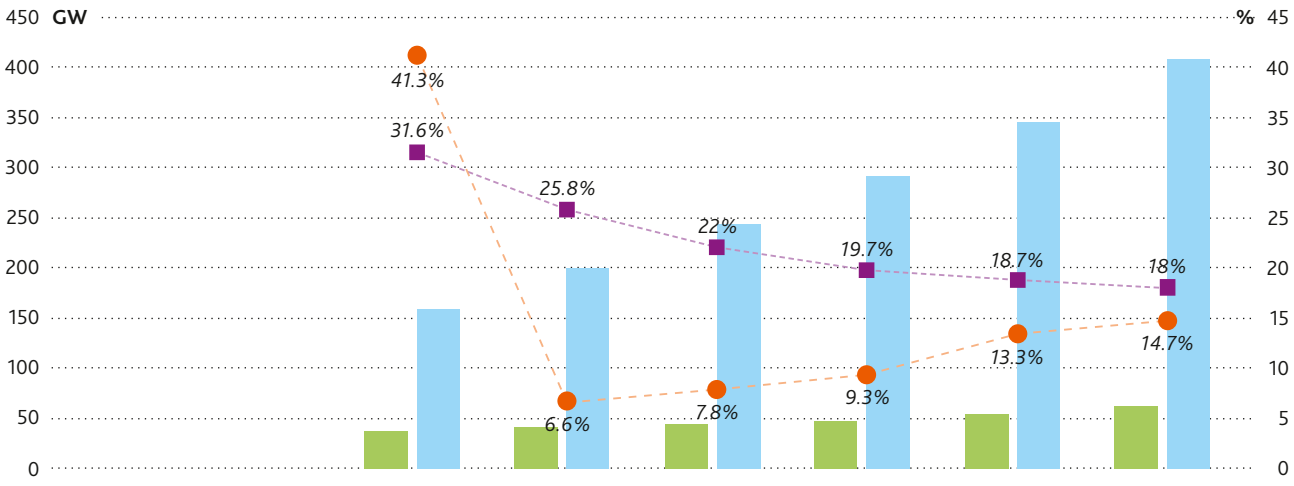
Grenzstrom Vindtved wind farm, Schleswig-Holstein, Germany *© Grenzstrom Vindtved*

GWEC's 5-year forecast for the development of the global wind energy industry has become a fixture of our annual report. Prognostication is always difficult, and never more so than in times of great economic uncertainty. In March 2009, at the height of the financial crisis, we were faced with the near impossible task to make predictions about the development of the wind sector for 2009 and beyond, but we gave it our best shot.

In the face of incredulity and disbelief from numerous financial analysts and energy experts, GWEC predicted a growth of 12.5% for the annual market in 2009, where others anticipated a down-turn, in many cases a dramatic one. In the event, we were wrong, but not nearly as wrong as just about everyone else, as the industry surprised us all with 41% market growth in 2009.

Since our first annual report in the spring of 2006, GWEC's predictions have followed a clear pattern: they seemed optimistic at the time, but were exceeded by the actual performance of the industry every single time. Nobody could have foreseen, on the basis of the evidence at hand, that the world's installed wind power capacity would grow by 170% in just five years, yet that is exactly what has happened. Of course, we hope that our forecast for the coming five years will be exceeded again in keeping with this fine tradition.

MARKET FORECAST 2010-2014



	2009	2010	2011	2012	2013	2014
Annual installed capacity [GW]	38.3	40.8	44.0	48.1	54.5	62.5
Cumulative [GW]	158.5	199.9	243.9	292.0	346.5	409.0
Cumulative capacity growthrate [%]	31.6	25.8	22.0	19.7	18.7	18.0
Annual installed capacity growthrate [%]	41.3	6.6	7.8	9.3	13.3	14.7

Over the past five years, two markets in particular have continuously outperformed all expectations – the US and China.

In the US, the development for 2010 will in all likelihood continue to be somewhat hampered by the lack of financing and the overall economic downturn. At the same time, just as they did in 2009, the provisions of the US government's Recovery Act, and in particular the grant programmes, will to some extent counteract the impacts of the crisis.

In China, growth is set to continue at a breathtaking pace, although it is difficult to see how the market could double yet again. Already in 2009, China accounted for one third of the total annual wind capacity additions, and it will remain one of the main drivers of global growth in the coming years.

GWEC predicts that in 2014, five years from now, global wind capacity will stand at 409 GW, up from 158 GW at the end of 2008. During 2014, 62.5 GW of new capacity will be added to the global total, compared to 38.3 GW in 2009.

The annual growth rates during this period will average 20.9% in terms of total installed capacity, and 10.3% for annual market growth. These rates are modest compared to past developments: in the last ten years, we have seen an average increase of over 28% for both total and annual capacity additions.

Regional distribution

Three regions will continue to drive the expansion of wind energy capacity: Asia, North America and Europe.

Asia will remain the fastest growing market in the world, driven primarily by China, which is set to continue the rapid upscaling of its wind capacity and hold its position as the world's largest annual market. Annual additions are expected

Zafarana wind farm, Gulf of Suez *© Wind Power Works*

to be well over 20 GW in China by 2014. This development is underpinned by a very aggressive government policy supporting the diversification of the electricity supply, supporting the growth of the domestic industry, and making significant investments in the transmission needed to get the electricity to market.

Sustained growth is also expected in India, which will increase its capacity steadily by 2 GW every year, and be complemented by growth in other Asian markets, including Japan, Taiwan, South Korea and the Philippines, and potentially some others.

For Asia as a whole, the annual market is expected to nearly double in the next five years, reaching 27 GW by 2014, which translates into 109 GW of new wind capacity to be installed in the region in five years – far more than in any other region of the world. In 2014, Asia is expected to overtake Europe as the region with the largest total installed capacity, with a cumulative 148.8 GW of wind generation.

We expect the **North American** market to stay pretty flat for the next two years, as the liquidity crisis continues to complicate financing, and the decrease in demand makes it more difficult to sign power-purchase agreements with utilities. Legislative uncertainty at the federal level in Canada is still a concern, although the outlook is brighter in a number of provinces. However, already in 2011 the market is expected to start to pick up, and by 2014, the annual North American wind market will have grown to 16.5 GW, taking the total up to 101.5 GW. This would translate into an addition of 63 GW in the US and Canada over the next five years.

Until 2013, **Europe** will continue to host the largest wind capacity. However, GWEC expects that by the end of 2014, Europe's installed capacity will stand at 136.5 GW, compared to Asia's 148.8 GW. By 2014, the annual market will reach 14.5 GW, and a total of 60 GW will be installed in Europe over this five year period.

Large scale offshore wind developments will in the coming years account for an increasing share of new wind capacity added in Europe, and by 2014, 2.7 GW (about 18%) of the annual market is expected to come from offshore installations. This share is forecast to grow rapidly and will lend new momentum to developments in the following years.

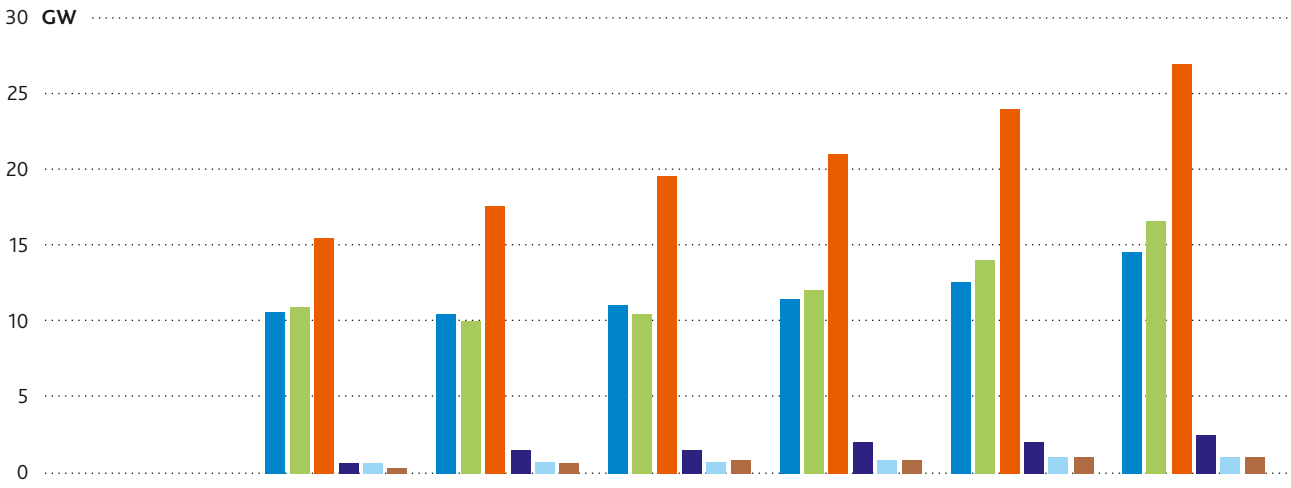
While Germany and Spain are expected to remain the leading European markets, the trend towards a larger number of strong markets will become more pronounced as Italy, France, the UK and Portugal continue expanding their wind capacity. There are also encouraging signs from growing markets in the new EU member states, especially in Poland, and some non-EU markets, such as Turkey. All of these countries are expected to contribute a larger share to the European total in the future.

GWEC expects wind energy installations in **Latin America** to be considerably stronger than previously thought. Encouraging developments in markets such as Brazil, Mexico and Chile lead us to believe that at the end of 2014, a total of 10.7 GW will be installed in the region, an increase of 9.5 GW from 2009. However, this is still a far cry from where many Latin American countries could be given the region's excellent wind resource. In many cases, the lack of favourable policy frameworks for wind power development and a lack of political commitment continue to hamper market development. Developments in the past year have shown that the region could still hold some suprises, however; and it may be that the expansion of the wind markets could be much larger than what we can see from where we are today.

In the **Pacific region**, both Australia and New Zealand seem to be firmly back in business, and the region is forecast to continue to grow at a steady pace to reach a pace of annual additions of 1 GW by 2014, up from 600 MW in 2009. This would bring the region's total installed capacity up to 6.4 GW by the end of 2014. Both countries have spectacular wind resources and a great untapped potential, which is only slowly being developed. However, especially in Australia, the political signals are encouraging, and the healthy wind development pipelines across the region suggest that even more than this could be achieved.

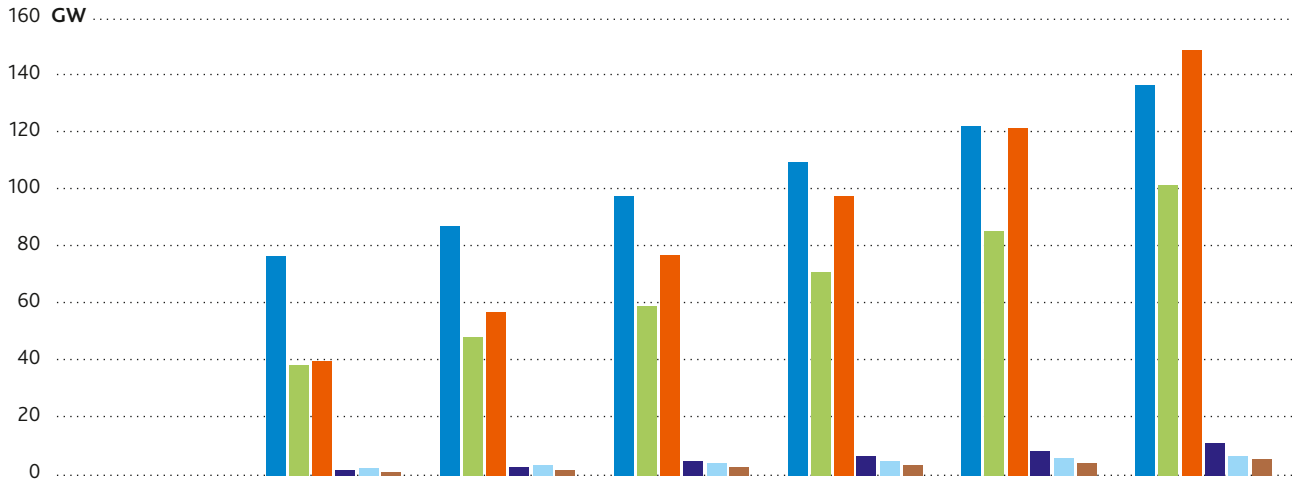
GWEC's outlook for **Africa** and the **Middle East** is least certain. In the medium-term, the regions will continue to be small players in the world's wind market with annual installations reaching 900 MW by 2014, taking the total capacity up to 5.1 GW. However, big plans in South Africa, and surprising developments in Kenya, Tanzania and Ethiopia suggest that we could see much stronger growth rates in the longer term.

ANNUAL MARKET FORECAST BY REGION 2009-2013



	2009	2010	2011	2012	2013	2014
Europe	10.5	10.5	11.0	11.5	12.5	14.5
North America	10.9	10.0	10.5	12.0	14.0	16.5
Asia	15.4	17.5	19.5	21.0	24.0	27.0
Latin America	0.6	1.5	1.5	2.0	2.0	2.5
Pacific	06	0.7	0.7	0.8	1.0	1.0
Middle East and Africa	0.2	0.6	0.8	0.8	1.0	1.0

CUMULATIVE MARKET FORECAST BY REGION 2009-2013



	2009	2010	2011	2012	2013	2014
Europe	76.2	87.0	98.0	109.5	122.0	136.5
North America	38.4	48.5	59.0	71.0	85.0	101.5
Asia	39.6	57.3	76.8	97.8	121.8	148.8
Latin America	1.3	2.7	4.2	6.2	8.2	10.7
Pacific	2.2	2.9	3.6	4.4	5.4	6.4
Middle East and Africa	0.9	1.5	2.3	3.1	4.1	5.1

Australia

Australia is host to world-class wind resources such as the Roaring Forties winds in southern Australia, and wind energy has already made a significant contribution to the country's clean energy mix. With the right policies in place, wind power will continue to increase its market share of the nation's electricity supply.

The foundations of the Federal Government's commitment to fight climate change and reduce its emissions are its proposed emissions trading scheme known as the Carbon Pollution Reduction Scheme (CPRS) and the recently legislated expanded Renewable Energy Target (RET). Wind energy is expected to be a major contributor to Australia meeting this target.

Four new projects became fully operational in 2009, adding 406 MW of capacity to the Australian electricity grid. At the close of 2009, there were 51 wind farms in Australia, with a total installed capacity of 1,712 MW. The estimated annual wind generation output in Australia from this capacity is 4,284 GWh or 1.6% of Australia's national electricity demand. Another seven projects totaling 588 MW are under construction and expected to be commissioned within the next three years.

© Verve Energy

The long-term pipeline

An additional 6,794 MW of projects are currently proposed for development in Australia. The developers of these projects have either received planning and environmental approvals or are currently applying for them. Projects with a total of 6,147 MW are undergoing feasibility studies.

Newly added wind power capacity in 2009

Owner	Location	State	Installed Capacity
Acciona	Waubra	Victoria	192 MW
Infigen Energy	Capital Wind Farm	New South Wales	141 MW
Pacific Hydro	Portland Stage 3 (Cape Nelson South)	Victoria	44 MW
Origin Energy	Cullerin Range	New South Wales	30 MW

Wind farms under construction

Owner	Location	State	Expected Commission Year	Installed Capacity
AGL	Hallett Stage 2	South Australia	2010	71.4 MW
Pacific Hydro	Clements Gap	South Australia	2010	56.7 MW
Union Fenosa	Crookwell 2	New South Wales	2010	92 MW
Infigen Energy	Lake Bonney Stage 3	South Australia	2010	39 MW
AGL	Oaklands Hill	Victoria	2011	67.2 MW
Roaring 40's	Musselroe	Tasmania	2011	129 MW
AGL	Hallett Stage 4 (Nth Brown Hill)	South Australia	2012	132.3 MW

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
MW	32	73	105	198	380	708	817	824	1,306	1,712

Installed wind capacity in Australia by state

State	Installed Capacity (MW)
South Australia	740
Western Australia	201.5
Victoria	428
Tasmania	143
New South Wales	187
Queensland	12.5
Total	**1,712**

While each of the six Australian states now generates wind power, South Australia's 740 MW provides more than 40% of the national total, followed by Victoria (428 MW) and Western Australia (201.5 MW).

The policy environment

Although there are many wind farm projects currently proposed, uncertainty around the future of the Federal Government's Carbon Pollution Reduction Scheme (CPRS) and difficulties with the recently legislated expanded Renewable Energy Target (RET) have resulted in many of them stalling. The global financial crisis has impacted upon the lending practices and risk appetite of banks, leading to difficulties in securing financial commitment.

THE CARBON POLLUTION REDUCTION SCHEME

The CPRS is a cap and trade emissions trading scheme planned to commence in July 2011. The emissions reduction target under the scheme will be 5% of 2000 emissions by 2020, and this could rise to 25% by 2020 with an international agreement. The long-term target is 60% by 2050. The CPRS legislation has been before the Australian Parliament three times, but without bipartisan support has so far been rejected. With the possibility of an Australian federal election in 2010, the CPRS could play a significant part in the government's policy position.

THE EXPANDED RENEWABLE ENERGY TARGET

The expanded RET Scheme was passed by federal parliament in August 2009, mandating that 45,000 GWh or 20% of Australia's electricity supply will be sourced from renewable energy in 2020, four times the previous 2001 mandatory renewable energy target (MRET). The expanded target commenced on 1 January 2010 with an initial annual target of 12,500 GWh which will be gradually increased until 2020.

Renewable energy generation under the RET scheme creates renewable energy certificates (RECs). As a result of other support measures for domestic small scale technologies, there is currently an oversupply of these certificates which has caused the REC spot price to ease to almost half of what it was worth a year ago. This has made it difficult for wind developers to obtain finance for their projects, and resulted in delays in the development of large scale wind farms.

On 26 February 2010 the Australian government announced amendments to the RET scheme in order to rectify existing problems. The amendments foresee that from January 2011, the scheme will include two parts – the Small-scale Renewable Energy Scheme (SRES) and the Large-scale Renewable Energy Target (LRET), the combination of which is hoped to achieve the 20% target. The LRET portion of the target will be increased to ensure that target is still met if the uptake of small scale technologies is lower than anticipated. An industry consultation process will follow this announcement, and the government intends to pass the amended legislation in the winter sittings of Parliament.

GREENPOWER SCHEMES

While the main incentive program for wind farms is through the renewable energy target, GreenPower schemes are becoming increasingly popular. These schemes allow consumers to purchase renewable energy from their electricity utility. More than 900,000 domestic and commercial customers have taken up GreenPower since its inception in 1997. There are also state based feed-in tariff or buyback schemes for domestic scale wind technology that provide some level of payment or credit towards electricity bills.

NATIONAL WIND FARM DEVELOPMENT GUIDELINES

In October 2009 the Environment Protection and Heritage Council (EPHC) released its draft National Wind Farm Development Guidelines for public consultation. The draft was developed to address the need for greater consistency in the approach to wind farm developments. It focuses on environmental and social aspects of wind farm development and contains provisions for community consultation, noise, shadow flicker, landscapes, birds and bats, and electro-magnetic interference. A final draft is expected in 2010.

With input from the Clean Energy Council (Australia)

Brazil

Praia Formosa wind farm *© SIIF*

Wind and hydro power – perfect partners

The total electricity generation capacity in Brazil stood at 107.5 GW in early 2010, of which 74% came from renewable sources, mostly large hydroelectric power plants.

Historically, Brazil has relied heavily on its abundant hydroelectric resources for power generation, and gas-fired thermal power plants for system reliability purposes. However, with most remaining larger hydro resources located in the Amazon region and growing awareness of the need to preserve forests and mitigate climate change, the addition of new large hydro and thermal plants is problematic. There is a growing interest in Brazil to develop new renewable energy sources, and the excellent seasonal complementarity of wind energy with hydro power is gaining acceptance.

A tremendous wind resource

A wind atlas published by the Electric Power Research Centre - CEPEL/ELETROBRÁS in 2001 shows a potential for onshore wind energy capacity of 143 GW in Brazil (at 50 meters height). In 2008 and 2009, new measurements carried out in several states based on measurements at 80-100 meters indicate that the real potential is considerably higher, probably more than 350 GW.

Large unpopulated land areas and a coastline of 9,650 km add to Brazil's prime position as a wind energy giant. The best wind resources in terms of wind speed and capacity factor are in the North/Northeast region, in particular, in the states of Rio Grande do Norte, Ceara, Pernambuco and Bahia. The South/Southeast region also has good quality resources (Rio Grande do Sul and Santa Catarina).

The PROINFA scheme

In 2002, the Brazilian government established the "Programa de Incentivo às Fontes Alternativas de Energia Elétrica" (PROINFA), a programme designed to boost the uptake of renewable energy sources in the Brazilian electricity mix. PROINFA's main objective was to increase the share of renewable energy to 10% of Brazil's electricity supply by 2020. The first phase of PROINFA comprised an auction for 3,300MW of wind, biomass and small and medium-sized hydropower (1,100 MW for each technology), held in 2004.

In the event, wind power projects were contracted by the state-owned utility, Eletrobras, for over 1,400 MW under 20-year power purchase agreements, while the Brazilian Development Bank (BNDES) provided long-term financing to the developers.

The deployment of the new renewable energy projects was expected to conclude by 2006. A second phase of PROINFA would then stimulate investments for the remaining capacity required to lift the share of renewable energy to a 10% share of the Brazilian power supply. PROINFA's investments could not be fully completed by 2006 due to a number of challenges, and the programme was extended.

TOTAL INSTALLED CAPACITY

year	2002	2003	2004	2005	2006	2007	2008	2009
MW	22	29	29	29	237	247	341	606

Wind projects awarded through the PROINFA programme account for over 95% of wind power installations in Brazil. Currently, 154.4 MW are still under construction, and nearly 560 MW remain under development. As a result, it seems increasingly likely that PROINFA will achieve at least the planned target of 1,100 MW of wind projects.

Market Developments in 2009

The Brazilian wind market grew by 264 MW in 2009, bringing the total installed capacity up to 606 MW. By mid-March 2010 this figure already reached 709 MW as additional PROINFA wind farms started operations[1)].

In December 2009, the Brazilian energy regulator, Agencia Nacional de Energia Eletrica (ANEEL), hosted the first wind only auction. Through that auction, 71 wind energy projects were contracted for a total capacity of 1,800 MW, awarded in the following regions:

- **Rio Grande do Norte** – 657 MW in 23 wind farms
- **Ceará** – 542 MW in 21 wind farms
- **Bahia** – 390 MW in 18 wind farms
- **Rio Grande do Sul** – 189 MW in eight wind farms
- **Sergipe** – 30 MW in one wind farm

At the time, ANEEL established a price ceiling of R$189 (74 €/102 US$) per MWh. Although this was already lower than expected, the average price achieved in the auction dropped to R$148 per MWh (57.49 € / 84.06 US$ on the day of the auction), as the result of the competition among developers of the more than 13 GW of wind projects that had already been licensed by ANEEL for this purpose.

While the price achieved may well make wind power in Brazil less profitable than some may have hoped, the sheer volume of the auctioned capacity also shows that the Brazilian wind market is a sleeping giant, and that we may finally see some continuity in the development of wind energy in Brazil.

Six major wind turbine manufacturers successfully received orders following the auction: GE, IMPSA Wind, Siemens, Suzlon, Vestas and Wobben/Enercon. These foreign suppliers will gradually become eligible for BNDES financing, based on their commitment to manufacture wind turbine generators in Brazil within a short time frame.

BNDES strictly finances equipment with 60-80% of local manufacturing (or value added), and until now, foreign wind turbines were not eligible for financing, which has limited competition between manufacturers. Now that key manufacturers will become eligible for BNDES financing, capital expenditure is expected to normalize as more projects will become competitive.

There have been additional positive signs for the wind industry, with some Federal and State Tax relief designed to stimulate investment, including moves to eliminate import taxes for wind equipment, as well as the state and municipal tax on circulation of goods and services between jurisdictions (ICMS). The latter has been eliminated for wind-related equipment and services during the period of construction expected for reaching the 1,800 MW.

One or two additional auctions comprising wind energy are expected for 2010, the details of which will be announced closer to the date.

Key Players in the Brazilian Market

Historically, only one wind turbine manufacturer, Wobben Windpower, a subsidiary of German company Enercon, was present in the Brazilian market, with two manufacturing plants. More recently other suppliers have begun to enter the market included the Argentinean company IMPSA, as well as Suzlon and Vestas, which have both sold turbines to PROINFA projects.

The number of developers and operators in the wind energy market has also been growing considerably. This was particularly visible during the wind auction, given that two thirds of the contracted wind projects belonged to developers that had not participated in PROINFA in 2004.

Established developers also continue their activities, including foreign companies like Enerfin/Elecnor, Iberdrola, IMPSA/ Energimp, Martifer, and Pacific Hydro. Local sponsors have become increasingly active, such as Brennand, Dobreve, ERSA, Renova and Servtec, as well as Brazilian utilities market, including CEMIG, CPFL Energia, Eletrobras, and EDP/Energias do Brasil.

With input from the Brazilian Wind Energy Association (ABEEolica).

1 Agencia Nacional de Energia Eletrica (ANEEL), Banco de Informacoes de Geracao, accessed on March 15, 2010; http://www.aneel.gov.br

Canada

Canada ranks 11th in installed capacity in the world, but this stands in sharp contrast to the immense possibilities the Canadian geography and wind resource provide for wind energy development, and is at odds with growing electricity demands and global climate concerns.

CanWEA's WindVision 2025 strives to bring Canada more in step with the global development of wind energy by setting a goal of producing 20% or more of the country's electricity from wind energy by 2025.

The year 2009 marked the best year to date for Canada's national wind energy market with 950 MW of new installed capacity bringing the total to 3,319 MW. For the first time, every province now has an operating wind farm, collectively generating enough electricity to power more than one million Canadian homes – or about 1.1% of Canada's total electricity production. This amounts to a ten-fold increase in capacity in the last six years. Wind energy projects built in 2009 represented a minimum of C$2 billion in new investment.

There is every reason to believe that 2010 will also be a record-breaking year given that new procurement processes are underway to launch signing of new power purchase agreements for wind energy projects in at least six provinces.

The national policy framework for wind energy in Canada

Canada's ecoENERGY for Renewable Power Program was established in 2007 to support the deployment of approximately 4,000 MW of new low-impact, renewable electricity projects by 31 March 2011. The mechanism offers payment of C$0.01/kWh (before tax) for the first 10 years of a project's life. However, the program became a victim of its own success, with applications exceeding the C$1.48 billion budget. As a result, the set target was met well ahead of schedule. In March 2010, the federal government took a decision not to extend and expand the programme, so the future of the programme remains uncertain.

Developments in 2009 at provincial and national level

TOTAL INSTALLED CAPACITY BY PROVINCE

Province	MW installed
Yukon	0.81
British Columbia	102
Alberta	590
Saskatchewan	171.2
Manitoba	104
Ontario	1,168
Quebec	659
New Brunswick	195
Nova Scotia	110
Prince Edward Islands	164
Newfoundland and Labrador	54.4

FEED-IN TARIFF IN ONTARIO, CANADA'S LEADING WIND ENERGY PROVINCE

Ontario leads Canada's wind energy development with 1,168 MW of installed wind capacity, with another 647 MW of additional wind energy projects currently under contract.

The province's Green Energy Act, which represents Canada's most comprehensive policy framework to support wind energy deployment, was announced in 2009. This act introduced a feed-in-tariff offering C$0.13/kWh for onshore wind farms, with an extra cent added on for small-scale community projects and an additional C$0.015/kWh for First Nations projects, i.e. wind projects involving the participation of Aboriginal communities. For offshore projects, the tariff will be C$0.19/kWh.

It is expected that the first effects of this new mechanism will be felt in 2010, when the first 20-year contracts will be signed.

The Ontario Power Authority's Integrated Power System Plan has called for 4,600 MW of wind energy by 2020. Three new wind energy projects came on line in the province in 2009, including Enbridge's 181.5 MW Ontario Wind Power Project, Sky Generation's 6.6 MW Proof Line project and TransAlta's 197.8 MW Wolfe Island Wind project.

TOTAL INSTALLED CAPACITY

year	2001	2002	2003	2004	2005	2006	2007	2008	2009
MW	198	236	322	444	684	1,460	1,846	2,369	3,319

Other leading wind energy provinces include Quebec (659 MW), Alberta (590 MW), followed at some distance by New Brunswick (195 MW), Saskatchewan (171 MW) and Prince Edward Island (164 MW), the latter of which has a target of 500 MW of wind by 2013. British Columbia was the last Canadian province to install wind energy, with a 102 MW project that came online in 2009.

Outlook for 2010 and beyond

The outlook for wind energy development in Canada remains very positive, with many provinces having signed contracts for expanding their wind energy capacity in 2010 and beyond. This includes two projects totaling 114 MW in New Brunswick, close to 200 MW in Nova Scotia, 169 MW in British Columbia. In Quebec, the government-owned utility Hydro-Quebec, has signed power purchase agreements for another 2,672 MW to be installed between now and 2015.

The year 2010 will also lay the foundation for future growth, with the results of competitive tenders announced in British Columbia, Saskatchewan, Quebec, Prince Edward Island and New Brunswick, and with the first feed-in tariff contracts signed in Ontario.

Improved policy frameworks at provincial level will also help the development of wind power in Canada. Nova Scotia, for example, is considering new policy approaches with respect to its renewable portfolio standard. The new standard would require that 25% of the province's electricity needs to be met with renewable sources by 2015.

Challenges for wind power development in Canada

ECOENERGY FOR RENEWABLE POWER PROGRAM

The biggest challenge for the Canadian wind energy industry going into 2010 is the uncertain future of federal incentives to support renewable energy development from the ecoEnergy programme.

CanWEA and other renewable energy organizations are calling on the government to either expand and extend the program in its 2010 budget or to put in place an alternative mechanism, such as a capital grant program, to ensure federal support for the wind industry continues. Failure to capitalize on this windfall would result in significant flow of capital from Canada to the US as investors move to take advantage of the more profitable wind energy investment opportunities that exist there as a result of the Obama administration's economic stimulus package.

West Cape Wind Farm, Prince Edward Islands
© GDF SUEZ Energy North America

INDUSTRY RESPONSE TO SOUND AND HEALTH

During 2009, wind development in Canada was continuously challenged by concerns over noise and the health effects of wind farms on local residents. In December 2009, an international panel of experts released a report based on a review of a large body of scientific literature on sound and health effects, and specifically with regard to sound produced by wind turbines. After extensive review, analysis and discussion, the panel has concluded that sounds or vibrations emitted from wind turbines have no adverse effect on human health[1].

With input from the Canadian Wind Energy Association (CanWEA)

1 Wind Turbine Sound and Health Effects – An Expert Panel Review. December 2009 http://www.canwea.ca/pdf/talkwind/Wind_Turbine_Sound_and_Health_Effects-Executive_Summary.pdf

PR China

Yan Kau wind farm, Rudong *© Wind Power Works*

China (excluding Taiwan) was the world's largest market in 2009, more than doubling its capacity from 12.2 GW in 2008 to 25.8 GW, adding a staggering 13.8 GW of capacity, and just slipping past Germany to become the world's number 2 in total installed capacity.

China's wind resources – a new assessment

At the end of 2009, the China Meteorological Administration published a new wind assessment, based on measurements at 50m height. This shows that China has a potential to develop 2,380 GW of class 3 wind power (avg. wind power density >300 W/m_2) and 1,130 GW for class 4 (average wind power density >400W/m_2), while the offshore potential (water depth 5-25m) reaches 200 GW for class 3.

Construction started on Wind Base programme

In 2008, the newly-established National Energy Administration highlighted wind energy as a priority for diversifying China's energy mix, which is currently heavily reliant on coal. The bureau selected six locations from the provinces with the best wind resources, and set target for each of them to be reached by 2020:

- Xinjiang Hami (10.8 GW)
- Inner Mongolia (20 GW in Inner Mongolia East and 37 GW in Inner Mongolia West)
- Gansu Jiuquan (12.7 GW; this started its first construction phase in August 2009)
- Hebei (14 GW in the Northern part and coastal areas)
- Jilin (23 GW)
- Jiangsu (3 GW onshore and 7 GW offshore)

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
MW	346	402	469	567	764	1,260	2,599	5,910	12,020	25,805

The planning and development for this 'Wind Base' programme, which aims to build 127.5 GW of wind capacity in six Chinese provinces, is well underway, and construction has started on some projects. The programme will be key to reaching the Chinese government's National Mid and Long-Term Development Plan of 3% non-hydro renewable electricity production by 2020.

Offshore development

In April 2009, the National Energy Administration (NEA) asked each coastal province to compile a provincial offshore wind development plan, and divided China's potential offshore wind sites into three categories, depending on the depth of water: an 'inter-tidal' zone for water depth of less than 5 m; an 'offshore' zone for water depth of 5-50 m; and a 'deep sea' zone deeper than 50 m.

The provincial governments are required to draft offshore development plans for 'inter-tidal' and 'offshore' wind development up to 2020.

Although offshore wind development is still in its infancy in China, the first projects already started construction in 2009. The Shanghai Donghai Daqiao project will have a total capacity of 102 MW, consisting of 34x3MW offshore turbines manufactured by the Chinese market leader Sinovel. By the end of 2009, 20 turbines had already been installed, three of them connected to the power grid.

The Chinese Renewable Energy Law

The breathtaking growth of the Chinese wind energy industry has been driven primarily by national renewable energy policies. The start of the government's active engagement in renewable energy development dates back to 2004, when the nation was drafting its first "Renewable Energy Law". The law was adopted in 2005 and entered into force in 2006. It gave huge momentum to the development of renewable energy and the wind industry has grown at a frantic pace since then.

The Renewable Energy law marks a major shift in energy policy towards market supportive policies for renewables. It stipulates, for the first time, that grid companies have the obligation to purchase the full amount of the electricity produced from renewable sources. Already in 2005, when the law was passed, the annual growth of the Chinese wind market reached 60%, followed by four consecutive years of over 100% growth.

In 2007, the first implementation rules for the Renewable Energy Law emerged, giving further impetus to wind energy development. In addition, the "Medium and Long-term Development Plan for Renewable Energy in China", released in September 2007, set out the government's long term commitment to renewable energy up to 2020, putting forward national renewable energy targets, priority sectors, and policies and measures for implementation.

For the first time, the Plan set a target for a mandatory market share (MMS) of electricity from renewable sources. By 2010 and 2020, electricity production from non-hydro sources should account for 1% and 3% of total electricity in the grid. It also requires larger power producers to source 3% of their electricity from non-hydro RES by 2010, and 8% by 2020. The MMS indicates a target of about 18-20GW by 2010 and 80-100GW by 2020 for all non-hydro renewable sources. It is worth noting the 2010 target has been exceeded by wind power alone by a considerable margin.

Renewable Energy Law 2009 Amendments

An amendment to China's Renewable Energy Law was introduced in 2009, reiterating priority grid access for wind farms, a stipulation which had previously not been enforced. In addition, the new amendment requires grid operators to purchase a certain fixed amount of renewable energy, and penalties for non-compliance are foreseen. The State Council energy department together with the state power regulatory agency and the State Council finance departments will be responsible for determining the proportion of renewable energy in the overall generating capacity, and draw up a detailed implementation plan for requiring grid companies to purchase the full amount of renewable electricity produced.

The amendment also requires grid companies to enhance the power grid's capability to absorb the full amount of renewable power produced. Grid companies can apply for subsidies from a newly established 'Renewable Energy Fund' to cover the extra cost for integrating renewables if necessary.

Yan Kau wind farm, Rudong *© Wind Power Works*

The Renewable Energy Fund was also introduced by the amendment, and it is designed to serve as the central fund to combine the Renewable Energy Premium (see below) and the government funding for renewables. It is not yet clear how this fund will be managed.

The Renewable Energy Premium

The Renewable Energy Law stipulates that the price difference between the electricity from renewable energy and that from coal fired power plants should be shared across the whole electricity system. To fulfill this objective and to finance the electricity from renewable energy sources, in the implementation regulations of the Renewable Energy Law published in 2006, there is a 0.001RMB/kWh (€0.01 cent) Renewable Energy Premium added to the cost of each kWh of electricity sold, aiming to cover the difference between electricity from coal-fired power plants and electricity from renewable energy. In 2008, the premium was raised to 0.002RMB/kWh (€0.02 cent) and again in November 2009 to 0.004RMB/kWh (€0.04 cent), to keep up with soaring renewable energy (mainly wind) development.

Feed-in-tariff regulation

Also in 2009, the Chinese government introduced a feed-in tariff for wind power, which applies for the entire operational period of a wind farm (20 years). There are four different categories of tariff depending on a region's wind resources, ranging from 0.51RMB/kWh (€5.4 cents) to 0.61RMB/kWh (€6.5 cents). This is considerably higher than the tariff paid for coal-fired electricity.

Prior to the introduction of the feed-it tariff, a dual track system existed in China, with a concession tendering process on the one hand, the project-by-project "government approval" process on the other. The new feed-in tariff now replaces both these processes.

The level of the new feed-in tariff is comparable to that of the government approved tariffs over the past several years in most regions and is substantially higher than the concession tariff. It gives investors a much clear idea of the long-term framework for the sector.

Is the Chinese wind manufacturing market overheating?

The Chinese government has been very successful in fostering a domestic turbine manufacturing industry through a variety of measures, including a local content requirement, by sharing the burden of the extra costs related to wind power across all the provinces, and by setting a mandatory renewable energy market share for the big utilities.

All these factors have driven the wind market to develop rapidly and to stimulate the wind manufacturing business. By the end of 2009, there were almost 80 wind turbine manufacturers, 30 of which had actually already sold wind turbines. In January 2009, a change in the VAT rules for wind manufacturing made it even more attractive for local governments to attract wind turbine manufacturing to their province, thereby even further stimulating growth in manufacturing capacity.

The Chinese government has signaled that it is worried about an 'overheating' of the wind manufacturing market. Already now, the three largest domestic manufacturers (Sinovel, Goldwind and Dongfang) have a combined production capacity of 8.2 GW for an annual market of 13.8 GW. Even in a booming market like China's it seems unlikely that all current Chinese manufacturers will survive this tough competition, and many will be squeezed out of the market. However, the government has taken no concrete measures to counteract this situation to date, and it is important to emphasise that the concerns expressed are not aimed at discouraging wind farm developers, but solely manufacturers.

Abolishment of the 70% local content requirement

The 70% local content requirement was introduced in 2004 when most of turbines in the then very small Chinese market were imported. After five years, the domestic wind turbine manufacturing industry is now the world's largest, and no longer needs such policies.

2009 was a turning point for the domestic industry, in the sense that it has completed its localization and is now gearing up for the international market. Although there were only 17 Chinese made wind turbines exported in 2009 (to the US, India and Thailand), Chinese turbine manufacturers appear ready to enter the international market.

Outlook for 2010 and beyond

Grid infrastructure continues to be a serious issue in China, and Chinese manufacturers have set themselves the task of improving the quality and reliability of their products, so it is expected that the rate of annual market growth will slow down somewhat, although it is expected that the annual market will continue to grow.

The offshore wind market is now starting to take off. Inter-tidal and relatively shallow offshore demonstration projects have been established in a number of coastal provinces. The National Energy Administration will soon begin a concession tendering process to find a reasonable tariff level for offshore wind power.

With input from the Chinese Wind Energy Association (CWEA)

Yan Kau wind farm, Rudong *© Wind Power Works*

Denmark

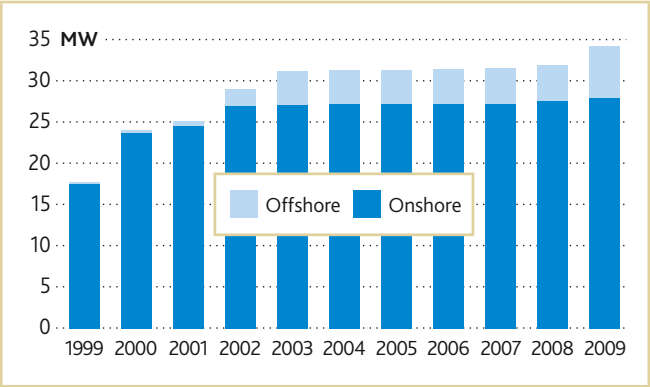
Denmark is the pioneer of wind energy development in Europe, and its wind farms now provide enough power to cover 20% of the country's electricity needs. However, the Danish Transmission System Operator Energinet.dk estimates that much more could be done, and it has set itself a target for wind power to account for 50% of Denmark's power demand by 2025. This target would be met by roughly 2,500 wind turbines, both on and offshore. The Danish Wind Industry Association (DWIA) believes that this could be achieved by 2020 already.

2009 represented a turning point for wind energy in Denmark. For the first time in seven years, new large scale projects came online.

Main market developments in 2009

Compared to previous years, Denmark saw a significant rise in installations in 2009, with 97 MW of new capacity being erected on land and 237 MW offshore in Danish waters, bringing the total installed wind capacity up to 3,465 MW at year end. This included the world's largest offshore wind farm, Horns Rev II, with 91 wind turbines totalling 209 MW of capacity.

CUMULATIVE WIND CAPACITY IN DENMARK (1999-2009)



Source: DWIA

The Danish wind energy industry

Denmark is home to two of the world's largest wind turbine manufacturers: market leader Vestas Wind Systems, and Siemens Wind Power dominate the Danish market and also have a major presence in the European and global markets. Gamesa, Suzlon and Nordex are also present in Denmark.

The wind industry is today among the most significant export industries of the Danish economy. In 2008, the combined export of wind energy technology and services was valued at some DKK 42 billion (€5,6 billion), which corresponds to approximately 7.2% of total Danish exports. At this rate, by 2010, wind energy technology and services will become Denmark's largest industry in terms of turnover (around DKK 84 billion, i.e. €11.3 bn) and exports.

Employment in the industry is also growing steadily, with an increase from 10,000 in 1997 to 28,400 in 2008.

Denmark – an early mover in wind energy

Denmark has a long history of combating climate change and promoting renewable energy. In 1988, two years after the Chernobyl disaster, the Danish government banned the construction of nuclear power reactors. In 1990, the third Danish energy plan set ambitious plans for the use of renewable energy sources, including a 1,300 target for wind power development by 2000. This was subsequently promoted by a favourable feed-in tariff. This goal was expanded in 1996 to 1,500 MW by 2005 for onshore wind power, and an additional 4,000 MW of offshore wind power by 2030.

In the 1980s, Danish families were offered tax incentives for generating their own power within their own or a nearby community. As a result, the first wind turbine cooperatives emerged to invest in community wind turbines. By 1996, around 2,100 such cooperatives existed throughout the country, and this created the basis for continuing strong popular support for wind power in Denmark. By 2001, wind turbine cooperatives, which counted more than 100,000 families, had installed 86% of all turbines in Denmark.

As private sector involvement grew, this proportion has started to fall. However, new legislation from January 2009 is aimed at stimulating local engagement and local ownership of new wind turbines. The Renewable Energy Act imposes an obligation on all new wind energy projects to offer 20% ownership to local resident, including cooperatives.

In 2002, Danish feed-in tariffs were reduced substantially, and the market stalled until 2008, when the new support framework was introduced.

TOTAL INSTALLED CAPACITY

year	2001	2002	2003	2004	2005	2006	2007	2008	2009
MW	2,489	2,889	3,115	3,123	3,127	3,135	3,124	3,136	3,465

Today, the main policy support mechanism for wind energy in Denmark is an environmental premium of DKK 0.25/kWh (€3.4 cents) for 22,000 full load hours (~10 years) added to the market price. In addition to this, an additional compensation for balancing costs of DKK 0.023/kWh (€0.3 cents) is added.

For offshore wind farms, the grid connection costs are socialised among all electricity consumers, and special tariffs are set, often after competitive tenders.

A tendering procedure is being used for the 400 MW Djursland-Anholt offshore wind farm, which will be concluded in April 2010. This wind farm is expected to start operations in 2012/2013.

Offshore wind energy in Denmark

With about 7,300 km of coastline, shallow waters and strong winds, Denmark is a prime candidate for offshore wind power development, and the country is now host to 305 offshore wind turbines totaling a capacity of 646 MW, second only to the UK. In 2009, 230 MW of offshore wind power were installed in Denmark, which represented 40% of the total 2009 European offshore market. The world's largest offshore wind farm, Horns Rev II, became operational in 2009.

Denmark is also a key player in terms of supplying offshore technology, and Danish manufacturers Siemens Wind Power and Vestas Wind Systems accounted for close to 90% of Europe's new installed offshore capacity in 2009.

However, despite the favourable conditions, Danish projects only make up around 3% of the European pipeline of 16,000 MW of offshore projects. In order to exploit the country's full potential, the Danish industry has therefore called for a political decision on 2020 goals for offshore wind development.

Repowering

Denmark has been an early mover on developing wind power projects, and many of the wind turbines installed in the 1980s and 1990s are now reaching the end of their lifespan. As a result, there is a substantial opportunity in 'Repowering', i.e. replacing many of the current 5,200 wind turbines with new and more efficient ones.

Over the last decade, an average of 26 MW (212 wind turbines) were decommissioned and replaced with bigger machines every year. The development was sped up when in 2005, the government introduced an incentive scheme for replacing up to 175 MW of old turbines (of up to 450 kW in size) with 350 MW of new machines, and this goal will be achieved in 2010. It is expected that the rate of repowering will accelerate gradually over the coming years, with an average of almost 200 MW to be replaced every year until 2020.

Outlook for 2010 and beyond

Denmark is recording an increase of new wind power projects in the planning or completion stage. For 2010, the offshore wind farm Rødsand II will be completed, adding 215 MW of capacity, and producing electricity for around 200,000 Danish homes. Danish onshore capacity is expected to increase by 100-150 MW in 2009.

The European Renewables Directive stipulates a target for Denmark to increase the share of renewable energy sources in its final energy demand from 17% in 2005 to 30% in 2020. Wind would then account for 50% of the total power demand.

Obstacles for wind energy development in Denmark

In order for Denmark to reach the goal of 50% wind power penetration in 2025, the development must progress faster than it has in recent years, and the project pipeline needs to be expanded considerably.

The main obstacle is more efficient and focused long-term planning, and this will be a matter of great attention in 2010. Municipalities, neighbours and developers have to keep a strong focus on the decentralized planning of wind farms in order to ensure a smoothly running regime. Without this, it will be difficult to reach ambitious wind power targets.

In addition, more flexible ways of consuming, producing and transporting electricity will need to be implemented in Denmark during the coming years in order accommodate a wind power penetration of 50%.

With input from the Danish Wind Industry Association (DWIA)

Egypt

Wind energy in Egypt

Thanks to the Egyptian government's commitment to develop the country's renewable energy potential and successful international cooperation, Egypt's renewable energy market has gained momentum over the last two decades.

The New & Renewable Energy Authority (NREA) was set up in 1986 with the objective to assess the country's renewable energy resource and to investigate technology options through studies and demonstration projects. Another aim of NREA has been to introduce mature technologies to the Egyptian market and to support the activities of the domestic industry.

Since the 1980s, a series of large-scale grid connected wind energy projects have been planned and implemented in Egypt. In 2009, 65 MW of wind power was added, bringing the total installed wind capacity to 430 MW at the end of 2009.

An excellent wind resource

Egypt enjoys an excellent wind regime, particularly in the Gulf of Suez, where average wind speeds reach 10 m/sec.

Egypt cooperated with Denmark to develop a wind atlas, published in 1996, for the Gulf of Suez west coast. In 2003, a detailed wind atlas for the same area was issued, concluding that the region can host several large scale wind farms. The atlas was expanded to cover the entire country in 2005, to establish the meteorological basis for the assessment of wind energy resources all over Egypt. The atlas indicates that large regions of the eastern and western deserts of the Nile River and parts of Sinai have average annual wind speeds of 7-8 m/s.

Egypt has large deserts and abundant land mass, the majority of which is only scarcely populated. These areas are well suited to host renewable energy projects, both to increase the country's share of renewable energy as well as to export excess energy to Europe. Large areas with high wind potential are already earmarked on the west of the Gulf of Suez, as well as the eastern and western deserts of the Nile River banks. Land use agreements for these areas will be signed with qualified wind project developers.

In addition, the Egyptian national grid is extensive, providing over 99% of the population with modern electric energy services. Currently, grid connected renewable energy projects enjoys priority in dispatching.

Policy development and investment opportunities

In February 2008, the Egyptian Supreme Council of Energy approved an ambitious plan to produce 20% of total electricity from renewable energy sources by 2020, including a 12% contribution from wind energy. This translates into more than 7,200 MW of grid-connected wind farms. The plan gives enough room for private investors to play a major role in realising this goal.

In order to achieve its ambitious renewable energy target, the Egyptian government has earmarked 7,600 square kilometers of desert land for implementing future wind energy projects. All permits for the land allocation have already been obtained by NREA.

A draft for a new electricity act was published in 2008, and is still undergoing consultation with stakeholders. This draft aims to reflect the ongoing market reforms and to strengthen the regulatory agency. It includes articles supporting renewable energy through encouraging private investment in the sector. In addition, it guarantees third party access and priority dispatch for renewable electricity. No progress on this act was made in 2009.

Polices to foster an increasing wind contribution in the Egyptian electricity mix consist of two phases.

Phase I will use a competitive bids approach, through international tenders requesting bids from the private sector to supply energy from renewables. The financial risk for investors is reduced through guaranteed long term Power Purchase Agreements.

Tender documents for the prequalification of the competitive bids were issued in May 2009, and 34 offers were received by

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
MW	5	5	68	98	145	145	230	310	365	430

the August deadline, including both domestic and foreign companies. 10 developers have been shortlisted.

Phase II will introduce a feed-in tariff, taking into consideration the prices achieved in Phase I.

Large scale projects in Egypt

ZAFARANA WIND FARM

During the last decade, a series of wind projects were established in Zafarana. The farm has been constructed and operated in stages since 2001, in cooperation with Germany, Denmark and Spain. 65 MW of wind capacity, using Gamesa turbines, were added to Zafarana in 2009 in cooperation with Japan, taking the total installed capacity up to 425 MW.

In 2009, 1033 GWh of electricity were generated by the Zafarana wind farm, avoiding emissions of about 570,000 tons of CO^2.

Another 120 MW are under implementation, in cooperation with Danish International Development Agency (DANIDA), scheduled to start operations in May 2010. Zafarana will then host 545 MW of grid connected wind power and will be the largest wind farm in Africa and the Middle East.

	In cooperation with	MW	Turbines
2001	Danida 1	30	Nordex 600 kW
2001	KfW1	33	Nordex 600 kW
2003	Danida 2	30.36	Vestas 660 kW
2004	KfW 2& 3	46.86	Vestas 660 kW
2006	Spain	85	Gamesa 850 kW
2007	KfW 4	79.9	Gamesa 850 kW
2008/09	Japan	120.7	Gamesa 850 kW
2010	Danida 3	120.7	Gamesa 850 kW
	Total	**546.52**	**700 turbines**

GULF OF EL ZAYT

An area north of Hurgahda in the Gulf of El Zayt has an excellent wind regime and was dedicated for developing wind energy projects. In addition to 5 MW already operating, there are currently about 720 MW in various phases of development in cooperation with Germany, the European Investment Bank, Japan and Spain.

For the first 120 MW, an environmental impact assessment is currently being finalised and is scheduled to be published in March 2010.

Another 200 MW IPP wind farm is planned in cooperation with MASDAR of the Abu Dhabi Government.

BUILD-OWN-OPERATE (BOO) WIND FARM PROJECT AT GULF OF EL ZAYT

In May 2009, the Egyptian government floated an international tender for a wind farm at the Gulf of El Zayt. In cooperation with the World Bank, it invited private international and local developers to submit their prequalification documents for the first competitive bid to build a 250 MW wind farm.

The sale of the rights for this wind farm will be for a build-operate-own (BOO) operation, which means that the developer will be responsible for the planning, construction and operation of the wind farm. The power produced will be sold to the Egyptian Electricity Transmission Company (EETC) under a 20-25 year Power Purchase Agreement (PPA).

Egypt's Central Bank will guarantee all financial obligations of the EETC under the PPA.

All renewable energy equipment will be exempt from customs duties, and the projects will benefit from carbon credits through the Clean Development Mechanism.

Following the tender, 34 offers were received and a short list of 10 qualified developers was announced at the beginning of November 2009. The bidders will now compile their final bids to be submitted in early 2011. The wind farm is scheduled to be operational at the beginning of 2014.

An environmental impact assessment, which will also include a bird migration study, will be prepared by NREA in cooperation with international consultants, and financed by the German Kreditanstalt für Wiederaufbau (KfW).

The experiences gained through a series of competitive bids for private wind energy projects will pave the way to develop a commercial framework for wind energy in Egypt.

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

European Union

Main market developments in 2009

The EU continues to be world's leader in total installed wind energy capacity, and one of the strongest regions for new development, with over 10 GW of new installed capacity in 2009. Industry statistics compiled by the European Wind Energy Association (EWEA) show that cumulative EU wind capacity increased by 15% to reach a level of 74,767 MW, up from 64,719 MW at the end of 2008.

In the EU, wind power is by far the most popular electricity generating technology. For the second year running wind energy had the largest market share: of almost 26 GW installed in the EU in 2009, wind power accounted for 39%. All renewable technologies combined accounted for 61% of new power generating capacity. Since 2000, installed wind capacity has increased from 9.7 GW to 75 GW.

Hétomesnil wind farm, Picardie, France *© Wind Power Works*

By the end of the year, a total of more than 190,000 people were employed in the wind energy sector, and investments in wind farms amounted to about €13 billion in the EU during 2009.

The wind power capacity installed by the end of 2009 will, in a normal wind year, produce 162.5 TWh of electricity, equal to 4.8% of the EU's electricity demand.

Lake Ostrowo wind farm, Wolin, Poland *© Wind Power Works*

Spain and Germany remain the two largest annual markets for wind power, competing each year for the top spot (2,459 MW and 1,917 MW respectively in 2009), followed by Italy (1,114 MW), France (1,088 MW), and the UK (1,077 MW). Eleven EU Member States – over one third of all EU countries – now each have more than 1,000 MW of installed wind energy capacity. Austria and Greece are just below the 1,000 MW mark.

Offshore wind is setting itself up to become a mainstream energy source in its own right. In 2009, 582 MW of offshore wind were installed in the EU, up 56% on the previous year. Cumulative capacity increased to 2,063 MW. The main markets were the United Kingdom and Denmark.

For 2010, it is expected that a further 1,000 MW of offshore wind will be installed in Europe. This would represent around 10% of the 2010 market.

Support framework for wind energy

For the past decade, the EU and certain Member States have shown strong support for renewable deployment. This has played a large part in wind power's spectacular growth over the past ten years. Since 2001, EU Directive 77/2001/EC, which promotes electricity from renewable sources and attributes Member States indicative targets for 21% of EU electricity to come from renewable energy sources by 2010, has given an important boost to the sector.

In December 2008, agreement was reached on a Renewable Energy Directive (2009/28/EC) which set an EU renewable energy target of at least 20% of final energy consumption by 2020. Each EU member state was set a national legally

TOTAL INSTALLED CAPACITY

year	2001**	2002**	2003**	2004*	2005*	2006*	2007	2008	2009
MW	17,315	23,159	28,598	34,371	40,511	48,029	56,531	64,719	74,767

***EU 15 *EU 25*

binding target for the share of renewable energy. In terms of electricity consumption, renewables should provide about 34% of the EU's power by 2020 to meet the binding EU target, with wind set to contribute 14-17%.

The directive legally obliges each EU Member State to outline the steps it will take to meet its target in a National Renewable Energy Action Plan (NREAP) to be submitted by 30 June 2010 to the European Commission. NREAPs will set out how each EU country is to meet its overall national target, including elements such as sectoral targets for shares of renewable energy for transport, electricity and heating/cooling and tackling administrative and grid barriers.

Every two years Member States will submit a progress report to the European Commission, containing information on their share of renewable energy, support schemes and progress on tackling administrative and grid barriers. Based on these reports from the Member States, the European Commission will publish its own report the following year.

Certain measures to promote flexibility have been built into the Directive in order to help countries achieve their targets in a cost-effective way, without undermining market stability. For example, Member States may agree on the statistical transfer of a specified amount of renewable energy between themselves. They can also cooperate on any type of joint project relating to the production of renewable energy, involving private operators if they like. Thirdly, two or more Member States may decide, on a voluntary basis, to join or partly coordinate their national support schemes in order to help achieve their targets. Under certain conditions, Member States will be able to help meet their national electricity sector target with imports from non-EU countries.

The Directive requires EU countries to take "the appropriate steps to develop transmission and distribution grid infrastructure, intelligent networks, storage facilities and the electricity system" to help develop renewable electricity. They must also speed up authorisation procedures for grid infrastructure.

EU countries must ensure that transmission system operators and distribution system operators guarantee the transmission and distribution of renewable electricity and provide for either priority access or guaranteed access to the grid system.

Maranchón wind farm, Guadalajara, Spain *© Wind Power Works*

Future prospects and scenarios

EWEA has developed two 2020 scenarios for each EU national market: a "baseline" scenario and a "high" scenario[1]. The "baseline" scenario is based on EWEA's traditionally conservative approach to setting future targets for wind energy. It assumes a total installed capacity of wind energy in the EU by 2020 of 230 GW, producing 580 TWh of electricity, and wind energy's share of total electricity demand would increase from 4.1% in 2008 to 14.2% in 2020.

The "high" scenario acknowledges that wind power – as the most affordable of the "new" renewable electricity technologies – is likely to meet a much higher share of the EU's Renewable Energy Directive 2020 target than the 12% of electricity demand indicated by the European Commission. For many of the countries, the "high" scenario also takes into account wind power targets already announced by national governments. In the "high" scenario, total installed wind power capacity will reach 265 GW by 2020, producing 681 TWh of electricity, and wind energy's share of total electricity demand would increase from 4.1% in 2008 to 16.7% in 2020.

1 EWEA: Pure Power (2009 update) http://www.ewea.org/fileadmin/ewea_documents/documents/publications/reports/Pure_Power_Full_Report.pdf

EU offshore

Offshore wind energy, although still in its infancy, is starting to have an increasing impact on Europe's wind power development, and it is expected to reach 40 GW or more of installed capacity by 2020 (EWEA target).

The wind resources in Europe's waters make it a prime location for offshore wind development, and offshore wind power will be key to Europe's energy future. In June 2009, a report by the European Environment Agency (EEA) report found that in 2030, the technical potential of offshore wind power would be 30,000 TWh[1)], seven times greater than the projected electricity demand.

The status of the European offshore market in 2009

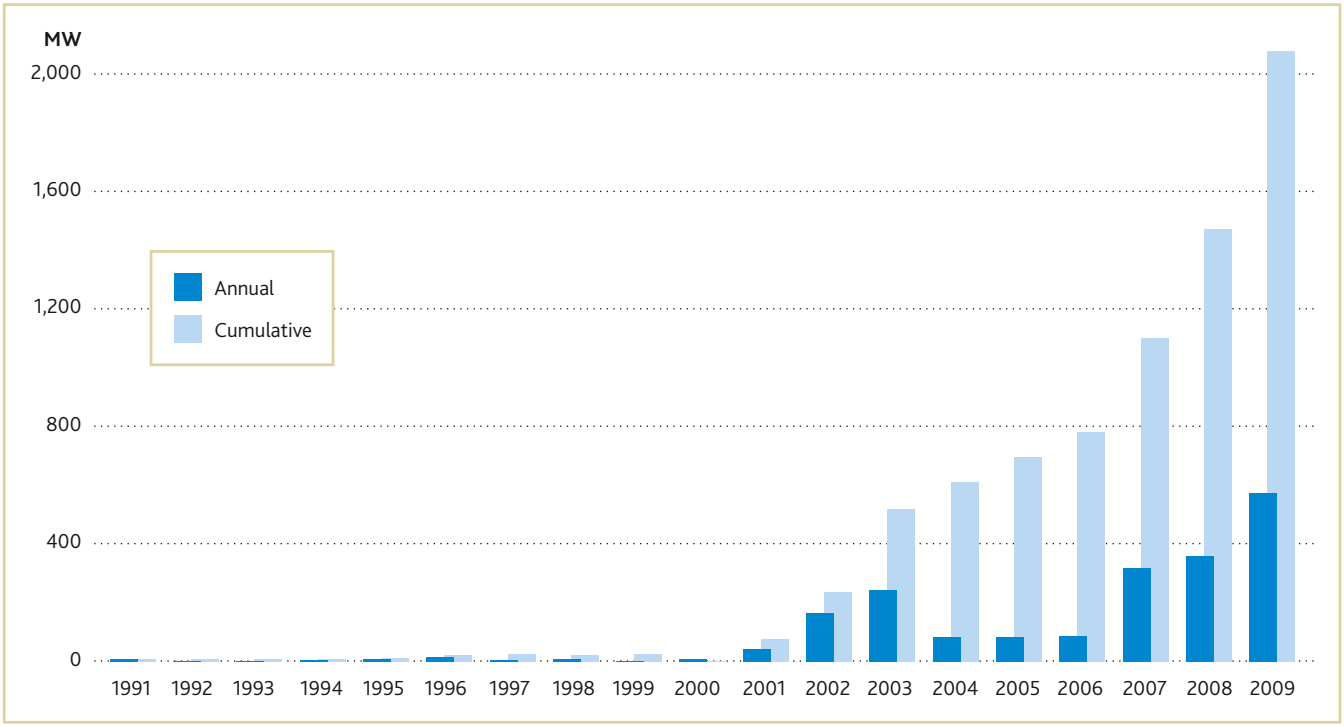
By the end of 2009, a total of 830 wind turbines were installed and grid connected in European waters, bringing the total installed capacity offshore in Europe to 2,063 MW.

These are spread across 39 wind farms in nine European countries. In terms of size they range from 2 MW (Lely, Netherlands, built in 1994) to 209 MW (Horns Rev 2, Denmark, built in 2009).

The main offshore markets in Europe are the United Kingdom (883 MW) and Denmark (646 MW), followed by the Netherlands (247 MW), Sweden (164 MW), Germany (42 MW), Belgium (30 MW) and Ireland (25 MW). Finland has a functioning near shore project (24 MW) and Norway a fully grid connected experimental floating turbine (2.3 MW).

In 2009, 201 wind turbines in nine separate offshore wind farms were installed in European waters, totalling 584 MW of new capacity – a 56% increase on 2008 installations. Of the €13 billion invested in new wind farms in the EU in 2009, €1.5 billion went towards offshore wind farms. This figure is expected to double to €3 billion in 2010.

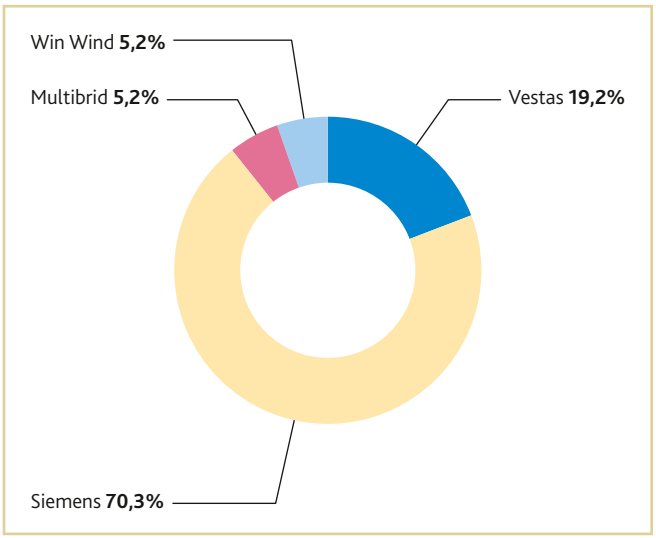
ANNUAL AND CUMULATIVE INSTALLED CAPACITY IN MW 1991–2009



Source: EWEA

1 European Environment Agency (EEA), 2009: 'Europe's onshore and offshore wind energy potential'. Technical report No 6/2009. http://www.eea.europa.eu/publications/europes-onshore-and-offshore-wind-energy-potential

The European offshore industry and technology



Source: EWEA

There are currently nine wind turbine manufacturers supplying the European offshore market: Siemens, Vestas, WinWind, Multibrid, Repower, Nordex, GE, BARD and Enercon.

Of the 199 wind turbines installed and grid connected during 2009, 146 were Siemens turbines (2.3 MW and 3.6 MW), 37 were Vestas turbines (3 MW), 10 were WinWind turbines (3 MW) and six were Multibrid turbines (5 MW) (see figure 1.1). In addition, six REpower turbines (5 MW) were installed but not grid connected.

The Danish utility DONG Energy was the leading developer during 2009, installing 313 MW of the 577 MW, followed by E.ON Climate & Renewables and RWE Innogy.

Water depth and distance to shore

The average water depth of the offshore wind farms installed during 2009 was 10.6m, 0.9m less deep than in 2008. The average water depth of wind farms remains below 20m. However, offshore wind farms under construction have an average water depth of 27.2m.

The average distance to shore of the offshore wind farms installed during 2009 was 12.8km, 2.3km further than in 2008. Most projects are still closer than 20 km, and the vast majority are less than 40 km. However, a noticeable increase is expected in the coming years, with offshore wind farms under construction averaging a distance to shore of 28.3km.

Connecting offshore wind farms

Connecting offshore wind farms to national electricity grids continues to present a challenge, and the ambitious plans outlined below require a dedicated offshore electricity system to provide grid access for the more remote offshore wind farms. A future transnational offshore grid will have many functions, each benefitting Europe in different ways. Not only will it provide grid access to offshore wind farms and smooth the variability of their output on the markets, but it will also improve the ability to trade electricity within Europe, thereby contributing dramatically to Europe's energy security.

Various models for such a European 'super grid' have been proposed, and the European Commission and national governments agreed in 2009 to provide political direction and a strategic plan for an offshore super grid.

In 2010, the European Commission will publish a 'Blueprint for a North Sea Grid' and the European Network of Transmission System Operators (ENTSO-E) will publish its first 10 Year Network Development Plan. The industry hopes that by 2020, the initial stages of a pan-European offshore grid should be constructed and operating with an agreed plan developed for its expansion to accommodate 150 GW by 2030.

The year 2009 already saw significant steps on planning and financing specific offshore cables that would contribute to the North Sea grid, including the UK/Norway interconnector, a planned link between Norway and Germany (NorGer), an undersea electricity cable to be installed on the seabed between the Netherlands and Denmark (Cobra cable), an East-West Interconnector linking Ireland and north Wales, BritNed linking the UK and the Netherlands and Kriegers Flak, a combination of three wind farms of 600 MW each linking Denmark, Sweden and Germany.

With input from the European Wind Energy Association (EWEA)

Financing offshore wind farms

The financial crisis is constraining the growth of the offshore wind sector, disproportionally affecting independent project developers, which have been severely affected by the lack of availability of project finance.

The second half of the year, however, saw some innovative financing deals, including the Belwind and Boreas transactions, which involved different sponsors, technologies, bank groups (including the European Investment Bank EIB) and authorities. These deals created two high profile precedents for the sector, which will hopefully open the door to similar financing options in the future.

In June 2009, the EIB for the first time assumed project finance risk for an offshore wind farm by granting €300 million of finance to the Belwind project, situated 46 km off the Belgian coast.

In addition to this, the EIB, in cooperation with five other leading public financial institutions, launched a pan-European equity fund called "Marguerite 2020 Fund", which will have an initial capital of €600 million intended to finance large infrastructure projects, and it announced its support for several offshore wind farms.

The offshore wind industry was also buoyed during 2009 by the European Union's European Economic Recovery Plan which already injected €255 million into the offshore wind sector, out of the total €565 million allocated to offshore wind.

This stimulus injection was vital, and it remains crucial that this financing is released as soon as feasible and that the Commission's review in 2010 of the European Economic Recovery Plan, or any further stimulus package, continues to target the offshore wind industry as a strategic European sector.

To ensure that the market growth expected for 2010 is not blown off course the European institutions, particularly the EIB, must continue to increase their involvement in the offshore wind industry.

Burbo Bank, Liverpool Bay, UK *© Wind Power Works*

Outlook for 2010 and beyond – over 100 GW already proposed

2010 will be a defining year for the offshore wind power market in Europe. The economic crisis permitting, 2010 will see around 1,000 MW installed offshore in European waters with more than ten wind farms being completed. This would amount to a growth of 71% compared to 2009.

Europe's 2010 offshore market could make up approximately 10% of Europe's total annual market for wind power capacity, and more than 20% of capital investments, making the offshore industry a significant mainstream energy player in its own right.

Looking beyond 2010, there is a significant pipeline of offshore projects at varying stages of development.

Currently 16 wind farms are under construction in European waters, totalling more than 3,500 MW. In addition, a further 52 offshore wind farms have been fully consented, totalling more than 16,000 MW.

In 2020, EWEA expects between 40 GW and 55 GW of offshore wind farms to be feeding electricity to the grid in the EU, producing between 145 and 198 TWh of electricity. EWEA has identified proposals for over 100 GW of offshore wind projects in European waters – either under construction, consented, in the consenting phase or proposed by project developers or implied in development zones proposed by governments. These 100 GW of offshore wind projects will be spread over 15 European countries, and it shows tremendous developer interest. It also provides a good indication that EWEA's expectation that 150 GW of offshore wind power will be operating by 2030 is feasible.

However, in order to achieve this target, coordinated action is required from the European Commission, EU governments, regulators, transmission system operators and the wind industry. Key issues in this respect include the development of the offshore industry supply chain, maritime spatial planning and the establishment of an offshore electricity grid based on the industry's needs.

With input from the European Wind Energy Association (EWEA)

France

Continuing growth in the French market

France enjoys Europe's second largest wind potential, and the wind resource is well distributed across the country. With nearly 4,500 MW of wind power installed at the end of 2009, France is the fourth largest market in Europe after Germany, Spain and Italy.

The French wind energy market grew by 1,088 MW in 2009 (up from 950 MW in 2008), representing 41% of all new generation capacity installed in France. In 2009, wind turbines generated 7.8 TWh of electricity, a 40% increase from 2008, but still only 1.6% of total power consumption. In the last six years, wind electricity production has been multiplied by 20.

Although this development shows that the sector is continuing to grow, the current pace of annual installations will not be sufficient for the country to meet its 2020 objective. According to the EU Directive, France must increase its share of renewable energy in its final energy demand from 10.3% in 2005 to 23% by 2020.

In December 2009, the French government set itself a target for achieving 11,500 MW of installed wind energy capacity by 2012, 1,500 of which should be offshore, and 20,000 MW by 2020, including 6,000 MW offshore.

Wind power industry in France

The top three market players in wind turbine manufacturing are Enercon, Vestas and REpower, while EDF Energies Nouvelles, Eole-RES and La Compagnie du Vent are the leading project developers. The wind sector now provides around 9,500 jobs to the national economy, and this number should continue to rise.

Four out of France's 22 regions now host a wind capacity of over 400 MW: Picardie (with more than 600 MW installed), Lorraine, Centre and Brittany.

The average size for French wind farms is 16 MW, but there have been a number of larger developments, three of which were built in 2009: Salles-Curan in Aveyron (87 MW), Pays de St Seine in Côte-d'Or (50 MW) and Mont-Gimont in Haute-Marne (48 MW). The largest wind park in France remains Fruges, in the north of the country, with 70 wind turbines accounting for 140 MW.

Hétomesnil wind farm, Picardie *© Wind Power Works*

The most promising regions for wind power development in 2010 are located in the north of France, and a third of all new projects will be located there. Out of 4,000 MW of approved wind power projects, more than 700 MW are in the Champagne-Ardennes region and 500 MW in the Picardy region.

According to a study performed by ADEME (French agency in charge of Environment and Energy) in July 2009, the wind energy sector has created 10,000 direct and indirect jobs in France. If the government's 2012 objectives are to be reached, this number will grow to 17,000.

The policy framework for wind energy in France

A feed-in tariff was introduced in France in 2002, ensuring a tariff of 8.2 ct€/kWh for a period of 10 years, which then decreases during the next five years of the contract.

In July 2005, this law was amended to stipulate that in order to be eligible for the feed-in tariff, wind farms must be built in special Wind Power Development Zones (ZDE). These zones are defined at the regional level based on the criteria of electrical production potential, grid connection capacity and landscape protection. The law also did away with the previous size limit of 12 MW for wind farms.

TOTAL INSTALLED CAPACITY

year	2002	2003	2004	2005	2006	2007	2008	2009
MW	148	253	390	757	1,567	2,454	3,404	4,492

The Grenelle Objectives and the introduction of regional renewable energy schemes

The French legislative and regulatory framework with regards to renewable energy is being fundamentally transformed, and there is, to date, no certainty over the outcome of the reform.

In 2007, during the *Grenelle de l'environnement*[1] process, the French Syndicat des Energies Renouvelables (SER) suggested a wind power generation target of 25 GW by 2020, including 6 GW offshore. This objective would allow France to reach the European target of 23% of final energy consumption from renewable energy by 2020, as outlined in the new EU Renewables Directive.

This last objective was approved by the French Parliament in 2009, in the Grenelle 1 law, which also provides for the implementation of renewable energy schemes at regional level. The schemes are jointly elaborated both by the executive representative of the state at regional level (prefet) and by the elected president of the regional council following a consultation process, and they are expected to be issued by 3 August 2010. The aim of these regional schemes is to determine geographical zones for the development of renewable energy, with a specific section for wind energy.

Another law from the Grenelle legislative process (Grenelle 2) will be issued in 2010 and will introduce regional schemes for climate, air (quality) and energy.

Despite these new provisions, the ZDE will continue to exist, and should also include the following criteria: public safety, landscape, biodiversity, historical monuments and classified sites, archeological patrimony.

Remaining obstacles to wind energy development

Despite the high wind power potential in France, there are several barriers that remain and hinder the development of wind energy in the country. These barriers include the slow authorization procedure for both ZDEs and individual projects, inadequate grid connection capacity, and the existence of zones in which wind power installations are forbidden.

Rather than promoting wind energy development, the ZDE law has hampered the growth of the French market, since it has resulted in longer and more complex administrative and grid connection procedures. A 2007 study issued by the Ministry of Industry and Economy indicates that nine weeks are necessary to notify the applicant that the application process is launched and that the authorization generally takes 19 months to be completed.

Adequate grid connection capacity remains a problem in some areas of France, although some commitment has been made towards reinforcing the French grid to accommodate more wind development. In several areas, grid connection capacities are running low and grid needs to be reinforced. The regional schemes of electricity grid connection, planned in the Grenelle 2, aim to address these problems.

Offshore wind energy in France

Offshore wind development in France is slow, and the legal framework which applies to offshore economic activity is not adapted to wind energy. Preparation for the first offshore wind farm in France began with a government tender in 2005, but due to long authorization procedures, construction has been delayed and is now scheduled to start at the end of 2010.

The French Government has set a target of 6,000 MW of offshore wind power by 2020 through a process of calls for tender. Three calls are foreseen, the first of which should be published in 2010, followed by additional calls in 2012 and 2014.

In addition, calls for tender should be launched on the basis of geographical zones determined by a consultation process involving all stakeholders, which will result in the definition of zones deemed favourable for offshore wind farms. The results of this process should be known by the summer of 2010.

The text of the Grenelle 2 Law currently under discussion foresees the suppression of ZDE and permitting requirements for offshore wind farms, which would simplify the autorisation process.

With input from the Sydicat des Energies Renouvelables (SER), France

1 The Grenelle de l'environnement is a national consultation process involving a large range of actors debating on environmental issues. It started in 2007 and it should result in the adoption of two Acts.

Germany

Main market developments

Despite the financial and economic crises, the German wind market recovered and experienced 15% growth during 2009. Last year, 958 wind turbines totalling 1,917 MW of capacity were added to the German fleet, including 136 MW repowering and 60 MW offshore[1]. Germany still leads Europe with a total installed capacity of 25,777 MW.

38 TWh of wind power were generated in Germany in 2009, in a wind year that was below average, accounting for about 7% of the country's net power consumption. All renewable energy sources combined produced around 17% of Germany's electricity needs, with wind being the largest single contributor within the renewable energy mix. The average size of the turbines installed during 2009 was above 2 MW. The leading manufacturer in Germany is Enercon with a market share of 60.4%, followed by Vestas (19.5%) and REpower Systems (8.8%).

The highlight of 2009 was the installation of the first German offshore wind farm, the test site Alpha Ventus with 12 turbines of 5 MW each, which are now delivering electricity to the mainland. More offshore projects are planned for 2010. The German turbine manufacturing and supply industries are strongly export oriented, with the biggest German manufacturers exporting around 80% of their production. Today, around 30% of the world's wind turbines are manufactured by German companies. The wind industry achieved a turnover in Germany of around 2.9 billion € in 2009 for new installations, including export as well as installation, operation and maintenance services in Germany, and it now provides employment for around 100,000 people.

The leading federal state in Germany in terms of installed capacity is Lower Saxony with 6,407 MW. A number of states now receive 40% or more of their electricity from wind energy, including Saxony-Anhalt (47%), Mecklenburg-Vorpommern (41%) and Schleswig-Holstein (40%).

The policy environment for wind power in Germany

THE GERMAN 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 still provides the main stimulus for the German wind market. The EEG stipulates a fixed feed-in tariff for each kWh of power produced and fed into the grid from renewable sources. In addition, electricity produced from renewable energy sources is given priority for grid connection, grid access in both distribution and transmission grids, and power dispatch.

For wind energy an 'initial tariff' is fixed for at least five and up to 20 years. It is reduced to a 'basic tariff' depending on how local wind conditions compare to a so called 'reference yield'. Wind installations on very good sites (reference yield of 150%) receive the initial tariff for example for five years, while for turbines on lesser sites this period can be extended. The tariffs are paid for 20 years. No compensation is granted for turbines with a reference energy yield of less than 60% to avoid installation of wind turbines on sites with poor wind conditions.

On 1 January 2009, an amended EEG[2] with new higher tariffs came into force, which strongly stimulated market growth. The initial tariff for onshore wind energy was increased to 9.2 cent/kWh (up from 8.7 cent/kWh), and the basic tariff was set at 5.02 cent/kWh. There is an annual degression of 1% for new installations every year.

For offshore wind energy, the tariff was increased to 13 cent/kWh plus an additional 'sprinter bonus' of 2 cents/kWh for projects which come into operation before the end of 2015. The initial 15 cents/kWh will be paid for a period of 12 years, and then decrease to 3.5 cents/kWh. The tariff is extend for projects in deeper waters and further from the coast. Offshore tariffs will annually decrease by 5% for new installations starting from 2015. In addition, a bonus for improved grid compatibility (system service bonus) was introduced, which will become effective in July 2010. Turbines in compliance with this standard earn another 0.5 cent/kWh on top of the initial remuneration.

A special tariff (repowering bonus) was maintained for replacing turbines which are ten years or older with turbines with at least double the rated capacity in the same or a neighbouring county. This has already led to a small but visible increase in repowering projects during 2009. Grid operators are obliged to feed in electricity produced from renewable energy and buy it at a minimum price within their supply area. Furthermore, the new EEG requires grid operators to extend, optimise and enhance the existing grid. Failure to comply with this can lead to claims for damages by anyone willing but unable to feed in.

1 This figure includes 30 MW at Alpha Ventus that were installed but not fully operational on 31 December 2009.
2 See www.eeg-aktuell.de for more detail

TOTAL INSTALLED CAPACITY

year	2001	2002	2003	2004	2005	2006	2007	2008	2009
MW	8,754	11,994	14,609	16,629	18,415	20,622	22,247	23,903	25,777

OTHER LEGISLATION RELEVANT TO WIND POWER DEVELOPMENT

In addition to the EEG, the German Federal Building Code continues to represent a key regulation for wind power development in Germany. Under this law wind energy plants are categorised as 'privileged projects', and local authorities are required to designate specific priority zones for wind energy development. However, this means that they can also restrict construction to specific areas (exclusion zones).

According to the EU Renewable Energy Directive Germany has an overall target of 18% renewable energy in final energy consumption by 2020. For the electricity sector the government's target is for more than 30% of renewable electricity by 2020. But the German Renewable Energy Association (BEE) estimates it could be as high 47%, which would include 25% wind power.

The new German conservative-liberal government has announced that it plans to discuss and publish a new energy concept by the autumn of 2010. This concept is to determine the future energy mix and to pave the way for a 100% renewable energy supply in the coming decades. At the same time, Germany is reconsidering the plan announced by the former social democrat/green government to phase out nuclear power. Contrary to this previous plan, the new government is expected to prolong the running time of existing nuclear power stations in Germany, which is causing serious debate between the government and the renewable energy industry, but also municipal energy suppliers (Stadtwerke), who fear that their access to the electricity system could be blocked if this happened.

Future trends – Repowering and offshore developments

Repowering can and will play a stronger role in Germany in the future. Studies and first projects in coastal areas estimate that repowering has the potential to double the amount of onshore wind capacity in Germany with significantly fewer turbines and to triple the energy yield. Despite the high technical potential, repowering in Germany is proceeding at a slow pace because most turbines have not reached the age deemed economical for repowering, which is after 15 years of operation. At the end of 2008, only 152 MW of capacity were old enough, and repowering in 2009 accounted for 136 MW of new installed capacity. Nevertheless, repowering is expected to increase significantly after 2010, and by 2015, more than 6,000 MW of currently operating turbines will be older than 15 years.

In many regions, however, height restrictions inhibit the placement of newer turbines designed to yield maximum energy from a given site, which also affects repowering. Modern turbines with hub heights above 100 meters can reach capacity factors of 35% on the German mainland, and 45% in coastal and mountainous areas. In order to maximise Germany's potential, the government and some federal states have indicated their willingness to rethink the framework conditions and to discuss these with local and regional planning authorities. The Federal State of Hessen e.g. has changed the planning rules last year to open parts of forest for wind development, and is currently rethinking height restrictions.

Offshore developments and obstacles

Projections for offshore wind energy in Germany predict a capacity of about 400 MW by 2010, and 3,000 MW by 2015. Most German offshore parks will be built 20-60 km away from the coastline in waters 20-40 meters deep. Thus far, the national maritime authority and the federal states have licensed 24 projects, with an overall capacity of close to 7,000 MW. The costs for connecting offshore wind farms to the mainland grid must be assumed by the transmission systems operators (TSOs), and the TSOs have started to plan connection lines for clusters of offshore projects. To date, only one connection (400 MW HVDC light) is under construction, but three more have been licensed.

Future developments – 2010 and beyond

For 2010 the German wind industry expects new installations of about 2,300 MW capacity, including 300 MW of offshore capacity. Offshore projects are expected to play a larger part in annual capacity growth over the coming years. The main impetus for growth, however, will continue to be from new onshore developments and repowering. According to calculations from the German Wind Energy Association (BWE), the overall German onshore capacity could be 45,000 MW, with an additional 10,000 MW of offshore wind by 2020.

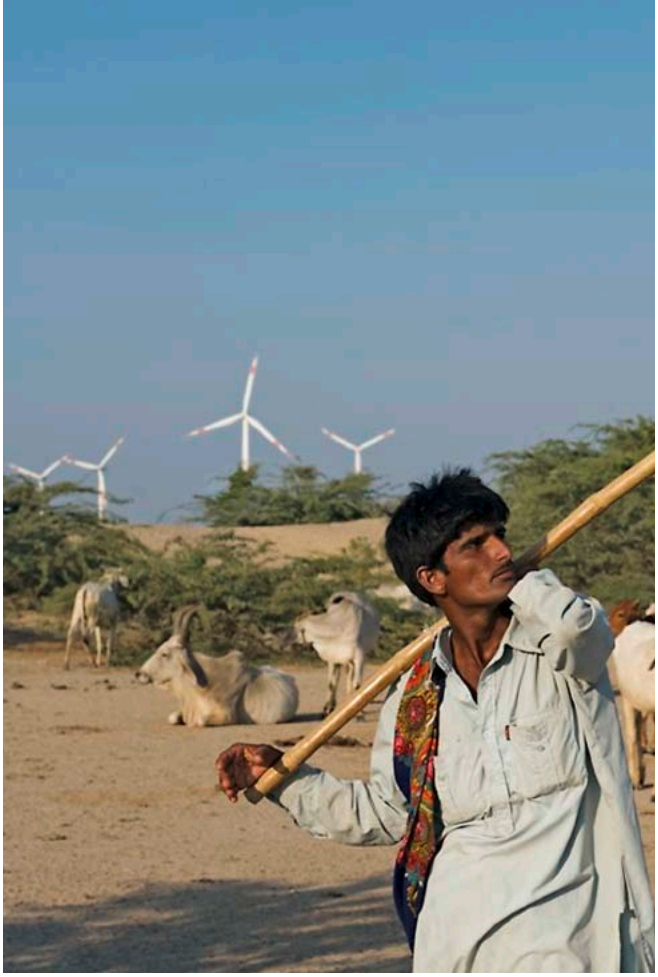
With input from the German Wind Energy Association (BWE)

India

The Indian power sector

India's rapidly growing economy and population leads to relentlessly increasing electricity demand. As a result, the country's installed power generation capacity has increased from just 1.4 GW in 1947 to over 150 GW in 2009. The current generation mix in India is dominated by coal (78.5 GW), large hydropower (36.9 GW) and gas (16.4 GW). Renewable sources rank fourth with an installed capacity of around 13.2 GW.

Despite the massive capacity additions, the Indian government is struggling to keep up with growing demand. The IEA predicts that by 2020, 327 GW of power generation capacity will be needed, which would imply an addition of 16 GW per year. This urgent need is reflected in the target the Indian government has set in its 11th Five Year Plan (2007-2012), which envisages an addition of 78.7 GW in this period, 50.5 GW of which is coal[1].



Kutch, Gujarat © *Wind Power Works*

Wind potential

The total potential for wind power in India was first estimated by the Centre for Wind Energy Technology (C-WET) at around 45 GW, and was recently increased to 48.5 GW, and adopted by the government as the official estimate. In addition, the government recently announced that it would soon be coming out with revised wind atlas which would include measurements in an increased number of states.

The C-WET study was based on a comprehensive wind mapping exercise initiated. However, only 9 states were included in this exercise and the wind measurements were carried out at relatively low hub heights (50 m). At greater heights, the Indian Wind Turbine Manufacturers Association (IWTMA) estimates that the potential is around 65-70 GW, and World Institute for Sustainable Energy, India (WISE) considers that with larger turbines, greater land availability and expanded resource exploration, the potential could be as big as 100 GW.

Steady market growth for wind

Wind energy is continuing to grow steadily in India, with a wind power capacity of 7,926 MW added in the last five years, taking the total installed capacity to 10.9 GW at the end of 2009, up from 9.6 GW at the end of 2008.

Wind power in India has been concentrated in a few regions, especially the southern state of Tamil Nadu, which maintains its position as the state with the largest wind power installation, with 4.3 GW installed on 31 March 2009, representing 42% of India's total wind capacity. This is beginning to change as other states, including Maharashtra (1,942 MW), Gujarat (1,566 MW) and Karnataka (1,340 MW) start to catch up.

The development of a domestic industry and foreign investment

India has a solid domestic manufacturing base, including global leader Suzlon with a 50% market share, as well as Vestas Wind Tech and RRB. In addition, international companies have set up production facilities in India, including Enercon, Vestas and GE and new entrants like Gamesa, Siemens, WinWinD, and others. Overall, 16 companies now manufacture wind turbines in India, with an annual production capacity of 3,000-3,500 MW. Greater stability in the Indian market has also stimulated a stronger domestic manufacturing sector; some foreign companies now source more than 80% of the components for their turbines in India.

1 http://cea.nic.in/planning/Capacity%20addition%20target%20during%2011th%20plan%20set%20by%20Planning%20Commission%20(Revised)-summary%20region%20wise.pdf.

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
MW	220	1,456	1,702	2,125	3,000	4,430	6,270	7,845	9,655	10,926

The policy environment for renewable energy in India

In the early 1980s, the Indian government established the Ministry of Non-Conventional Energy Sources (MNES) to encourage diversification of the country's energy supply, and satisfy the increasing energy demand of a rapidly growing economy. In 2006, this ministry was renamed the Ministry of New and Renewable Energy (MNRE).

Renewable energy is growing rapidly in India. With an installed capacity of 13.2 GW, renewables (excluding large hydro) currently account for 9% of India's overall power generation capacity. The Indian government's stated target is for renewable energy to contribute 10% of total capacity and 4-5% of the electricity mix by 2012. For the period of 2008-2012, the objective is to add 14 GW of renewable generation capacity, 10.5 GW of which will be wind. However, India does not have a national renewable energy policy, and most of the incentives for wind power generation were introduced at state level. The promotion of renewables only figures in one clause of the 2003 Electricity Act. This act restructured the Indian electricity industry and established State Regulatory Commissions (SERCs) in charge of setting electricity tariffs, which were also to set Renewable Portfolio Standards for electricity production in their state.

At national level, wind power development benefits from fiscal and financial incentives, such as a provision for 80% accelerated depreciation for wind farms over one or two years and a ten year tax holiday for wind power projects; and favourable provisions on wheeling, banking and third party sales. In addition, the Indian government set up the Indian Renewable Energy Development Agency (IREDA), to provide loans for renewable energy projects; and the Centre for Wind Energy Technology (C-WET) which does R&D, training, certification, testing and resource assessment for the sector.

State policies

RENEWABLE PORTFOLIO STANDARDS AND FINANCIAL INCENTIVES

In the absence of a national renewable energy policy, 18 out of the 29 Indian States have now implemented quotas for a renewable energy share of up to 10% and have introduced preferential tariffs for electricity produced from renewable sources. In addition, several states have implemented fiscal and financial incentives for renewable energy generation.

FEED IN TARIFFS

Nine Indian states with Renewable Portfolio Standards (RPS) or other policies to promote wind generation, have also introduced feed-in tariffs for wind generation, usually amounting to Rs 3.10 – Rs 4.3 (€5.1 – 7.1 cents) per kWh.

Policy developments in 2009

NATIONAL GENERATION BASED INCENTIVE (GBI)

In September 2009, India's Central Electricity Regulatory Commission (CERC) announced a national generation-based incentive scheme for grid connected wind power projects. Investors which, because of their small size or lack of tax liability, cannot draw any benefit from accelerated depreciation can opt for this alternative incentive up to 31 March 2012. After this date, the Accelerated Depreciation may be phased out.

As of 17 December 2009, the Indian scheme provides an incentive of 0.5 Rupees per KWh (0.8 Euro cents) in addition to the existing state incentives, with an upper ceiling for a total payment of 6.2 million Rupees per MW (102,000 EUR). The incentive will be paid out over a maximum of 10 years, or until the ceiling is hit, but no less than 4 years. The GBI is limited to the first 4,000 MW fully commissioned (i.e. grid connected) by March 2012.

NATIONAL RENEWABLE ELECTRICITY TRADING SCHEME

In January 2010, the India's Central Electricity Regulatory Commission announced rules for trading with renewable energy certificates. These can be bought by companies to meet the requirements to purchase a minimum level of renewable energy according to the state renewable portfolio standards. A national agency would be put in place to administer the certificates trading.

Outlook for 2010 and beyond

The new GBI scheme is expected to provide a significant incentive for new entrants into the Indian wind market, and it is expected that a minimum of 2,200 MW of new wind power capacity will be installed in India in the financial year or 2010/2011.

With input from the Indian Wind Turbine Manufacturers' Association (IWTMA)

Italy

Main market developments in 2009

At the end of 2009, Italy was host to 4,850 MW of wind generation capacity, an increase of more than 1,100 MW compared to 2008. The regions which added the most new capacity were Sicily, Puglia and Calabria, followed by Campania and Sardinia. Some developments are also taking place in central and northern Italy, in regions such as Liguria, Piedmont, Veneto, Emilia Romagna and Tuscany.

The Italian Wind Energy Association (ANEV) estimates that more than 6TWh of electricity were produced by wind energy in 2009, bearing in mind that around 700 MW of new capacity came online only in the second half of the year.

The most active developers and power producers were the Gruppo IVPC, Veronagest, Asja Ambiente, Edison Energie Speciali, Falk Renewables and Sorgenia. In terms of total installed capacity, IP Maestrale, Gruppo IVPC and Enel Green Power are now the leading wind farms owners in Italy.

The global financial crisis affected Italy's wind energy sector, not in terms of production or employment, but in terms of tightening project finance. Consequently, some project funding has slowed down, and this is expected to continue through 2010.

Installed capacity by region

	Total
Puglia	1,158.16
Sicilia	1,115.82
Campania	808.99
Sardigna	585.81
Calabria	397.84
Molise	241.52
Basilicata	227.36
Abruzzo	205.42
Toscany	44.75
Liguria	20.20
Emilia Romagna	16.30
Piedmont	12.50
Total Italy	**4,850.00**

Florinas wind farm, Sardinia *© ANEV*

Policy developments

In 1991, a feed-in tariff was introduced by the CIP6 regime, which provided for the payment of premium prices for renewable electricity. The regime was implemented between 1992 and June 1995 and was abolished in 1997, as part of the government's reorganisation of the electricity sector.

The 1999 Bersani decree provided for the gradual liberalisation of the Italian electricity market and encouraged generation from renewable sources by introducing priority grid access for renewable electricity, as well as a renewable energy quota system. This requires power producers and importers to produce a certain percentage of electricity from renewable sources. Green certificates are used to fulfil this obligation, starting from 2% and gradually increasing.

In January 2002, Italy implemented a new support mechanism for renewable energy sources based on Green Certificates, to replace the abolished CIP6 regime and to complement the quota system.

The 2008 Finance Act and the subsequent Ministerial Decree from December 2009 introduced an increase of the quota, which provides for an annual increase of 0.75% for the years 2007 to 2012. This translates into a quota of 5.3% in 2009, 6.05% in 2010 and 6.8% in 2011.

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
MW	427	690	797	913	1,255	1,718	2,123	2,726	3,736	4,850

In addition, the following changes were implemented to the Green Certificate system:

- **Duration:** RE plants with a capacity of more than 1 MW and coming into operation after 31 December 2007 are entitled to receive Green Certificates for a period of 15 years instead of 12 years.

- **Characteristics of Green Certificates:** From 2008, Green Certificates have a value of 1 MWh. For calculating the number of Green Certificates, the net electricity output of each plant is multiplied with a parameter, depending on the technology. For onshore wind, this parameter is 1.0; for offshore wind it is 1.1.

- **Value and price:** Starting from 2008, Green Certificates issued by the national TSO (GSE) are sold at a price equal to the difference between a reference value, which is €180 per MWh for the first year, and the annual average price for electricity sale. The reference price may be altered every three years by the GSE to ensure a remuneration that is adequate.

Another innovation was introduced in 2009, which moved the obligation to source a certain amount of energy from renewable energy sources (or buy Green Certificates) from the producer to the distributor by 2012. For renewable energy generators, this will mean that they will trade Green Certificates with distributors rather than producers. However, further implementation measures concerning the operational details of these changes are still outstanding.

Under the EU Renewable Energy Directive, Italy is required to increase its share of renewable energy to 17% of its final energy consumption, up from just 5.2% in 2005.

Obstacles for wind energy development

The Italian wind energy market continues to be hampered by ambiguities in the current policy design and a delay in the introduction of measures needed to develop the industry, such as guidelines and details on the regional breakdown of the country's overall renewable energy quota.

In addition, the Italian electricity system suffers from inadequate grid infrastructure, which leads to frequent curtailment of wind power production to manage grid congestion. The grid problem concerns all projects in Campania, Apulia and Basilicata and some projects in Sardinia. These problems occur systematically due to the low capacity of the grid, especially on old-fashioned 150kv lines that are incapable of dispatching all the power produced by the wind farms. In 2009, some wind farms operated at 30% less than their normal capacity over the course of the year due to inadequate grids. In some cases, wind farms were limited by over 70%, and in other cases, some wind farms were shut down completely.

Italy's grid issues need urgent attention, and the sector is waiting for a strong structural response to adapt the grid to accommodate both the current installed capacity and the planned wind energy capacity increase. In addition, wind operators must be adequately compensated for such curtailment. In addition to grid issues, Italy also suffers from administrative constraints such as complex authorization procedures and high connection costs.

The Italian wind sector employs 15,000 people

The wind sector is beginning to gain importance in Italy as employment grows in various sectors that are directly and indirectly connected to clean energy technology development.

A study on employment in the sector, jointly conducted by the Italian Labour Union and ANEV, revealed that in 2008, 15,152 people were employed in the Italian wind energy sector, 4,430 of whom were employed directly. Assuming that Italy reaches its goal of 16,200 MW by 2020, the total number of jobs would rise to 66,010, of which 19,000 would be direct employment.

Outlook for 2010

ANEV estimates that at least another 1,100 MW of wind energy capacity will be added to the Italian portfolio in 2010, but there is hope that this number will be even higher as Italy's economy improves.

According to ANEV, 16,200 MW of wind energy could be installed by 2020, producing 27 TWh of electricity, and reaching approximately 50% of the 2020 objective.

With input from the Italian Wind Energy Association (ANEV)

Mexico

Mexico offers significant wind energy potential with conditions that are considered among the best in Latin America, especially in the area of "La Ventosa", Oaxaca (7,000 MW)[1] with average capacity factors above 40%.

In addition, other sites in several states also offer good wind power potential, in particular "La Rumorosa" in the state of Baja California and sites in the states of Tamaulipas, Yucatán, Veracruz, Zacatecas, Hidalgo and Sinaloa. The Ministry of Energy (SENER)[2] has estimated that a total of 40,000 MW of wind energy potential could be developed in Mexico.

Despite this significant potential, wind development in Mexico has been slow, mainly due to the lack of adequate financial incentives, issues with the existing regulatory framework and a lack of policies to encourage use of wind energy. However, in 2009, new laws and regulations were introduced to boost renewable energy development, and more than 560 MW of wind projects are currently under construction.

The Mexican power generation system

Mexico has around 50 GW of total installed electricity generation capacity, including 11,457 MW from independent power producers (IPP) and about 7,900 MW of self-generation and cogeneration capacity. During the last years, the generation mix in Mexico changed significantly, moving away from fuel-oil generation plants to natural gas-based generation.

Traditionally, large hydroelectric and geothermal energy have been Mexico's most widely used renewable sources. Other renewable energy sources, such as wind power, solar PV, small hydro, biomass, and biofuels have experienced only slow growth to date.

Main Market Developments in 2009

In 2009, Mexico's installed wind capacity more than doubled with 117.4 MW of new capacity added to the existing 84.5 MW operating at the end of 2008. The total installed wind power capacity now amounts to 202.28 MW. This increase was the result of two private self-supply projects

La Mata-La Ventosa wind farm *© AMDEE*

brought online in 2009, "Parques Ecológicos de México" (79.9 MW) and the first phase of the "Eurus" project (37.5 MW). They were added to the two existing CFE projects La Venta I (1.6 MW) and La Venta II (83.3 MW).

Of course, the global economic and financial crisis has, as in other countries, had a negative impact on financing for wind energy in Mexico. Projects suffered from financial institutions' shrinking risk appetite, as well as from their preference for more developed markets.

Wind energy projects in Mexico

In operation

Project	Developer/Owner	Turbines	MW
La Venta	CFE	Vestas	1.6
La Venta II	CFE	Gamesa	83.3
Parques Ecológicos de México	Iberdrola	Gamesa	79.9
Eurus, 1st Phase	Cemex/Acciona	Acciona	37.5
			202.28

Under construction

Project	Developer/Owner	Turbines	MW
Bii Nee Stipa I	Cisa-Gamesa	Gamesa	26.35
Gobierno Baja California	GBC/Turbo Power Services	Gamesa	10
La Venta III	CFE/Iberdrola	Gamesa	101
Oaxaca I	CFE/EYRA	Vestas	101
La Mata - La Ventosa	Electrica del Valle de México (EDF-EN)	Clipper	67.5
Eurus 2nd Phase	Cemex/Acciona	Acciona	212.5
Fuerza Eólica del Istmo	Fuerza Eólica	Clipper	50
			568.35

OPF: Publically Financed (Obra Pública Financiada)
IPP: Independent Power Producer

1 According to the Federal Energy Commission (CFE)
2 Energías Renovables para el Desarrollo Sustentable en México, Secretaría de Energía, SENER, 2006 http://www.sener.gob.mx/webSener/res/0/ER_para_Desarrollo_Sustentable_Mx_2009.pdf

TOTAL INSTALLED CAPACITY

year	2005	2006	2007	2008	2009
MW	3	85	85	85	202

Policy background

To date, Mexico still lacks a fair and clear regulatory framework to promote renewable energy. The state-owned enterprise Federal Commission for Electricity (CFE), is responsible for two thirds of Mexico's energy generation and nearly all of its transmission, and has favoured the development of conventional energy sources in the past, as well as some large hydro and geothermal projects. In addition, wind power developers are in direct competition with the CFE, while depending on it for basic interconnection and transmission services.

In 1992, the amendment of the "Electric Energy Public Service Law"[3] allowed the private sector to participate in power generation, either through self-generation for particular entities or individuals, through generation from Independent Power Producers (IPP), or for export to other countries.

Under the *self-generation scheme*, power consumers can produce electricity for their own use, which will get delivered to the CFE interconnection point and then transported to the consumer. To date, a total of 598 self-supply power generation permits have been granted by the Energy Regulatory Commission (CRE), accounting for a total of 6,105 MM, with wind energy accounting for a third of the permits issued to date.

Under the *Independent Power Producer (IPP) scheme*, private producers with plants over 30 MW must sell their power to the CFE through long-term power purchase agreements (PPA). Since 1992, more than more than 20% of Mexico's power generation is supplied by IPPs using conventional thermal power generation. There are now two IPP wind projects under construction; "La Venta III" (101 MW) and "Oaxaca I" (101 MW), both of which are expected to start operation in 2010.

The 2008 Energy Reform bill

In October 2008, the Mexican Congress approved the Energy Reform bill, which also included a new Renewable Energy Law[4] (LAERFTE), aiming at reducing Mexico's fossil fuel dependence by promoting renewable energy technologies. The new law recognises that renewable energy needs both significant support and financial incentives to achieve its potential.

The bill put SENER in charge of drafting a renewable energy programme, and it called for the development of a national strategy for the sustainable use of energy. Various bodies were created to design a renewable energy strategy and related public policies, which also involve the private sector.

Along with the LAERFTE, a "Special Program for the Use of Renewable Energy" was issued, setting the objective of increasing the share of renewable energy in the total national installed generating capacity from 3.3% (1,900 MW) to reach 7.6% (4,500 MW) by 2012; wind power is expected to account for more than half of this capacity.

Finally, a Renewable Energy Fund was created to promote the use of renewable sources and energy efficiency, including providing financing guarantees and direct support. Three billion pesos (220 million US$) have been allocated for this on an annual basis from 2009 to 2011.

Obstacles for Wind Energy Development

The Mexican wind energy industry is facing numerous problems, including insufficient transmission infrastructure and unclear rules for power transmission that make it difficult for private companies to develop and expand the renewable energy market. In addition, there are no specific support mechanisms or other incentives, and the rules for the Renewable Energy Fund remain undefined. Other obstacles include a weak judicial system, problems with long-term land leasing and conflicting objectives of the national utility and RE project developers.

While there is strong interest in wind energy development in Mexico from the side of the private sector, it is critical that federal and state governments address those obstacles in order to secure investments. Based on currently known or announced projects (see table) around 3,600 MW of wind farms could be operational by 2014.

With input from the Mexican Wind Energy Association (AMDEE)

3 Ley del Servicio Público de Energía Eléctrica
4 Law for the Development of Renewable Energy and the Financing of the Energy Transition

Morocco

Morocco relies on imported oil and coal for 97% of its energy needs, and its expanding economy creates an annual increase in electricity demand on the order of 8%. 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.

In a bid to alleviate the country's expensive dependence on energy imports, the Moroccan government in the 1980s turned its attention to promoting renewable energy sources.

With 3,500 km of coastline and average wind speeds between 6 and 11 m/s, wind power is one of the most promising sectors for renewable energy generation in Morocco. Data gathered by the Moroccan Center for Renewable Energy Development (CDER) confirms that Morocco has several areas with excellent potential for exploiting wind energy, particularly in the regions around Essaouira, Tangier and Tetouan (with average annual average wind speeds between 9.5 and 11 m/s at 40 metres) and the areas of Tarfaya Dakhla, Laayoune and Taza (with annual average wind speed between 7.5 and 9.5 m/s at 40 metres).

In 2009, two new wind farms were installed in Morocco with a total capacity of 119 MW: 107 MW in Tangier and 12 MW for a Lafarge cement factory in Tetouan. This nearly doubles the total installed wind capacity in Morocco, taking it up to 253 MW. In 2010, 33 MW will be added to the same site in Tangier.

Policies for wind power development in Morocco

The target of the Moroccan National Programme for Development of Renewable Energies and Energy Efficiency (PNDEREE) is to raise the contribution of renewable energy to reach 18% of the national electricity consumption (up from 7.9%) and 10% of primary energy (up from 3.4.%) by 2012. This translates into 1,564 MW of wind power development in this time frame. By 2020, 2,000–2,200 MW are envisaged, plus around 4,000 MW by the private sector.

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 50 MW of installed capacity.

Tetouan Wind Farm project for Lafarge Cement Plant *© CDER*

Through this initiative, the national electricity authority Office National l'Electricité (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.

Several pieces of new legislation were adopted by the Moroccan parliament in January 2010 to encourage renewable energy deployment.

Most significantly a new law was adopted to promote renewable energy by modifying an existing decree of 1968, authorising the production of electricity from renewable sources by companies other than ONE.

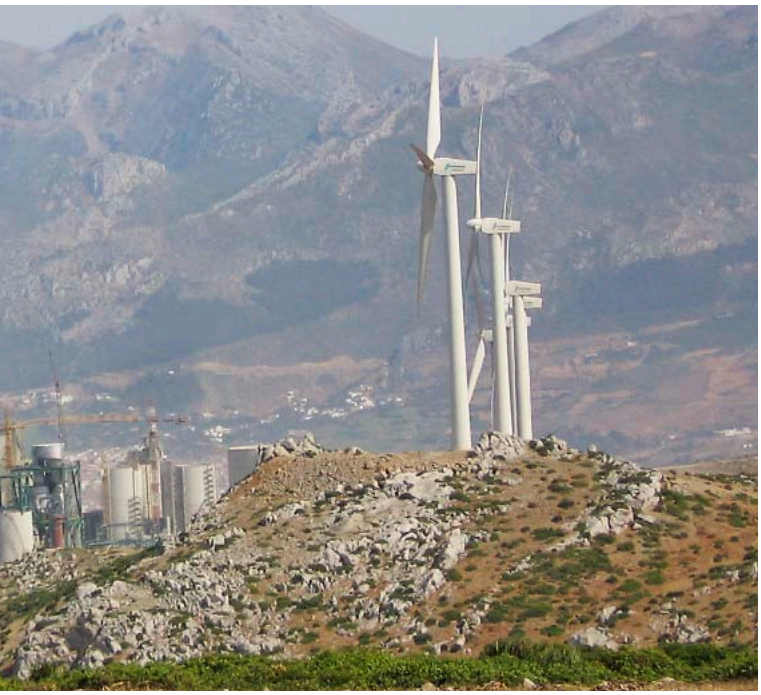
In addition, a new agency for renewable energy and energy efficiency (ADEREE) was created, which will replace CDER.

Existing wind farms in Morocco

The first wind farm in Morocco was installed in 2000 with a capacity of 50.4 MW in El Koudia El Baida (Tlat Taghramt -

TOTAL INSTALLED CAPACITY

year	2004	2005	2006	2007	2008	2009
MW	54	64	64	124	134	253



Province of Tetouan), a site with mean wind speeds of about 10.94 m/s and maximum wind speeds of 36.5 m/s at 10 meters height. The project was carried out by the company CED and consists of 84 Vestas turbines of 600 kW each. These wind turbines are connected to the national electrical grid of the North of Morocco. The annual production is about 200 GWh.

This was followed by a 3.5 MW project at the same site in March 2001, carried out in cooperation with Germany and using seven Enercon turbines of 500 kW each.

Another project of 10.2 MW was carried out by the cement company Lafarge for the electricity supply of its factory near Tetouan. 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 will be fed into the Moroccan grid. An additional 10 MW were added to this project in December 2008, bringing the capacity up to 20.2 MW.

In April 2007, Morocco's wind farm "Amogdoul" started operations, situated on Cap Sim 15km south of Essaouira. The site 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 210 GWh/year, reducing 156,000 tons of CO^2 per year.

New developments in 2009

In 2009, two new wind power projects started operations:

An initial 107 MW came online at a project at the sites of Allak, El Haoud and Beni Mejmel near Tangier and Tetouan cities, and a further 33 MW will be added in 2011, bringing the total capacity of the project to 140 MW. The project will be composed of 165 Gamesa turbines of 850 kW, and with wind speeds of 9 m/s at 40 meters, annual production is expected to be around 526 GWh per year.

In addition, a further 12 MW were added to the Lafarge wind farm near Tetouan in June 2009, made up of six turbines of 2 MW each. This brings the total capacity up to 32 MW.

Outlook for 2010-2012

Morocco is well on track to meeting its target of 1,500 MW of wind power by 2012, mainly due to plans by industrial companies to install around 1,000 MW of wind energy for their own consumption.

In March 2007, the Moroccan government launched a call for expressions of interest and prequalification of companies and consortia for the development, financing, construction and operation of a 300 MW wind farm in Tarfaya. Out of 17 companies that participated in the tender, two companies were shortlisted for the final selection, which is scheduled to take place in 2010.

The project will be installed in two phases. The first 200 MW are scheduled to be operational in September 2011, with the remaining 100 MW following in October 2012.

In addition to this, 33 MW will be added to the site in Tangier in 2010.

With input from the Center for Renewable Energy Development (CDER)

New Zealand

A tremendous untapped resource

Wind energy now supplies just over 3% of New Zealand's annual electricity demand. With New Zealand's excellent and largely untapped wind resource, this share has the potential to grow to 20% within 20 years.

In terms of total potential, a study completed for the Electricity Commission (New Zealand's electricity market regulator) indicated that the country's economic wind resource is sufficient to meet annual demand several times over. The study identified areas with an annual wind speed greater than about 8.5 metres/second, which have the potential to generate over 50,000 GWh per year. An even larger resource was identified in the next band of wind speed, from 7.5 m/s to 8.5m/s.

Hydro generation supplies about 55% of New Zealand's electricity, thermal generation supplies about 30%. Growing electricity demand and plans for phasing out 500 MW of coal-fired thermal generation are creating opportunities for new wind farm development.

RECORD CAPACITY GROWTH IN 2009

2009 saw record growth in installed wind capacity, which increased from 325 MW at the beginning of 2009 to 496.6 MW at the end of the year. Meridian Energy's 142 MW Project West Wind, near the capital city of Wellington, delivered first power in April. West Wind, the second stage of NZ Wind Farm's Te Rere Hau (30 MW) and the much smaller Horseshoe Bend (2.25 MW) were all fully commissioned by the end of the year.

Market Share (%)	2008	2009
Turbine supplier		
Vestas	95	62
Siemens	0	29
Windflow Technology	2	7
Other	3	2
Operator		
Trust Power	49	32
Meridian	46	59
NZ Windfarms	2	7
Other	3	2

West Wind wind farm, Wellington *© Windflow Technology*

Although 2009 saw substantial growth in wind energy capacity, for much of the year economic and policy uncertainty created doubt about industry growth beyond the completion of the three new projects mentioned above. Progress on achieving consent for proposed projects was mixed. Furthermore, a combination of high turbine prices and the relatively low value of the New Zealand Dollar compared to the Euro and US Dollar deterred investment in consented projects.

Towards the end of 2009 a window of opportunity opened for New Zealand developers as the value of the NZ Dollar increased while turbine prices and availability appeared to ease. Meridian's October announcement that it was beginning construction at Te Uku, in the upper North Island, provided a welcome indication that well-planned wind farm projects can be competitive with other forms of new generation. Also, TrustPower is now tendering for turbines for the first 30MW stage of its 200 MW Mahinerangi wind farm in the Lower South Island.

Operating wind farms in New Zealand

Wind Farm	Operator	Region	Capacity (MW)
Tararua	TrustPower	Manawatu	161
West Wind	Meridian	Wellington	142.6
Te Apiti	Meridian	Manawatu	90.8
White Hill	Meridian	Southland	58
Te Rere Hau	NZ Windfarms	Manawatu	32.5
Hau Nui	Genesis	Wairarapa	8.7
Horseshoe Bend	Pioneer Generation	Cental Otago	2.25

TOTAL INSTALLED CAPACITY

year	2001	2002	2003	2004	2005	2006	2007	2008	2009
MW	36	36	36	168	168	171	322	325	497

Policy environment for wind power

New Zealand is unique in that there are currently no incentives for investment in renewable energy. Early wind farm development was supported through the allocation of emission units under the Ministry for the Environment's Projects to Reduce Emissions (PRE) Scheme, which was introduced in 2003. New wind farms, including Te Uku and West Wind, have proceeded without support, showing that well-planned and executed projects can compete economically with other forms of new generation.

The New Zealand government has a target of meeting 90% of the country's electricity needs by renewable energy by 2025, up from the current 70%. The introduction of an Emissions Trading Scheme in 2008, combined with efforts to streamline the consent process, is designed to provide sufficient incentives to achieve this target.

THE RESOURCE MANAGEMENT ACT

In 2009 the Government implemented Phase One of its reforms to the Resource Management Act (RMA), the legislation under which the environmental effects of wind farms and all other forms of development are assessed and permission, or consent, is granted. The Act seeks to promote the sustainable management of natural and physical resources.

The reforms to the RMA set out to streamline and simplify the consent process and resulted in the establishment of the Environmental Protection Agency, which is expected to receive and process applications for projects of national significance (including wind farms over 100 MW when requested by the applicant) and provide support to Boards of Inquiry considering the proposals. How well the EPA works in practice remains to be seen. The Government is expected to progress Phase Two of its reforms this year.

THE EMISSIONS TRADING SCHEME

In late 2008, New Zealand's Labour government introduced an Emissions Trading Scheme, which was amended in 2009 by the new government, led by the center-right National Party. The scheme puts a price on greenhouse gas emissions, including those from electricity generation.

The 2009 amendments reduce the price signal for investors. Power generators will now receive 50% free allocations, and the amendments include a 25 NZ$ (17.2 US$) price cap on the cost of emissions units for the remaining 50%, effectively capping the carbon price at NZ$ 12.50. Both the free allocations and the price cap are currently legislated to end at the end of December 2012, but a review of the legislation is scheduled for 2011.

Also in 2009, the New Zealand government undertook a major review of the electricity sector and introduced legislation that, if passed in Parliament, will result in major changes to regulatory arrangements, including dissolving the Electricity Commission (the electricity market regulator).

Obstacles for wind energy development

Concerns over the visual impact of wind farms are increasingly threatening development in New Zealand.

A recent decision by the NZ Environment Court to decline consent for a proposed 630 MW wind farm in the lower South Island (Project Hayes) risks setting a precedent for the assessment of wind farms under the Resource Management Act. The decision suggested that the visual effects of renewable energy should be measured on a purely economic basis and that all possible alternative electricity generation projects to the proposed wind farm should have been explored in more depth. The applicant, Meridian Energy, has appealed the decision to the High Court.

2010 – a year of opportunity

2010 will be a significant year for the industry, even though there will be only a small growth in installed capacity. With the Government pursuing RMA and electricity sector reforms, combined with the entry of the electricity sector into the moderated Emissions Trading Scheme, there is the opportunity to ensure that the regulatory and policy environment enables all the options for new generation to compete on an equal footing.

With all of New Zealand's major electricity generators, as well as domestic and international wind energy developers, exploring options for wind generation, there is little doubt wind energy's role in New Zealand's electricity system will grow in the coming years.

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

Poland

A promising Eastern European market

Poland is well suited for large scale wind power development. Average wind speeds between 5.5 and 7.0 m/s (at 50 meters height) in large areas of the country make Poland one of the most promising wind energy markets in Europe.

According a report published by the Polish Wind Energy Association in November 2009[1], 13 GW of wind energy could be installed in Poland by 2020.

Wind power is the only renewable energy technology in Poland ready to attract significant investment, and there is a substantial pipeline of large wind farms spread evenly over the area of the entire country. These projects could be commissioned relatively soon and will make an important contribution to meeting Poland's target mandated by the new EU Renewable Energy Directive.

Developments in 2009

In 2009, the Polish wind market continued its growth by adding 181 MW of new capacity, taking total installations up to 724,6 MW. 864 GWh of wind power were produced in 2009.

New wind farms installed in 2009 include a number of large scale developments in the region of Zachodniopomorskie (Western Pomerania) in northwest Poland, such as a 32 MW wind farm in Śniatovo (using 2 MW Vestas turbines), a 69 MW wind farm in Karścino (using 1.5MW Fuhrländer turbines) and a 50 MW wind farm in Tychowo (using 2MW Nordex turbines).

Other large wind farms became operational in Podlaskie in the north east of Poland (a 41.4 MW wind farm in Suwałki, using 2.3 MW Siemens turbines) and in Wielkopolskie (a 20 MW wind farm in Margonin, using Gamesa 2 MW turbines).

1 PWIA 2009: Wind power development in Poland by 2020 – a vision

Wind farms in Poland

22 wind farms currently operate in Poland, and there are also single turbines or clusters of small turbines spread across the country. The table below shows those with 20 MW or more.

Location	Capacity (MW)
Jagniątkowo	30.6
Kamieńsk	30
Karścino	69
Kisielice	40.5
Lake Ostrowo	30.6
Łosina k/Słupska	48
Margonin	20
Puck	22
Śniatovo	32
Suwałki	41.4
Tychowo	50
Tymień	50
Zagórze	30
Zajączkowo & Widzino	90

The policy framework for wind

Poland depends on coal for 95% of its electricity production. According to the new EU Directive, Poland needs 15% of its final energy consumption to come from renewable energy by 2020, up from 7.2% in 2005. To date, the country has renewable energy production from biomass, biogas, wind and hydropower.

In 2000, the Polish government introduced a power purchase obligation for renewable energy sources, which was first amended in 2003, and again in August 2008. This requires energy suppliers to provide a certain minimum share of power generated by renewable sources (from 3.1% in 2005 up to 10.4% in 2010 and 12.9% in 2017).

While failure to comply with this legislation should, in theory, lead to penalties, the European Commission's 2007 report found that fines were not enforced.

In 2005, the Polish Law on Energy (1997) was amended to introduce an obligation for all renewable energy producers, regardless of the size of the installations, to obtain a license

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
MW	4	18	59	60	65	84	153	276	545	725

from the Energy Regulation Authority. Following this new requirement, more than 600 producers of renewable energy applied for and received licenses for producing electricity from renewable sources.

In January 2010, the Polish Sejm (lower house of Parliament) approved a new act amending the Energy Law, and most of the changes came into force in March 2010. The main provisions of this amendment concern electricity trading, grid connection agreements and related charges, agricultural biogas and new tools and rules to enable the Transmission System Operator (TSO) to secure the electricity supply.

Regarding renewable energy projects, new provisions were introduced in regards to advance payments on interconnection fees. In addition, entities seeking grid connection now have to prove their ability to develop new generation capacity, which could put wind farm developers at a disadvantage, and there are fears that this new instrument could form a barrier to investment of wind energy.

In August 2009, the Polish government also published a strategic document entitled "Energy policy of Poland up to 2030" [2], which is a starting point for a debate on the country's energy strategy. The main priorities outlined in this document concern energy security, economic competitiveness, nuclear power, increasing the use of renewable energy sources and environmental protection. The document also sets out a target of 15% of RES in final energy consumption by 2020, and a 20% share by 2030.

The Polish government is currently working on a new amendment to the Energy Law which would implement the provisions of the new EU Renewables Directive. The objective is for this to be adopted by the end of 2010, but it is unclear if this deadline will be met.

Obstacles for wind energy development in Poland

Some 6% of the area with the best wind conditions in Poland is situated in nature reserve areas (NATURA 2000), and while this does not prohibit the construction of wind farms in these areas, it makes it more difficult.

As in many other countries, grid infrastructure development is also an issue in Poland. The main problem is the lack of an effective mechanism which would oblige grid operators to focus their investments on increasing the operational security of the electricity system and to allow for grid access for wind energy producers. There are also no clear and transparent rules for determining and allocating costs between grid operators and power producers.

For offshore wind energy, limitations mainly arise from the protected nature reserve areas, weak grid infrastructure in the north of the country and numerous administrative barriers.

Prospects for wind energy development in Poland

Based on the number of applications received by the Polish Energy Regulatory Office for issuing licenses for wind farms, a big increase in wind generating capacity is expected in the near future.

In the period up to 2013, support schemes currently available to investors, including EU cohesion funds (Operational Programme Infrastructure and Environment) and structural funds (Regional Operational Programmes) will help drive wind power growth. However, the most rapid increase is predicted between 2014-2020, when even more significant financing will become available from the EU funds, in particular from structural funds.

While onshore wind is expected to grow at a healthy rate, no offshore developments are foreseen until 2018, when about 500 MW will be developed. By 2020, offshore wind capacity could reach 1,500 MW.

The Polish Wind Energy Association predicts very dynamic growth of installed capacity in the wind power sector, amounting to about 13 GW in 2020[3]. The figure comprises almost 11 GW of onshore wind farms, 1.5 GW in offshore wind and 600 MW of small wind.

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

1 http://www.mg.gov.pl/English/Programmes/Polands+Energy+Policy+until+2030.htm
2 PWIA 2009: Wind power development in Poland by 2020 – a vision

Spain

Maranchón wind farm, Guadalajara *© Wind Power Works*

2009 was one of the best years for wind power in Spain with 2,459 MW of new capacity added to the grid, second only to the record year of 2007, when 3,515 MW were added. This installed capacity growth represents an increase of 14.7% over 2008, and Spain is now the world's fourth largest wind energy market, with 19,149 MW of wind power installed at the end of 2009.

Wind power installations in Spain are concentrated in four regions, which account for 70% of the country's total installed wind capacity. Castilla y Leon (3,883 MW) overtook Castilla-La Mancha (3,700 MW) as the region with the most wind power, followed by Galicia (3,232 MW). However, the biggest growth happened in Andalusia, which added 1,077 MW of wind capacity, bringing its total up to 2,840 MW, and putting it in fourth place.

Wind energy now represents Spain's third largest power generation source with a production of 36,188 GWh in 2009, covering 14.5% of the country's electricity demand, compared to 11.5% in 2008, according to the Spanish Electric System Operator (REE). Only combined cycle gas and nuclear power produced more power over the year.

The Spanish wind industry

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

The four companies that led the development of wind farms in 2009 were Iberdrola Renovables, Acciona Energía, Neo Energía and EUFER.

Iberdrola Renovables maintained its leadership with a cumulative installed capacity of 4,882 MW (out of which 341 MW were installed in 2009), but it was Acciona that installed the most new capacity (360 MW), which reinforces its second place in the ranking. Other developers also contributed to the 2009 total, including EUFER (247 MW in 2009) and Neo Energía (291 MW).

In terms of manufacturers, Gamesa continues to lead the market, and accounted for 34% of the new, and 47% of the cumulative capacity at the end of 2009. Gamesa is followed by Vestas in second place and Acciona Wind Power in third. Other manufacturers in the Spanish market include Enercon, Suzlon and Siemens.

Wind energy: A key driver for Spain's economic development

In November 2009, the Spanish Wind Energy Association (AEE) presented an update of its 2008 study on "The

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
MW	2,235	3,337	4,825	6,203	8,263	10,027	11,623	15,145	16,689	19,149

Macroeconomic Impact of the Wind Energy Sector in Spain" [1)], carried out by the consultancy Deloitte. The study shows that the Spanish wind energy sector continues to contribute more to the country's GDP than some other key industry such as fisheries or wine.

In 2008, the Spanish wind industry exported equipment worth 2.9 billion Euros (up from 2.5 billion in 2007), invested close to 200 million Euros in research and development activities and created more than 41,000 jobs, including indirect employment and employment created by a large Spanish export industry producing components for the global wind market. Overall, the Spanish wind sector contributed € 3.8 bn to the country's GDP in 2008 (12.7% more than in 2007).

Wind power targets and the Spanish feed-in tariff

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 final electricity consumption should be met by renewable sources.

In 2005, the Spanish government set a goal for the country's installed wind power capacity to reach 20,155 MW by 2010.

In order to boost the uptake of renewable energy, a feed-in tariff system was first introduced in 1997 and then amended in 2004, 2006 and 2007.

According to the latest modification, there are now two alternative remuneration options for wind power:

a. a regulated tariff, which is a fixed amount paid for each kWh of wind generated electricity;

b. a premium added to the market price.

The power producer can choose between these two options for the duration of one year, after which they can keep to the chosen 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.

New 2009 legislation puts the pact of future development in doubt

In May 2009, a new law was published without prior consultation with the industry, which stipulated that every renewable energy developer had to register its projects in a newly created Pre-Assignment Register and await the decision of the Industry Ministry as to whether the projects were accepted. This provision has added a new level of complexity to the approval process for wind farms, and also lead to considerable delays as companies had to wait for up to seven months before being informed if the projects they submitted had been included in the Register. These delays resulted in the loss of thousands of jobs and the closure of some component and wind turbine manufacturing facilities.

Wind industry participants and AEE have warned that as a result of these regulations, wind installations could drop considerably in the coming years, putting the government's short- and medium-term targets in danger.

Outlook for 2010 – only 1,000 MW expected

As a result of the introduction of the Register, the Spanish Wind Energy Association (AEE) estimates that no more than 1,000 MW will be installed in 2010, a 60% drop compared to 2009. This would mean that the government's objective of reaching 20,155 MW of wind power capacity by the end of 2010 might not be met.

AEE highlights that the wind power industry has been affected by the creation of the Register of Pre-Allocation in the second half of 2009, which resulted in a sharp decrease of orders, and the loss of 5,000 direct jobs and additional indirect ones. However, the association estimates that the real effect of the administrative obstacle created by this law will only fully be felt in 2010.

With input from the Spanish Wind Energy Association (AEEolica)

1 AEE/Deloitte, 2009: Estudio macroeconómico del impacto del Sector Eólico en España

Turkey

Turkey is facing serious challenges in satisfying its growing energy demand. To fuel a rapidly growing economy, the country's electricity consumption is increasing by an average of 8-9% every year, and significant investments are needed in generation, transmission and distribution facilities to balance the power system's supply and demand.

With very very limited oil and gas reserves, Turkey is increasingly turning to renewable energy sources as a means to improve its energy security and curb dependence on imported gas from Russia and Iran.

In addition, fuelled by preparations for joining the European Union and the ratification of the Kyoto Protocol as an Annex I country, policy makers increasingly recognize the potential role of wind power as part of the country's future energy mix.

A Wind Atlas of Turkey published by the Turkish Energy Market Regulatory Agency (EMRA) 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.

Recent market developments

In 2009, 343 MW of new wind energy capacity were added in Turkey, bringing the total up to 801 MW. This represents a year-on-year growth rate of 75%. Taking into account the projects currenly under construction, it can be expected that some 500 MW of wind projects will be added in 2010.

Recent years have seen the start of a wind energy boom in Turkey. Before the famous tender on 1 November 2007, EMRA had received applications for more than 6,300 MW worth of wind projects, more than half of which are still under evaluation today.

Following the call for tender in November 2007, additional applications for 751 projects were received by EMRA in one day, totaling 78 GW.

To date, close to 3,000 MW of Turkish wind power projects have been licensed by EMRA, out of which 822.90 MW were operational at the end of February 2010, and a further 490.4 MW are under construction. It is expected that the remaining applications received before November 2007 will be licensed in the very near future. Following this, licenses are scheduled to be granted for 10,000 MW in the coming five years, 15,000 within 10 years and 20,000 MW in the long term. However, experts caution that Turkey's transmission infrastructure needs substantial upgrades in order to allow such large scale developments to be connected to the power grid.

Cesme Kores Wind Farm *© Dost Energy Inc*

The policy environment for wind power in Turkey

Since the introduction of Turkey's Electricity Market Law in March 2001, Turkey has taken substantial steps towards creating a competitive and functioning electricity market, restructuring public institutions operating in the sector, and implementing the market rules that will ensure liberalisation of the sector.

1 Law No. 5346 Law on Utilization of Renewable Energy Resources for the Purpose of Generating Electrical Energy; http://www.epdk.gov.tr/mevzuat/diger/diger.htm

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
MW	19	19	19	20	20	20	50	147	458	801

Turkey has a target of increasing the country's installed wind power capacity to 20,000 MW by the year 2023.

In order to boost the uptake of renewable energy, the Turkish government in May 2005 enacted its first Renewable Energy Law[1)], which introduced tariff support for electricity produced by renewable sources. In May 2007 a revision of the law increased the tariff slightly to 5 – 5.5 Euro ct/kWh for a period of 10 years.

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

A number of additional policy measures have helped to increase renewable energy 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 to stabilize the power system. Furthermore, most restrictions on foreign investment in the Turkish power sector have been lifted.

In addition, a law has been enacted to exempt wind power installations of less than 500 kW from the obligation to receive a generation license from the EMRA. It is expected that this limit will soon be significantly increased to include larger installations.

With input from the Turkish Wind Energy Association

Wind power projects in operation (February 2010)

Name	MW
ARES (Rüz-Alaçatı)	7.2
BORES (Rüz-Bozcaada	10.2
SUNJÜT (Rüzgar-Hadımköy)	1.2
AKBÜK RES (Akbük)	31.5
ALİZE ENERJi RES (Alaçatı)	1.5
AYYILDIZ RES(Bandırma-2)	15.0
BARES (Bandırma-3)	30.0
ÇAMSEKİ RES(Çanakkale)	20.8
DATÇA RES (Datça)	28.8
DÜZOVA RES (Bergam-Ayvalık)	15.0
İNTEPE (Çanakkale-Anemon)	30.4
KARAKURT RES (Akhisar)	10.8
KELTEPE RES (Göbel)	18.9
KORES (Urla-Mare)	15.0
MARE-RES (Alaçatı)	39.2
MAZI-RES (Alaçatı)	22.5
SAYALAR RES(Akhisar)	34.2
SOMA RES(Soma)	45.0
ŞAMLI RES(Balıllesir-1)	90.0
YUNT DAĞI RES (Alosbi)	42.5
BURGAZ RES (Gelibolu)	14.9
ÇATALCA RES (B.Çekmece)	60.0
ERTÜRK TEPE RES (Gelibolu)	0.9
SARIKAYA RES	28.8
LODOSRES (Taşoluk)	24.0
BELEN RES (İskenderun)	30.0
ROTOR OSMANİYE RES (Bahçe)	77.5
SEBENOBA RES (Antakya-3)	31.2
BANDIRMA RES(Akçalar)	45.0
Total	**822.90**

Projects under construction for 2010

Company	Project	Location	Mw
Akdeniz Elektrik Üretim A.Ş.	Mersin	İçel	34.0
As Makinsan Temiz Enerji Elektrik Üretim San. ve Tic. A.Ş.	Bandırma III	Balıkesir	24.0
Boreas Enerji Üretim Sistemleri San. Ve Tic. A.Ş.	Hisartepe RES	Edirne	15.0
Deniz Elektrik Üretim Ltd. Şti.	Sebenoba	Hatay	30.0
Doruk Enerji Üretim San. ve Tic. A.Ş.	Seyitali	İzmir	30.0
EZSE Elektrik Üretim Ltd. Şti.	Türbe	Hatay	35.1
EZSE Elektrik Üretim Ltd. Şti.	Samandağ	Hatay	22.5
Rotor Elektrik Üretim A.Ş.	Osmaniye	Osmaniye	135.0
Sabaş Elektrik Üretim A.Ş.	Turguttepe	Aydın	24.0
Soma Enerji Üretim San. ve Tic. A.Ş.	Soma RES	Manisa	140.8

United Kingdom

Despite being host to some of the best wind resources in Europe, the United Kingdom's wind energy market has taken a long time to start realising this potential.

For the first time, in 2009, the UK wind energy sector delivered more than 1,000 MW of new wind power capacity in one year, spread over 39 wind farms. From January to December 2009 a total of 1,077 MW of capacity were installed on and offshore, taking the UK installed total to 4,051 MW.

The pipeline also looks very healthy, with 1,713 MW in construction and a further 7,599 MW with planning consent. Given that in the UK it takes 2–3 years from getting planning permission to commissioning a wind farm, BWEA expects a total of about 10 GW of new wind capacity coming forward by the end of 2012.

The policy environment for renewable energy in the UK

THE RENEWABLE ENERGY OBLIGATION

The main instrument to stimulate growth in renewable energy has been the "Renewables Obligation", which came into force in April 2002 as part of the UK's Utilities Act (2000). It requires power suppliers to derive from renewables a specified proportion of the electricity they supply to their customers. This started at 3% in 2003, rising gradually to 10.4% by 2010, and 15.4% by 2015. The cost to consumers will be limited by a price cap and the Obligation is guaranteed in law until 2027.

Eligible renewable generators receive Renewables Obligation Certificates (ROCs) for each MWh of electricity generated. These certificates can then be sold to power suppliers, in order to fulfil their obligation.

The Renewables Obligation has often been criticised as too expensive, as it has resulted in an upwards trend in electricity prices in the UK. However, since it is a market based mechanism that is designed to reflect the supply and demand balance of renewable electricity, the shortage of projects in recent years resulted in a hike in prices. This was mainly due to delays in planning consents and a lack of grid connections, but this situation has improved steadily in recent months.

Statistics from the national market regulator OFGEM (Office of Gas & Electricity Markets) show that in the period 2008/2009 the average price for 1 ROC was £54.37 (€ 60.74), on top of the electricity price paid for 1 MWh[1]. Like in previous years, the Obligation was fulfilled at a level of 65%, which, given the increase in the Renewables Obligation, means that generation is growing in line with the growth in the Obligation.

For the second year running, onshore wind generated the largest number of ROCs, around 33% of the total, while offshore wind contributed 7.9%. This proportion is predicted to increase further in the 2009/2010 period.

FEED-IN TARIFFS

January 2009 saw the introduction of feed-in tariffs (FIT) for renewable energy projects up to 5 MW, which will come into force in April 2010. As a result, the UK now has two support mechanisms, ROCs and FIT, which aim to stimulate two different markets. ROCs will remain a key support incentive for larger installations and FIT is supposed to stimulate domestic and smaller-scale deployment.

Electricity generators will receive the FIT for 20 years, and for wind energy, it ranges from 34.5 pence (38.5 € cents) for installations smaller than 1.5 kW to 4.5 pence (5 € cents) for wind installations of 1.5-5 MW.

The UK government estimates that 2% of the country's electricity demand could be met by small scale renewable installations eligible for the FIT in 2020.

THE 2009 BUDGET

UK Budget, which was announced in April 2009, delivered a host of measures to ensure renewable energy projects were properly capitalised, particularly as project finance in 2008 and 2009 had dried up and many smaller and medium-sized developers were having problems raising capital. The Budget included a plan backed by the European Investment Bank (EIB) to inject much needed liquidity into the onshore wind market by making available a total of GBP 1.4 billion for wind farms with planning permission. This includes a GBP 700 million contribution from the EIB, matched with a further GBP 700 million from three commercial banks.

1 OFGEM: Renewables Obligation: Annual Report 2008-2009, March 2010; http://www.ofgem.gov.uk/Sustainability/Environment/RenewablObl/Documents1/Annual%20Report%202008-09.pdf

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
MW	406	474	552	648	888	1,353	1,962	2,406	2,974	4,051

There were also concerns about costs and profitability of offshore wind projects, which the government sought to address by increasing the ROC multiple temporarily for projects reaching financial close in the financial years 2009/10 and 2010/11. This will result in a higher amount of ROCs received per MWh for these projects. Combined with a reconfirmed commitment to ROCs up until 2037, the hope is that the measures will create a stable investment climate.

THE 2009 RENEWABLE ENERGY STRATEGY

The Renewable Energy Strategy (RES) was launched by the government in July 2009, a co-ordinated approach to bring into play a broad variety of low-carbon technologies, with a view to comprehensively cut transport, heat and electricity emissions.

The RES includes a target of reaching 15% of final energy consumption from renewable sources by 2020 (up from 2% in 2008), in line with the EU Renewables Directive. In order to meet this target, around 35% of the UK's electricity demand would have to be generated by renewables. Given the limits on solar and other renewable resources, a combination of on- and offshore wind energy will have to deliver the major portion of this percentage. The UK government would like see onshore wind grow from around 3.4 GW today to at least 13-14 GW by 2020, and suitable sites for up to 50 GW of offshore wind power development have been identified for this timeframe.

The world's leading offshore market

The UK continues to hold its position as the world's leading market for offshore wind energy, with 883 MW installed at the end of 2009, 284 of which came on line in 2009.

The scale of the potential for offshore development in the UK is phenomenal, with average capacity factors of around 35%, according to the Digest of United Kingdom Energy Statistics (DUKES), published in 2009 by the Department of Energy and Climate Change. The Crown Estate, the agency that manages the seabed on behalf of the Government, has identified potential development sites adding up to close to 50 GW. The British Wind Energy Association (BWEA) estimates that a substantial part of this could be delivered by the end of the next decade, during a time when a considerable number of old fashioned coal and gas generation plants would reach the end of their lifetime or would have to be decommissioned for environmental reasons.

An industrial base for wind energy?

Both the Renewable Energy Strategy and the 2009 Budget have sent robust signals for the UK Government's commitment to renewable energy. As a result, towards the end of 2009, first signs were pointing towards increased investor confidence in the UK market. A series of announcements from companies such as JDR Cables, Clipper Windpower, Mitsubishi and Mabey Bridge heralded a fresh wave of investment in the country's manufacturing base.

The potential size of the wind energy sector in terms of direct employment has been estimated at around 70,000 jobs, and the UK is trying to position itself as the hub of European offshore development. The small wind systems sector has also continued to perform well, with strong exports and signs of domestic growth following the announcement of the feed-in tariff.

Future Developments

Both the UK Government and the general public seem to have woken up to the potential of the domestic wind energy sector. There is a an expectation that wind energy could bridge the looming energy gap, and replace the diminishing North Sea oil and gas reserves, both in terms of fuel and industry and employment.

While public opposition continues to be a problem in the UK, the latest research conducted in 2009 shows that a significant majority (73%) of the UK's population supports the EU's 2020 targets, with 62% saying that they would not mind living within 5km of a wind farm. Unfortunately, these attitudes are often overshadowed by a minority of vociferous anti-wind campaigners.

The UK Government and large sections of the business community have moved away from judging the EU 2020 targets as a painful and costly obligation, and now see it as a valuable opportunity to create jobs and revitalize some of the country's manufacturing and logistics sectors. Obstacles remain, chiefly planning, grid and radar objections, but there is a sense that the UK wind sector is on course not only to take its place amongst established forms of generation domestically, but to catch up with more developed national markets in Europe and around the world.

With input from the British Wind Energy Association (BWEA)

United States

US wind market breaks all records in 2009

Despite an inhospitable economic climate, the US wind energy industry shattered all records in 2009, installing nearly 10,000 megawatts (MW) of new generating capacity, enough to serve over 2.4 million average American homes.

The 9,996 MW installed in 2009 expanded the nation's wind plant fleet by 39% and brought total wind power generating capacity in the U.S to over 35,000 MW. The five-year average annual growth rate for the industry is now 39%, up from 32% between 2003 and 2008. US wind projects today generate enough to power the equivalent of 9.7 million homes.

The 2009 numbers reflect a fourth quarter boom, during which over just over 4,000 MW were installed, slightly below the 2008 fourth quarter total of 4,112 MW, which is still the high water mark for US wind energy installation in a single quarter.

The strong growth of US wind installations amidst an economic downturn reflects the impact of financial incentives adopted by the US Congress early in 2009. However, to sustain the growth over a longer period, increase wind energy manufacturing jobs, and solidify wind's place in the US energy market, the US wind industry in 2010 is seeking permanent renewable energy targets, in the form of a national renewable electricity standard (RES), which must be enacted by the US Congress and signed into law by President Obama.

The American Recovery and Reinvestment Act

In February 2009, the US Congress passed the American Recovery and Reinvestment Act (ARRA), an economic stimulus bill which included several provisions to spur development of wind energy in the adverse economic climate, such as:

- a 3-year extension of the Production Tax Credit (PTC) through to 2012;
- an option to elect a 30% Investment Tax Credit (ITC) in place of the PTC. The initial provision stipulated that this credit could then be converted into a grant for projects that begun construction or started operation in 2009, but this has now been extended until the end of 2010;
- tax credits for new manufacturing facilities;
- a new $6 billion Department of Energy (DOE) renewable energy loan guarantee program.

These financial incentives, and particularly the grant programme, have been very beneficial in keeping the industry moving forward during the 2009-2010 economic slowdown.

Wind energy now operating in 36 US states

Thirty-six of the 50 states now have utility-scale wind installations and 14 states now have more than 1,000 MW installed. Texas remains th e leading state with more than 9,000 MW of total installed capacity. Iowa is in second place with 3,670 MW, followed by California, Washington state and Minnesota.

In terms of new capacity added in 2009, Texas led the pack with 2,300 MW, followed by Indiana, which got started in wind late in 2008, and installed more than 900 MW in 2009. Oregon, Iowa and Illinois round out the top five in new capacity added in 2009.

During 2009, work was completed on the world's largest wind farm near Roscoe, Texas, with an installed capacity of 781.5 megawatts (MW), generating enough electricity to power more than 230,000 homes. It covers nearly 100,000 acres in four counties, and hosts 627 turbines.

Wind industry employs 85,000 people

The wind industry now employs around 85,000 people in the US, and at least 100 manufacturing plants have been built, announced or expanded in the past five years, 55 of those in 2008 alone. The eight wind turbine manufacturers with a significant market share in the US have set up manufacturing facilities in the US, or have announced that they will do so.

The five top turbine manufacturers in the US market in 2008 were GE Energy, Vestas, Siemens, Suzlon and Gamesa. The five top wind developers at the end of 2008, were Next Era Energy Resources (formerly FPL Energy), Iberdrola

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
MW	2,578	4,275	4,685	6,372	6,725	9,149	11,575	16,824	25,068	35,064

Renewables, MidAmerican Energy, Horizon-EDP Renewables, and Invenergy.

Studies show: 20% of US electricity could come from wind in 2020

Wind energy now is generating close to 2% of US electricity needs, but experts estimate that with the right policies in place, the potential is much greater. In 2008, the US Department of Energy released a ground-breaking report, finding that wind power could provide 20% of US electricity by 2030[1]. A more recent analysis of wind integration in the Eastern region of the country drew similar conclusions[2].

Policy certainty: A national Renewable Energy Standard?

In the last decade the US wind energy industry has been subject to an on-again, off-again tax policy that has made it difficult to sustain momentum; growth in wind installed tended to rise and fall with the renewal or expiration of the main national policy incentive, the Production Tax Credit (PTC).

This situation has not been remedied. Although the PTC received a three-year extension as part of the Recovery Act, its future remains unclear, and there is a chance that the US market could return to the boom-and-bust cycle that it experienced in the first half of the last decade.

In order to provide stability and investor certainty to the market, the US wind industry has continuously called for the introduction of a national electricity standard (RES), which would provide a predictable, competitive market, within which renewable generators compete with each other to lower prices. RES policies currently exist in 28 U.S. states, but not at the national level.

A national RES would ideally call for 25% of the country's electricity to come from renewable energy by 2025, with an aggressive near-term target, such as 10% by 2012, as was called for in the Obama-Biden New Energy for America plan, to ensure rapid renewable energy deployment. This would signal a long-term national commitment to wind and other renewable energy, spur greater demand for wind energy and for wind energy components, and also lead to more turbine manufacturers building facilities in the US.

The US House of Representatives in June 2009 passed the American Clean Energy and Security Act, which contains a 20% RES by 2020 (allowing 8% of the standard to be met through energy efficiency improvements). A similar bill, which was introduced to the Senate also in June 2009, contains 15% RES by 2020 standard, with a maximum of 4% to be met through energy efficiency improvements.

However, the US Senate has not to date passed this bill, which also contains wider ranging cap-and-trade climate legislation. The American wind energy industry is working hard on getting the RES bill passed through Congress in 2010 to provide a real long-term boost to the wind power sector.

Transmission upgrades needed

The other policy priority for the US industry concerns transmission. If the United States is to take full advantage of its wind resources, significant new transmission is needed to connect wind farms to the population centers where the power is consumed. New transmission capacity will also have to connect markets that are now segregated.

However, the present US regulatory structure makes it difficult and time consuming to get new transmission planned, financed and permitted. The US industry is seeking changes in present laws and regulations so that new transmission lines can be built.

Uncertain outlook for 2010 and beyond

It is difficult to predict how the US wind industry will perform in 2010 and beyond. While during the year 2010, Recovery Act incentives will continue to be a driving factor, beyond this, the outlook for the industry will largely depend on market signals.

Congressional action on an RES and transmission reforms will send an important signal that will stimulate demand and increase US manufacturing facilities. Only hard, long-term targets and an RES will be able provide the necessary stability for manufacturers to expand their US operations.

With input from the American Wind Energy Association (AWEA)

1 www.20percentwind.org
2 NREL 2010: Eastern Wind Integration and Transmission Study http://www.nrel.gov/wind/systemsintegration/ewits.html

About GWEC

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**
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- **GLOBAL OUTREACH**
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  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, GWEC's members represent the entire wind energy community. Including:

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