

A photograph of an offshore wind farm. The image shows a large white wind turbine in the foreground, with its three blades extending outwards. The turbine is mounted on a tall, slender tower. In the background, several other similar wind turbines are visible, creating a sense of depth. The sea is dark blue, and the sky is a clear, light blue. A small red and white boat is visible on the horizon in the distance.

GLOBAL WIND REPORT

Annual market update 2010

GWEC
GLOBAL WIND ENERGY COUNCIL

Foreword

2010 was a tough year for our industry, and although cumulative market growth was still a healthy 24.1 %, the annual market decreased for the first time in about two decades. The medium term consequences of the financial crisis and the economic slowdown finally took their toll, and very low orders in OECD countries at the end of 2008 and the beginning of 2009 made themselves felt in the 2010 installation totals, particularly in the United States.

Having said that, 38.3 GW of new wind power capacity was added around the world last year, and for the first time the majority of that new capacity was in developing countries and emerging economies; driven mainly by the booming wind sectors in China and India, but also with strong growth in Latin America, where we believe we are on the cusp of the wind energy boom in that wind resource-rich region which we have been waiting for and expecting for so many years.

We look forward to a rebound in the global market and for the period out to 2015. There has been a massive intake of orders by major manufacturers in 2010 which will manifest itself in the 2011 and 2012 installation figures, driven by continued strong growth in Asia, a recovery in North America, and steady growth in Europe. Also, new markets in Latin America and Africa will begin to seriously flex their muscles for the first time.

Public finance continues to play a stronger role in the financing of wind projects, and we see that as a permanent shift in the financing pattern for our industry. While we are hoping for a strong return of the commercial banks to the sector, that will no doubt take a lot longer than was thought last year. Fortunately, public finance institutions seem to have taken up the slack with some gusto, well beyond the stimulus funds put forward during the worst of the recession in 2009.

We are still waiting for a resolution to the global debate on climate change and we are still waiting for any signs of a clear pathway towards a global price on carbon. If the pace of the international climate negotiations during 2010 is any indication, we are going to have to continue to wait for some time. Hopes are higher for COP17 in Durban this year than they were for Cancun, but few observers expect final resolutions to the fundamental unresolved issues.

We expect that by the time this report is printed global installed capacity will have reached 200 GW. We estimate that this will double again within three to four years, keeping open the option to reach GWEC's aspirational goal of 1,000 GW of installed capacity by 2020.

This is the sixth 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 about 80 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.

April 2011



Steve Sawyer
Secretary General
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Wind power in emerging economies

In 2010, for the first time ever, more new wind power capacity was installed in developing countries and emerging economies than in the traditional wind markets of the OECD. This puts an end to the assertion that wind power is a premium technology only for rich countries which cannot be deployed at scale in other markets. It is also testament to the inherent attractiveness of wind power for countries striving to diversify their energy mix, improve their security of supply in the face of rapidly growing demand, and relieve national budgets of the burden of expensive fossil fuel imports at volatile prices. Environmental factors such as improving air quality and public health, and carbon reductions to fight against climate change also play an important role in many of these new markets.

There is also a noticeable shift in attitudes towards wind power in many countries. While the technology would have been dismissed as too expensive by many developing country energy planners just a few years ago, the continuing success of the technology in an ever widening group of countries has changed that attitude to one of dramatically increased knowledge about wind generation and the role that it can play in a country's power mix.

The growth of wind power outside of the OECD has been primarily driven by the continuing boom in **China**, which is now the country with the largest installed wind power capacity in the world. The Chinese government has a clear commitment to developing the country's massive wind resource, partly driven by the need for increasing its power generation capacity to fuel a growing economy and to spur rural economic development. Furthermore, the Chinese government is committed to slowing down the country's increasing greenhouse gas emissions and reducing air pollution. This political commitment was underpinned by favourable policies to boost wind power development, and this has led to exceptional growth in this sector. After four years of doubling its installed wind capacity from 2006-2009, a record capacity of 18.9 GW was added to the Chinese wind fleet in 2010, taking the total up to 42.3 GW. Wind power now represents nearly a fifth of all yearly net power generation capacity additions in China, nearly on par with hydro.

Beyond wind power's environmental and energy security benefits, the Chinese government also recognises the

economic opportunity of building a strong domestic manufacturing base. In 2009, out of the world's top ten wind turbine manufacturers, three were Chinese, and annual domestic production capacity is now at least 30 GW. Chinese manufacturers are increasingly looking at international markets, and it is expected that Chinese wind turbines will soon be fully competing in the global market place. (For more information on China, see p. 30)

A similar picture is emerging in **India**, albeit on a smaller scale. A rapidly growing economy and expanding population create a growing demand for power, and supply struggles to keep up with demand. Electricity shortages are common, and a significant part of the population has no access to electricity at all. In order to address this problem, the Indian government created a target of an additional 78.7 GW of generation capacity from 2007-2012, 10.5 GW of which will be new wind generation capacity. The Indian Ministry of New and Renewable Energy (MNRE) estimates that there is a potential of 48.5 GW of wind power development, but industry experts estimate that a minimum of 100 GW could be realised in India. At the end of 2010, India had 13.1 GW of installed wind capacity, with 40% operating in the southern state of Tamil Nadu.

Like in China, India's wind power development has spurred domestic manufacturing, and the Indian company Suzlon is now a global leader. 17 companies now manufacture wind power equipment in India, with a production capacity of 7.5 GW per year. Thanks to new market entrants, it is expected that this will rise to 17 GW or more by 2013, according to the World Institute for Sustainable Energy (WISE). Wind turbines and turbine blades made in India have been exported to the USA, Europe, Australia, China and Brazil. (See p. 44 for more information on India)

While wind markets in the rest of **Asia** are only at the early stages of development, there is considerable potential and some promising signs. Across the region there are at least a dozen vibrant and rapidly growing economies in which wind energy could play a significant role, and there is increasing interest in the technology from policymakers and utility executives.

While wind energy in **South Korea** is still in its infancy, the Korean government recently introduced a Renewable

Portfolio Standard (RPS) scheme and set an ambitious target of developing 2.5 GW of offshore wind power by 2020. Several Korean heavy manufacturers such as Samsung, Hyundai and Daewoo have started to include wind turbines in their portfolio in order to compete both domestically and in the international marketplace. In 2010, installed wind capacity increased by 30 MW to reach 379 MW.

In the **Philippines**, 33 MW of wind power are currently operating, but the technical potential is estimated at around 55 GW, over three times the country's current total installed generation capacity, according to UNEP's Solar and Wind Resource Assessment (SWERA). The government has set a target for 40% of its electricity to be generated by renewable sources by 2020, up from the current 33%. Both the Philippines government and the Asian Development Bank (ADB) have set up funds to help with this process.

Vietnam has 18 MW of operating wind power capacity, but strong winds could support 642 GW of wind energy development, according to SWERA. In addition, Vietnam has a fast-growing economy and a growing demand for electric power. The Vietnamese government is aiming for renewable power to provide about 5% of the nation's electricity by 2020. Investor interest in the Vietnamese wind market is considerable, and various wind power projects are reported to be in the pipeline.

Thailand's growing affluence has led to a startling rise in per capita electricity consumption, which has grown by almost 25% in the past five years. An estimated 30.2 GW of new generation capacity will be needed by 2021. The government has announced a target of increasing the share of renewable energy from 6.4% in 2008 to 20% in 2022, with an 800 MW target for wind capacity. According to SWERA, Thailand's technical wind resource could support the development of 190 GW of wind power.

Prosperous **Taiwan** imports 98% of its fuel needs, and has set a target for renewables to meet 10% of its electricity by 2010, up from 5.8% currently. Wind power is expected to meet 80% of that, and a feed-in tariff was introduced in 2009. During 2010, Taiwan installed 83 MW of new wind power, bringing its total to 519 MW.



La Mata-La Ventosa wind farm, Mexico © AMDEE

In **Pakistan**, the far-reaching implications of the flood disaster of 2010 on infrastructure in general, and the power infrastructure specifically, have worsened the supply situation and led to acute power shortage. Most of the country's power needs to date are met by fossil fuels. To support the addition of renewable capacity, the Asian Development Bank set up a 510 million USD financing facility in 2006, and a feed-in tariff was introduced. In addition, USAID is co-funding a public-private partnership to develop a 150 MW wind project in the Gharo Corridor. The potential for wind power is estimated to be around 350 GW, according to both the Pakistani government and SWERA.

Other countries in the region have also set ambitious targets for wind power development, but this has not always been followed up by the introduction of effective policy frameworks. **Bangladesh**, for example, has set a target of reaching 5% of its electricity to come from renewables by 2015; **Mongolia** plans to increase its share of renewable electricity from the current 3% to 20–25% by 2020; **Sri Lanka** wants to go from the current 5% to reach 10% by 2017 and 14.1% by 2022, and **Indonesia** is planning to build 255 MW of wind capacity by 2025.¹



Latin America

Latin America, a region of great cultural and economic diversity, has some of the world's best wind resources. Home to many growing economies with increasing electricity demand, this part of the world is considered prime territory for the deployment of wind power.

While beginnings have been modest, there are now concrete signs that the region is on the verge of developing a substantial wind power industry to complement its rich hydro and biomass (and potential solar) resources, most notably in Brazil and Mexico. The total installed capacity in the region grew by 50% during 2010, and more than 2,000 MW of wind power are now operating across the region.

Wind power is making the most progress in **Brazil**, the region's largest economy. This country has many areas with tremendous potential for wind energy, combined with a

growing electricity demand and solid industrial and grid infrastructure. As a country with a large share of hydro power, this combination forms an ideal basis for large-scale wind power development. At the end of 2010, 930 MW of wind capacity were operating in Brazil, with a project pipeline of more than 4,000 MW up to 2013, most of which were contracted in the 2009 and 2010 auctions. Two new auctions have already been announced for June 2011. Since the December 2009 auction, seven major international manufacturers have committed to building production facilities in Brazil, most of which are already under construction. Brazil is set to not only be the largest wind power market in the region, but will also be a major manufacturing hub for the region. (See p. 24 for more information on Brazil)

Mexico, too, has an outstanding wind resource, especially in the Oaxaca region, but also in Baja California as well as in other regions. Mexico's installed wind capacity has increased more than 6-fold since the end of 2008, and 316 MW of new capacity were added in 2010 to reach a total of 519 MW. (See p. 48 for more information on Mexico)

Argentina's wind resources are unrivalled in the region, and are estimated to be sufficient to supply Latin America's entire electrical demand several times over. However, to date, only a tiny amount of the potential has been developed with just 60 MW of wind power operating, up from 33.5 MW at the end of 2009.

Another promising market is **Chile**, which had nearly 172 MW of wind power in operation at the end of 2010. A number of large wind power projects are under development, and they are desperately needed to help alleviate chronic gas shortages.

Uruguay is also starting to develop its wind resource and added 23 MW of new capacity for a total of 43 MW at the end of 2010. The country has a target of reaching 500 MW by 2015.

Other wind power markets in the region include **Costa Rica**, which had about 123 MW of wind power at the end of 2010, and a new 50 MW project in the pipeline; **Peru**, which had nearly 150 MW under construction at the end of 2010; **Venezuela** with 100 MW currently under construction,

1 REN21 Global Status Report 2010

scheduled to come on line in 2011; **Jamaica**, with 24 MW installed capacity; **Nicaragua**, which installed 40 MW of wind power in 2009; and **Honduras**, with 102 MW under development, due to come online in 2012.

Unfortunately, however, most of these early markets suffer from the lack of a clear, long-term policy framework for wind power development which continues to hamper market development.

Africa

Wind energy could bring many benefits to Africa due to its scalability, which means that it can play a key role in both decentralized and centralized systems. Also, the fact that wind power uses no water to generate electricity is good news for this water-stressed continent.

About a quarter of the world's population has no access to electricity, and the problem is especially acute in peri-urban and rural areas in Sub-Saharan Africa. In many African countries, the electricity that is available is likely to be generated from diesel generators or other small-scale plant. These very often use expensive imported fuel and many countries spend a considerable share of their scarce foreign exchange reserves on energy imports.

Large-scale power production in Africa, where it exists, is mostly by large hydro (as found in Egypt) or coal-based generation (as in South Africa).

Africa's wind resource is best around the coasts and in the eastern highlands, but it is only in Mediterranean North Africa that wind power has been developed at scale. 97% of the continent's total wind installations are located in Egypt (550 MW), Morocco (286 MW) and Tunisia (114 MW).

Egypt has a target of producing 20% of its electric power from renewable sources by 2020, and this includes a 12% contribution from wind energy, which translates into more than 7,200 MW of grid-connected wind power. Most of Egypt's wind development to date is in the Zafarana district on the Red Sea coast, but there are also plans to construct a 250 MW plant at Gabal el-Zeit, and a recent tender has called for proposals to build a further 500 MW in the Gulf of

Suez. A second tender for the same amount is expected for July 2011. (For more information on Egypt see p. 34)

Morocco has excellent wind resources along the coastline, as well as inland near the Atlas Mountains. The Moroccan government has set a target of raising the contribution of renewable energy to 20% of national electricity consumption (up from 7.9%) by 2020. Wind power is poised to play a key role with a targeted 2,000 MW of capacity, up from the existing 286 MW at the end of 2010. Half of this will be installed by the government owned utility ONE, with the other half coming from industrial players producing their own wind power. (See p. 50 for more information on Morocco)

South Africa's electricity system, which is primarily based on coal, suffers from low reserve margins, and is barely adequate to meet demand. The state utility Eskom estimates that the country needs to construct 40 GW of new generating capacity by 2025. South Africa is ideally suited for wind power development, given its abundant wind resources.

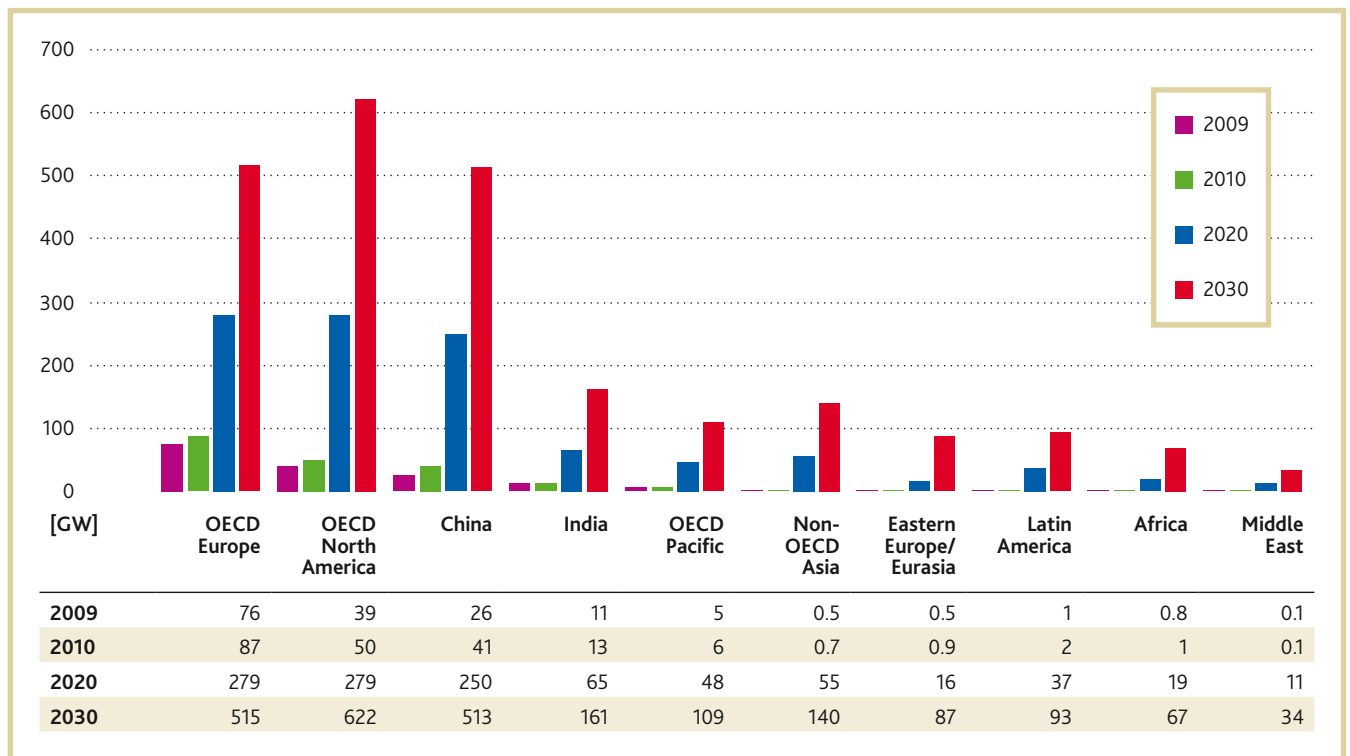
While currently only one commercial-scale wind farm is in operation, the 8 MW Darling wind farm, the South African Wind Energy Association (SAWEA) estimates that with the right policy framework, wind power could provide as much as 20% of the country's energy demand by 2025, translating into 30,000 MW of installed wind capacity. According to SAWEA, 7,000 MW of this wind capacity is already at various stages of development, waiting for confirmation of grid connection and a Power Purchase Agreement (PPA).

Interestingly there have recently been developments in East Africa, with a 300 MW project under construction in **Kenya** and other wind projects well advanced in **Ethiopia** and **Tanzania**. These early projects will make a substantial contribution to the total generating capacity in each of these countries and may spur similar large scale developments in other African countries.

Middle East

The Middle East is rich in oil and gas, yet these reserves are unevenly distributed, with some countries major oil exporters and others importers. With increasing prosperity in much of the region, power demand has been growing rapidly.

REGIONAL BREAKDOWN: ADVANCED SCENARIO (GWEO 2010)



A number of governments in the Middle East have developed national plans for renewable energy, but current uptake of wind power is in its infancy, with only 92 MW installed in Iran, 8 MW in Israel and 2 MW in Jordan. While less evenly distributed than solar, the region's wind resource is excellent in some countries such as Iran, Oman, Syria, Saudi Arabia and Jordan.

Iran is the only country in the region with any large scale wind power installations. The country currently has two wind farms, with a combined capacity of 92 MW. There are plans for expanding wind capacity to reach 400 MW in the coming years. Preliminary studies conducted by SUNA have shown that Iran has at least 6.5 GW of practical wind power potential. (For more information on Iran see p. 46)

Jordan has a target of achieving 7% of its primary energy demand from renewables by 2015, and 10% by 2020. In 2010 Jordan introduced a Renewable Energy Law which requires the National Electric Power Company to purchase all electricity produced by independent and small-scale renewable plants at full retail price (net metering). **Syria's** target is for renewable energy to make up 4.3% of primary energy demand by 2011, and it has two wind farms (100 MW and 30 MW) in planning. **Oman** also has considerable wind power potential, mainly in the South and in the mountains north of Salalah.

Wind power uptake in emerging economies – A trend for the future?

Given the vast potential for wind power development in Asia, Latin America, Africa and the Middle East, GWEC's Global Wind Energy Outlook "advanced scenario" forecasts that by 2020, more than 40% of the total global wind power capacity could be installed in these regions, up from 31% at the end of 2010.¹ Given the swing in the 2010 market, this shift could be even more pronounced. China will continue to drive this development, hosting more than half of the wind power operating outside of the OECD by 2020, but other markets in the rest of Asia, Latin America and Africa are also expected to contribute substantially to the global total.

While there are strong economic, supply security and environmental drivers for wind power in developing countries and emerging economies, a key determining factor for realising the vast potential will be the political will of governments to make this happen. Favourable support schemes, financial incentives, adequate grid infrastructure and access to financing are some key conditions required for allowing wind power to thrive in these countries.

¹ Global Wind Energy Council: Global Wind Energy Outlook 2010. www.gwec.net/index.php?id=168

The global status of wind power in 2010

The expectations for wind power market growth in 2010 were mixed, as the low level of orders seen during the financial crisis worked their way through the system. The results of this were felt much more strongly in 2010 than in the previous year, and the overall annual market shrunk by 0.5% to 38.3 GW, down from 38.8 GW in 2009. The new capacity added in 2010 represents investments worth EUR 49.8 billion (USD 71.8 billion).

The US market installed almost 50% less than in 2009. In the European market, new installed capacity in 2010 was 7.5% down on 2009, despite a 50% growth of the offshore market in countries like the UK, Denmark and Belgium, and rapid growth in Eastern Europe, led by Romania, Bulgaria and Poland.

Despite the decrease in annual installations, global installed wind power capacity increased by 24.1% during the year, and now stands at 197.0 GW. For most other sectors that have not become accustomed to growth rates of 30% or more, this would represent a major achievement.

The main markets driving growth continue to be Asia and Europe, which installed 21.5 GW and 9.9 GW respectively in 2010. However, emerging markets in Latin America are beginning to take off, led by Brazil and Mexico. In cumulative terms, the Latin America and Caribbean market grew by more than 53% during 2010.

For the first time in 2010, more than half of all new wind power was added outside of the traditional markets of Europe and North America. This was mainly driven by the continuing boom in China, which accounted for half the new global wind installations, with 18.9 GW. China now has 44.7 GW of wind power, and has surpassed the US to claim the number one spot in terms of total installed capacity.

The outlook for 2011 is more optimistic, with overall investment in wind power in 2010 up by 31% to reach USD 96 billion (EUR 70.4 billion), according to Bloomberg New Energy Finance (BNEF). This investment gives rise to some optimism going forward, as it is likely to translate into actual projects in 2011 and 2012. It is notable that 38% of this total investment was accounted for by China and by large European offshore wind farms.

China leads booming markets in Asia

For the third year in a row, Asia was the world's largest regional market for wind energy, with capacity additions amounting to 21.5 GW.

China was the world's largest market in 2010, adding a staggering 18.9 GW of new capacity, and slipping past the USA to become the world's leading wind power country. The Chinese market more than doubled its capacity from 12 GW in 2008 to 25.8 GW in 2009 and added 16.5 MW in 2010 to reach 42.2 GW at the end of 2010.

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. China has now become the world's largest producer of wind energy equipment, and components made in China are now starting to not only satisfy domestic demand, but also meet international needs. Two Chinese companies, Sinovel and Goldwind, were already among the world's top five turbine manufacturers in 2009, and there are first moves by Chinese manufacturers to enter international markets.

The planning, development and construction for the "Wind Base" programme, which aims to build 138 GW of wind capacity in eight Chinese provinces, is well underway. In its twelfth Five-Year Plan, which was passed by the Chinese Parliament in March 2011, the government set a new target of building a total 90 GW of wind energy by 2015.

After a few years of slow growth, the **Indian** wind power market is now back on track and witnessed significant growth in 2010. It comes in third behind China and the USA in terms of new installed capacity during 2010 at 2,139 MW, taking total capacity up to 13.1 GW. The states with highest wind power concentration are Tamil Nadu, Maharashtra, Gujarat, Rajasthan, Karnataka, Madhya Pradesh and Andhra Pradesh.

The country's energy mix now boasts a share of 10.9% of renewable energy in terms of installed capacity, contributing about 4.13% to the electricity generation mix. Wind power accounts for 70% of this renewable installed capacity. In 2010 the official wind power potential estimates for India were revised upwards from 45 GW to 49.1 GW by the Centre

GLOBAL INSTALLED WIND POWER CAPACITY (MW) – REGIONAL DISTRIBUTION

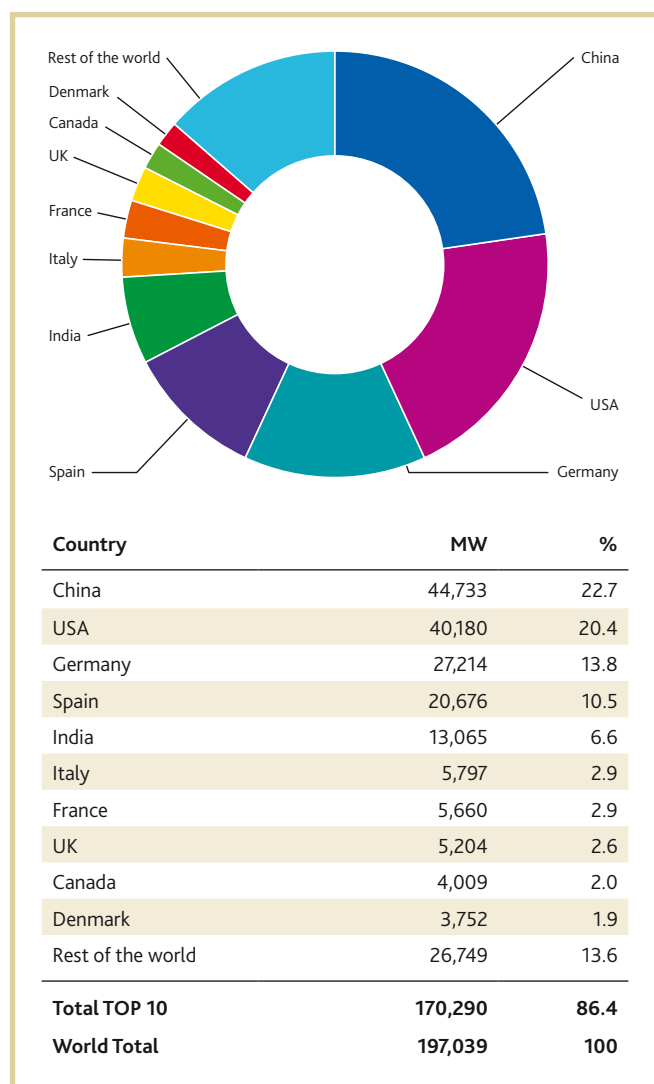
		End 2009	New 2010	End 2010
AFRICA & MIDDLE EAST	Egypt	430	120	550
	Morocco	253	33	286
	Tunisia	54	60	114
	Iran	92	0	92
	Other ¹⁾	37	0	37
	Total	866	213	1,079
ASIA	China	25,805	18,928	44,733
	India	10,926	2,139	13,065
	Japan	2,085	221	2,304
	Taiwan	436	83	519
	South Korea	348	31	379
	Philippines	33	0	33
	Other ²⁾	6	48	54
	Total	39,639	21,450	61,087
EUROPE	Germany	25,777	1,493	27,214
	Spain	19,160	1,516	20,676
	Italy	4,849	948	5,797
	France	4,574	1,086	5,660
	UK	4,245	962	5,204
	Denmark*	3,465	327	3,752
	Portugal	3,535	363	3,898
	Netherlands	2,215	32	2,237
	Sweden	1,560	604	2,163
	Ireland	1,310	118	1,428
	Turkey*	801	528	1,329
	Greece	1,087	123	1,208
	Poland	725	382	1,107
	Austria	995	16	1,011
	Belgium	563	350	911
	Rest of Europe ³⁾	1,610	1,070	2,684
	Total	76,471	9,918	86,279
<i>of which EU-27 ⁴⁾</i>	<i>75,090</i>	<i>9,295</i>	<i>84,278</i>	
LATIN AMERICA & CARIBBEAN	Brazil	606	326	931
	Mexico	202	316	519
	Chile	168	4	172
	Costa Rica	123	0	123
	Caribbean	91	8	99
	Argentina	34	27	60
	Others ⁵⁾	83	23	106
	Total	1,306	703	2,008
NORTH AMERICA	USA	35,086	5,115	40,180
	Canada	3,319	690	4,009
	Total	38,405	5,805	44,189
PACIFIC REGION	Australia	1,712	167	1,880
	New Zealand	497	9	506
	Pacific Islands	12	0	12
	Total	2,221	176	2,397
World total	158,908	38,265	197,039	

- 1 South Africa, Cape Verde, Israel, Lebanon, Nigeria, Jordan, Kenya
- 2 Thailand, Bangladesh, Indonesia, Sri Lanka, Philippines, Vietnam
- 3 Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Faroe Islands, Finland, Hungary, Iceland, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Norway, Romania, Russia, Slovakia, Slovenia, Switzerland, Ukraine
- 4 Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, UK
- 5 Colombia, Chile, Cuba
- * Provisional figures

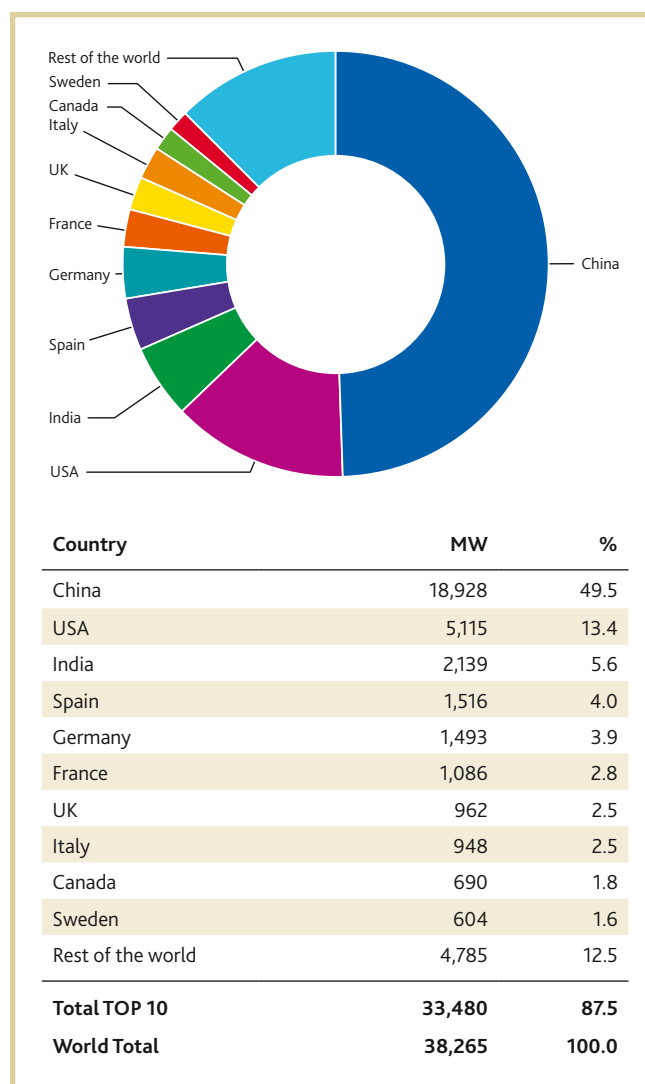
Please note:
Project decommissioning of 151 MW and rounding affect the final sums

Source: GWEC

TOP 10 CUMULATIVE CAPACITY DEC 2010



TOP 10 NEW INSTALLED CAPACITY JAN-DEC 2010



for Wind Energy Technology (C-WET). However, the estimations of various industry associations and wind power producers are more optimistic, citing a potential in the range of 65-100 GW.

Other Asian countries with new capacity additions in 2010 include **Japan** (221 MW, for a total of 2.3 GW), **South Korea** (31 MW for a total of 379 MW) and **Taiwan** (83 MW for a total of 519 MW).

North America: Disappointing USA results

The USA wind energy market installed 5.1 GW in 2010, only about half of the 2009 market. The country now has 40.2 GW of wind power capacity (up from 35.1 GW at the end of 2009), thereby conceding its global leadership to China.

38 of the 50 states now have utility-scale wind installations and 14 of those have more than 1,000 MW installed. Texas remains the leading state with more than 10 GW of total installed capacity and wind power now generates 7.8% of the state's electricity needs. Iowa is in second place with 3,675 MW, and now receives close to 20% of its electricity from wind power, followed by California, Minnesota and Washington State.

In terms of new capacity added in 2009, Texas again led the pack with 680 MW, followed by Illinois (498 MW), California (455 MW), South Dakota and Minnesota (396 MW each).

The American manufacturing sector, meanwhile, appears to view 2010's slowdown as short-term. New component suppliers continued to enter the wind energy industry last year, and over 400 US manufacturing plants now serve the



Horse Hollow wind farm, Texas, US © Wind Power Works

industry. Around half of the wind generation equipment deployed in the USA is now manufactured domestically. In addition, the construction pipeline for wind power is healthy, with 5,600 MW currently under construction. Given such indicators, the industry could finish 2011 well ahead of 2010 numbers.

Canada's wind power market was also down in 2010 compared to the previous year, but it was still the second best year ever. 690 MW of new wind capacity came online, compared to 950 MW in 2009, taking the total capacity up to more than 4,000 MW.

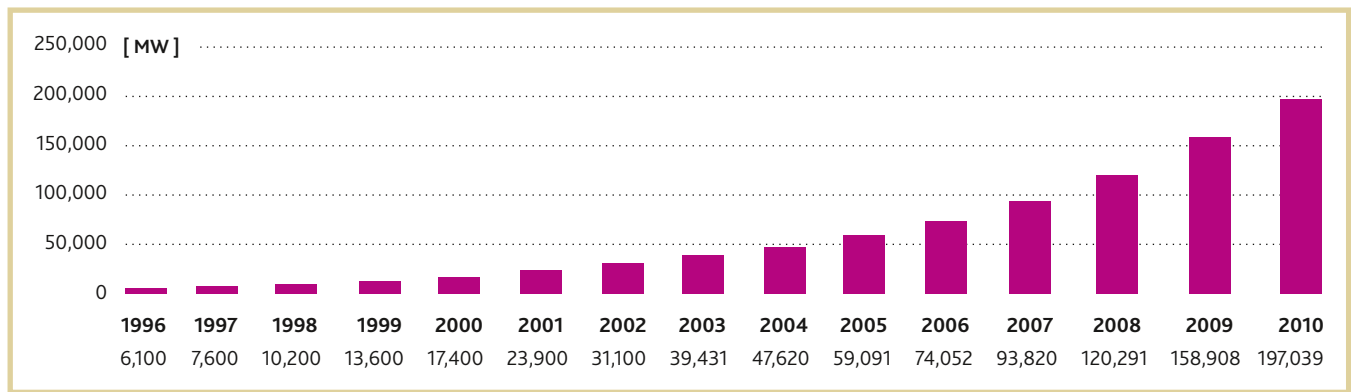
Ontario leads Canada's wind energy development with 1.5 GW of installed wind capacity. The province adopted its Green Energy Act in 2009, which introduced a feed-in tariff for wind power, and this is set to substantially boost wind

power development in the province. Other leading wind energy provinces include Quebec (806 MW) and Alberta (663 MW).

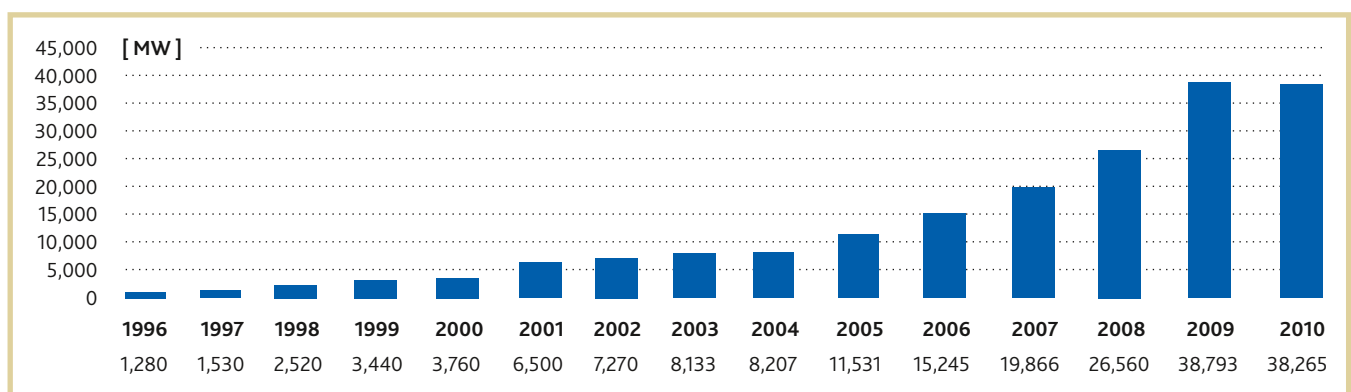
European growth driven by Eastern Europe and offshore wind

During 2010, 9,918 MW of wind power was installed across Europe, with European Union countries accounting for 9,295 MW of the total. This represents a decrease in the EU's annual wind power installations of 10% compared to 2009. Of the 9,295 MW installed in the EU, 8,412 MW were installed onshore and 883 offshore. This means that in 2010, the annual onshore market decreased by over 13% compared to last year, while the annual offshore market grew by 51%, and accounted for 9.5% of all capacity additions.

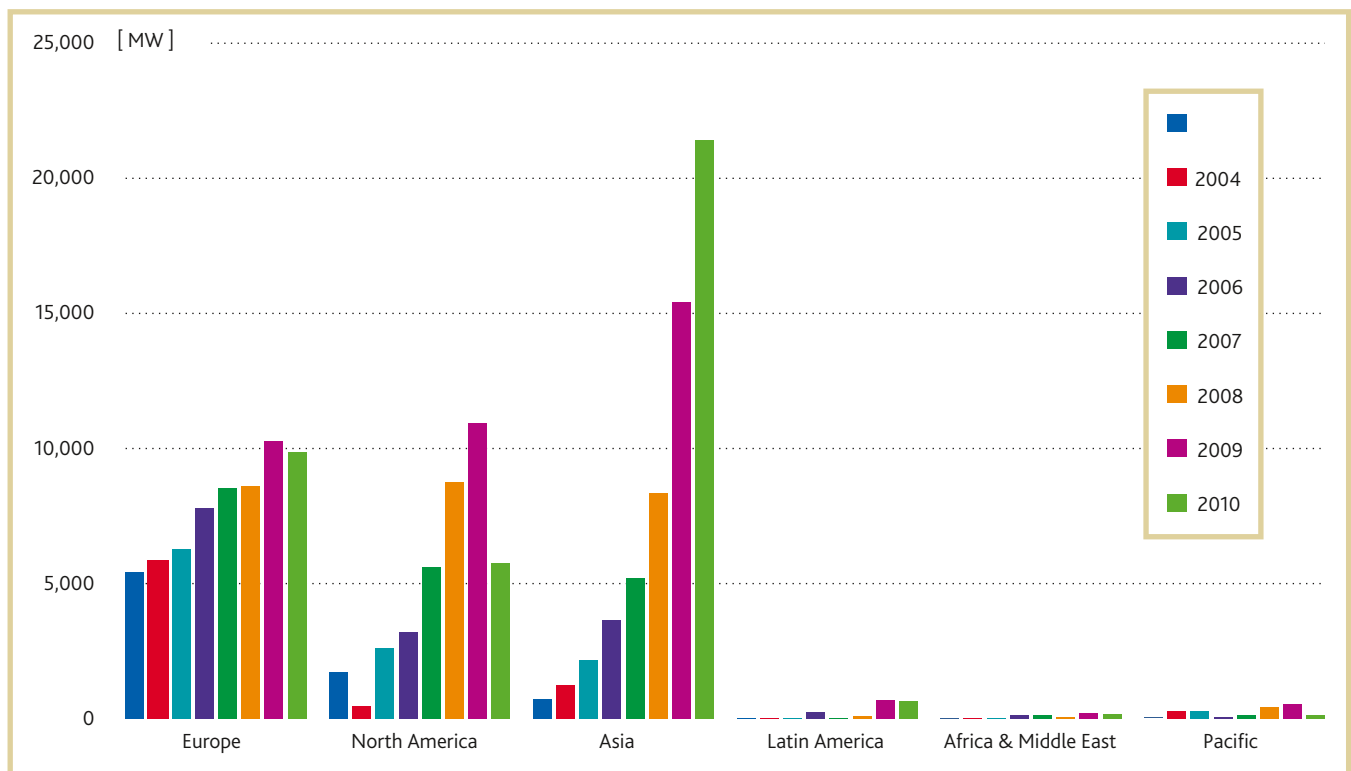
GLOBAL CUMULATIVE INSTALLED WIND CAPACITY 1996-2010



GLOBAL ANNUAL INSTALLED WIND CAPACITY 1996-2010



ANNUAL INSTALLED CAPACITY BY REGION 2003-2010





Hétomesnil wind farm, Picardie © Wind Power Works

In terms of annual installations, Spain was the largest market in 2010, installing 1,516 MW, followed by Germany with 1,493 MW. France was the only other country to install over 1 GW (1,086 MW), followed by the UK (962 MW), Italy (948 MW), Sweden (604 MW), Romania (448 MW), Poland (382 MW), Portugal (363 MW) and Belgium (350 MW). For the first time, two new EU Member States were among the top ten largest annual markets.

The total wind power capacity installed by the end of 2010 will, in a normal wind year, produce 181 TWh of electricity (up from 163 TWh), meeting 5.3% of overall EU electricity consumption (up from 4.8% in 2009).

Germany continues to lead Europe in terms of total installed capacity, adding 1.5 GW in 2009 for a total of 27.2 GW. As in other developed markets, growth was hampered by the ramifications of the financial crisis.

The leading federal state in Germany in terms of installed capacity is Lower Saxony with 6.7 GW. A number of states now receive 40% or more of their electricity from wind

energy, including Saxony-Anhalt (52%), Mecklenburg-Vorpommern (45%) and Schleswig-Holstein (44%).

The contribution of wind energy to total German power consumption is around 6.2%.

Spain led the European league tables for new installed capacity just ahead of Germany, with additions of 1.5 GW of wind power, bringing its total up to 20.7 GW. This represented the smallest annual wind power since 2003.

2010 was a good year for wind resources, and the country's wind farms generated 42.7 TWh of electricity, accounting for 16.6% of total Spanish power consumption.

Castile and Leon was again the region that installed the most wind power in 2010 (917 MW, or 60.4% of the new installed capacity), followed by Catalonia with 327 MW and Andalusia with 139- MW. As a result, Castile and Leon continues to lead the country in terms of total wind installations with 4.8 GW, followed by Castile-La Mancha with 3.7 GW and Galicia with



Rio do Fogo wind farm, Brazil © Wind Power Works

3.3 GW. Five out of Spain's 17 regions now host 1,000 MW or more of wind power.

Italy now has a total installed capacity of 5.8 GW. The regions which added the most new capacity were Sicily (334 MW for a total of 1,449 MW), Calabria (189 MW for 589 MW) and Molise (130 MW totalling 372 MW). The other regions which added new wind power capacity in 2010 were: Apulia, Sardinia, Basilicata and Abruzzo. In the North and the Center of Italy, only Liguria installed 2.4 MW in 2010. The Italian wind power sector now employs more than 28,000 people, of which some 10,000 directly.

France's wind capacity is also growing steadily and has now reached 5.7 GW, up from only 30 MW in 2000. Overall, wind power now covers 1.8% of the country's electricity demand. The French wind energy sector now employs around 11,000 people, spread over more than 180 companies. The French government set a target to achieve 25 GW of installed wind energy capacity by 2020, including 6 GW of offshore wind.

In the **United Kingdom**, around 40 new wind farms were opened in 2010, totalling 962 MW of additional capacity and taking the country's total installed wind power capacity to 5,204 MW. With 1,341 MW of installed capacity, the UK continues to be the world's leading offshore wind market.

The majority of wind farms in the UK are located in Scotland (2,374 MW), in the North West (1,009 MW) and in Wales

(530 MW). Scotland alone installed a third of all new wind power capacity in 2010 (376 MW).

Latin America: new wind capacity in five countries

The Latin American market seems to be waking up to the opportunity of its enormous wind power potential. While growth in 2010 was still small in absolute terms, with 703 MW installed across the continent, this represented a 50% increase in total installed capacity. In addition, the pipeline for new developments is substantial.

Brazil added 326 MW of new capacity, slightly more than in 2009, and is now host to 931 MW of wind power.

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 full 1,400 MW target will be met. Overall, 40 PROINFA wind farms are now in operation, totalling 900 MW, while a further 13 projects (394.1 MW) are still under construction, and the majority of these are scheduled to be connected to the grid in 2011.

Traditionally dominated by just one turbine manufacturer, Wobben Enercon, several other international players have

now entered the Brazilian market, including Vestas, Suzlon, Impsa, GE, Alstom, Gamesa, and Siemens.

Two renewable energy auctions took place in Brazil in 2010, contracting more than 2,000 MW worth of new wind power capacity. Together with the 1,800 MW of the 2009 auction and new auctions announced for June 2011, this makes for a very healthy pipeline for the coming years.

In 2010, **Mexico's** installed wind capacity more than doubled for the second year in a row, with 316 MW of new capacity added to the existing 202 MW operating at the end of 2009. The total installed wind power capacity now amounts to 519 MW.

Nearly all the wind projects operating in Mexico are located in Oaxaca (six projects with a capacity of 508 MW), and a further 19 projects are in the pipeline in this region. Other promising regions with good wind potential include Baja California and the Bay of Campeche in the Gulf of Mexico.

Pacific region adds 176 MW

At the end of 2010, 1,880 MW of wind capacity were installed in **Australia**, an increase of 167 MW from 2009. There are now 52 operating wind farms in the country, mostly located in South Australia (907 MW) and Victoria (428 MW).

Australia's expanded Renewable Energy Target (RET) Scheme, which entered into force in January 2010, mandates that 45 TWh or 20% of Australia's electricity supply will be sourced from renewable energy in 2020. The initial target is 12.5 TWh, and this will be gradually increased until 2020.

Following a good year in 2009, the speed of development in **New Zealand** dropped with just 8.8 MW of new wind capacity added in 2010, taking the total up to close to 506 MW. Wind energy currently supplies just over 3% of New Zealand's annual electricity demand.

213 MW installed in Africa and the Middle East

In North Africa, the expansion of wind power continues in Morocco, Egypt and Tunisia. **Egypt** not only saw the largest addition of new capacity in 2010 (120 MW), bringing the

total up to 550 MW but also continues to lead the region.

Morocco comes in a distant second with a cumulative capacity of 286 MW, 30 MW of which were added in 2010.

Tunisia added 60 MW of new capacity in 2010, taking the total up to 114 MW. Other promising countries in the region include **Ethiopia, Kenya, Tanzania** and **South Africa**, where wind project development is slowly yet firmly underway.

National policies continue to drive wind power development

2010 was a tough year for most industries, and the wind sector was no exception, with annual capacity additions decreasing for the first time in 20 years. This was primarily a result of low levels of orders during the financial crisis resulting in fewer projects being built in 2010.

The outlook for 2011 is positive, as the global economy is recovering and order books are full again. Global investment in wind power was up by 38% in 2010, and projects will start to materialise from these investments in 2011 and 2012.

Emerging markets such as China, India and Latin America are gathering strength and will continue to drive growth. North Africa is already firmly on the wind energy map, and there are signs that sub-Saharan Africa will also soon complete its first wind projects.

The signs are also positive in the established markets. In the USA, AWEA is reporting a very healthy project pipeline, while in Europe, the offshore boom has only just begun and Eastern European countries are starting to realise their potential.

While the climate negotiations have failed to deliver a new climate deal which would put a price on carbon emissions and provide a powerful driver for wind power development, the wind industry will continue to draw its strength from national policies and measures. These continue to bear fruit, providing both environmental and economic benefits to those countries enacting them.

Market forecast for 2011-2015



Iberdrola control center, Spain © Wind Power Works

Every year in the spring, GWEC undertakes the difficult task of forecasting global wind market developments for the coming five years, and this exercise has become a fixture in our annual report. There is, of course, always a level of uncertainty in prognostication, and never more so than in times of economic upheaval. While the financial and economic crises seem to have been overcome in most markets, the full consequences of the credit crisis in 2008/2009 are only now becoming fully apparent in the wind industry, as the low levels of orders for wind turbines at the end of 2008 and the beginning of 2009 have worked their way through the project development cycle.

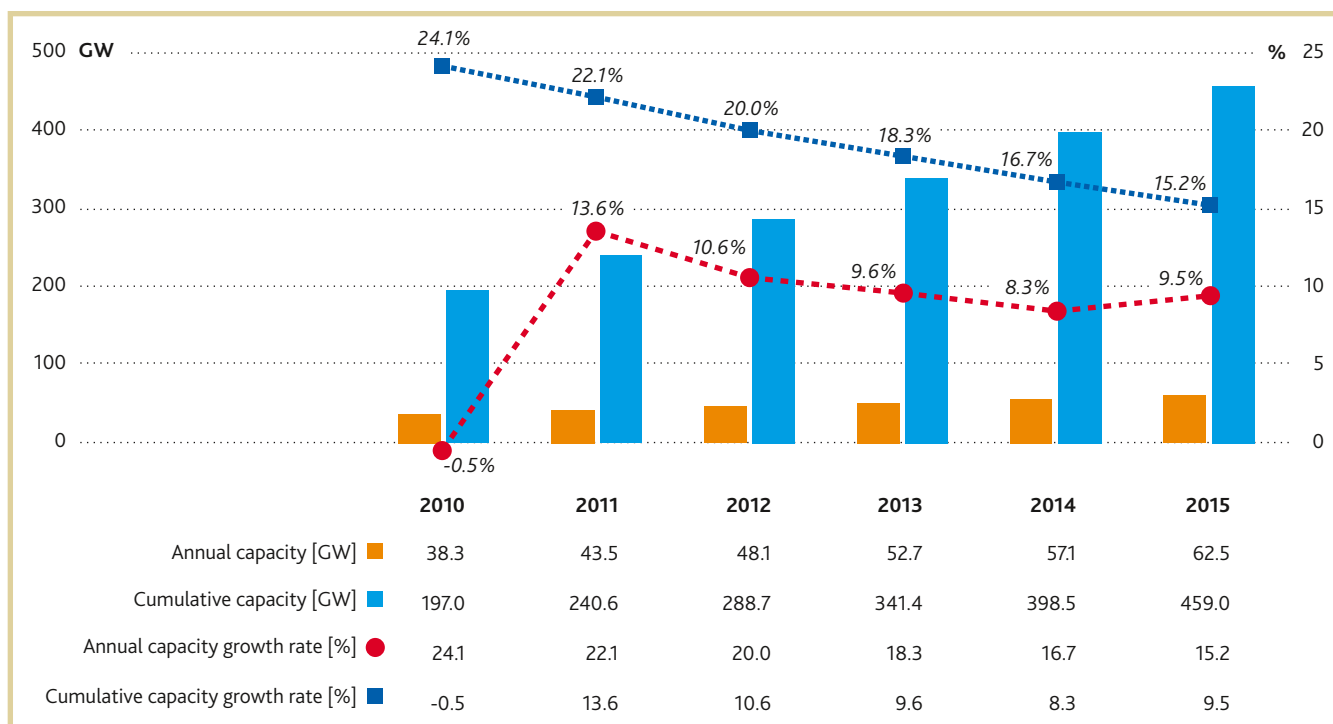
For the past five years, GWEC's forecast, which has always erred on the conservative side, was exceeded by actual market developments. Not so for 2010, where we had

anticipated a global market of 40 GW, while only 38.3 GW were in fact installed. This was mainly due to a depressed US market with new wind power installations reaching a mere 50% of those in 2009.

However, there is reason for cautious optimism for 2011 and the following years. Overall investment in wind power was up by 31% in 2010, reaching a record level of USD 96 billion (EUR 70.4 billion), according to Bloomberg New Energy Finance. This investment will translate into actual projects in the coming years.

The growth in the Chinese wind sector has continuously outperformed the most optimistic expectations, and 2010 was no exception, with 18.9 GW of new wind power added, accounting for half of the total annual market. Ambitious

MARKET FORECAST 2011-2015



government plans, supportive policies and staggering investment in the wind sector in 2010 all lead to the conclusion that growth is set to continue for the years to come, and China will remain one of the main engines driving the global wind sector.

As for the USA, the other major market driving global growth in the past, the future is less certain. The US manufacturing industry is reporting a healthy 5,600 MW under construction at the beginning of 2011, which is considerably more than at the same time in 2010. Given such indicators, we will probably see an upturn for wind in the USA, and the market might recover to its record 2009 level by 2015, or even before.

Overall, GWEC predicts that at the end of 2015, five years from now, global wind capacity will stand at 459 GW, up from 197 GW at the end of 2010. During 2015, 62.5 GW of new capacity will be added to the global total, compared to 38.3 GW in 2010.

The annual growth rates during this period will average 18.4% in terms of total installed capacity, and 110.3% for annual market growth. These rates are considerably lower than in GWEC's last forecast published in 2010, and they are very modest compared to the past developments. This is mainly due to the continuing uncertainty about the North American market.

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 and cumulative market. Annual additions are expected to be well over 20 GW in China by 2015. This development is underpinned by very aggressive government policies supporting the diversification of 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 2-3 GW every year, and be complemented by growth in other Asian markets, including Japan, Taiwan, South Korea and the Philippines, among others.

For Asia as a whole, the annual market is expected to increase from 21.5 GW in 2010 to 28 GW in 2015, which would translate into a total of 125.5 GW of new capacity to be added over this period – far more than in any other region. In 2012, Asia is expected to overtake Europe as the region with the largest total installed capacity, and it will reach a cumulative wind power generation capacity of 184.6 GW by 2015.



Horns Rev II wind farm, Denmark © Wind Power Works

We expect the **North American** market to remain subdued for the next two years, as legislative uncertainty at the federal level in both the US and Canada continues to be a concern, although the outlook is brighter in several US states and Canadian provinces. We expect the 2011 market to recover to 8 GW of new wind capacity (up from 5.8 GW in 2010), and by 2014, the annual North American wind market will have recovered to its 2009 size of 11 GW, growing to 12 GW in 2015. This would translate into an addition of 50 GW in the US and Canada over the next five years, and take cumulative capacity up to 94.2 GW.

Europe will continue to host the largest wind capacity globally until 2012, when it will be overtaken by Asia. GWEC expects that by the end of 2015, Europe's installed capacity will stand at 146.3 GW, compared to Asia's 184.6 GW. By 2015, the annual market will reach 14.0 GW, and a total of 60 GW will be installed in Europe over this five year period.

Large scale offshore wind developments in the coming years will account for an increasing share of the new wind capacity added in Europe, and by 2015, 3.1 GW (about 21%) 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.

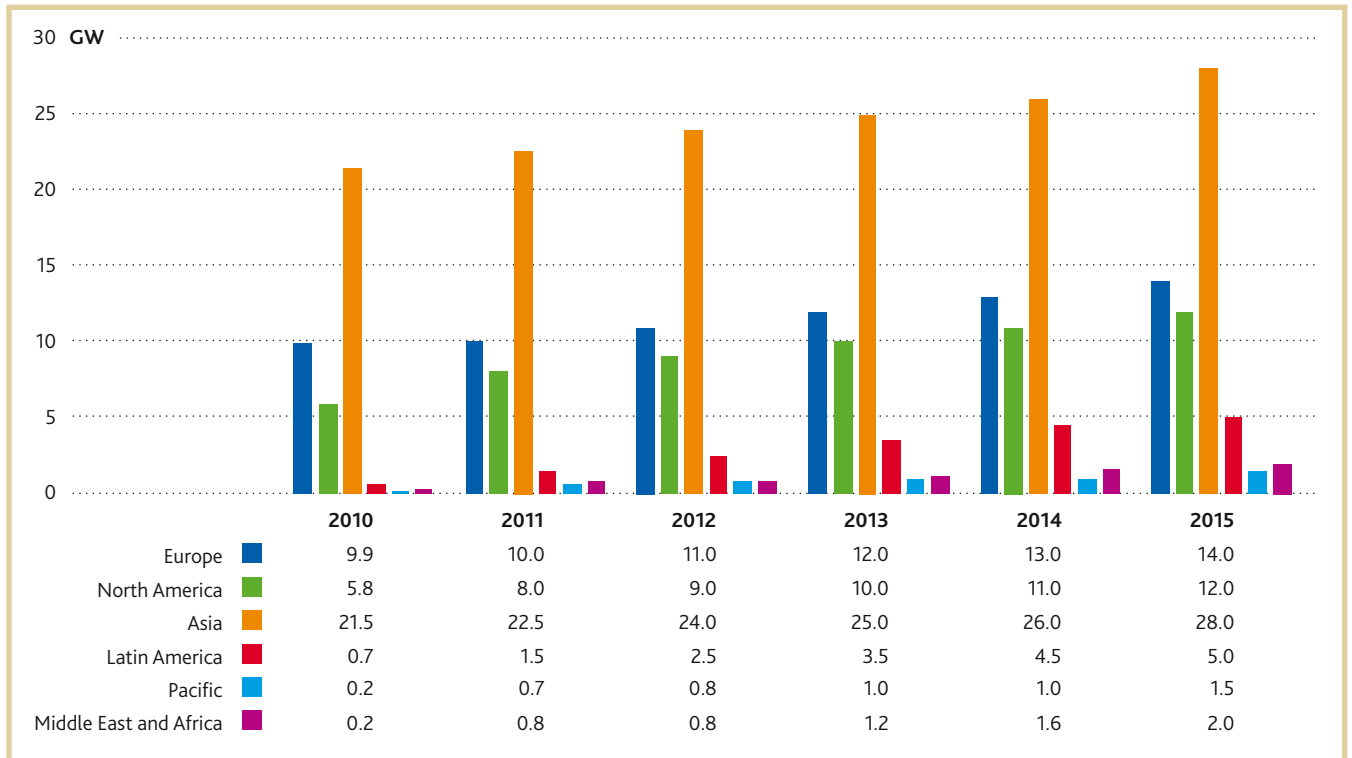
While Germany and Spain are expected to remain the leading European markets, a larger number of strong markets will become the trend as Italy, France, the UK and Portugal continue expanding their wind capacity. There are also encouraging signs from growing markets in the new EU member states, especially in Romania and 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.

Wind energy installations in **Latin America** will start to contribute a growing share to the global market. Encouraging developments in markets such as Brazil, Mexico and Chile lead GWEC to expect that at the end of 2015, a total of 19 GW will be installed in the region, an increase of 17 GW from 2010. However, this is still far 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 surprises, and there are chances that the expansion of the wind markets could be much larger than what we can see from where we are today.

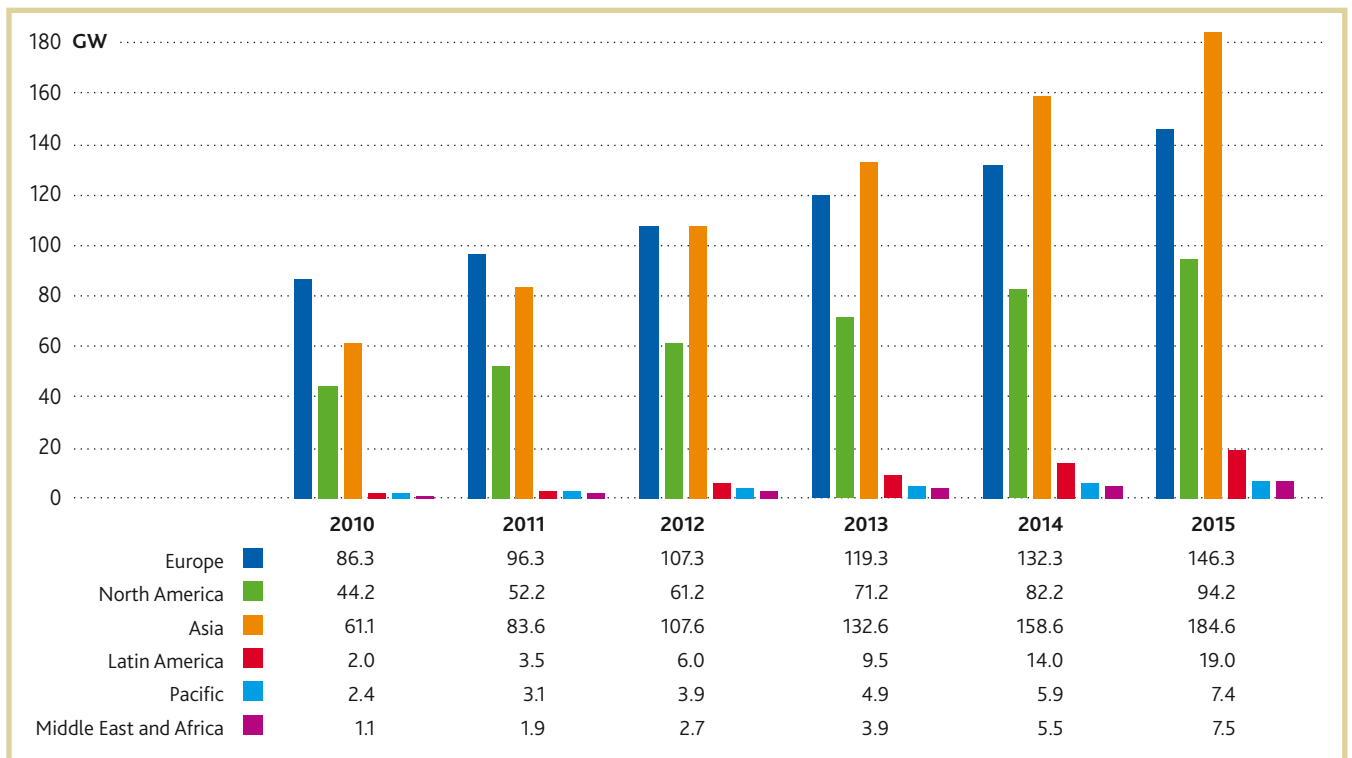
In the **Pacific region**, both Australia and New Zealand are expected to start growing at a stronger pace in the coming years to reach annual additions of 1.5 GW by 2015, up from just 176 MW in 2010. This would bring the region's total installed capacity up to 7.4 GW by the end of 2015. Both countries 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 could develop into small but not insignificant players in the world's wind market with annual installations reaching 2 GW by 2015, taking the total capacity up to 7.5 GW. However, substantial wind resources in some areas, developments in Kenya, Tanzania and Ethiopia, and a very large potential market in South Africa on the verge of taking off suggest that we could see much stronger growth rates in Africa in the long term.

ANNUAL MARKET FORECAST BY REGION 2010-2015



CUMULATIVE MARKET FORECAST BY REGION 2010-2015



Australia

Wind power is expected to play a major role in helping Australia's transition to a low carbon economy. The country boasts some of the best wind resources in the world, the so-called "roaring forties" which sweep the south coast. The Australian government has set a 20% Renewable Energy Target by 2020, and today, wind power is supplying over 5,100 GWh annually, which represents around 2% of national electricity consumption.

At the end of 2010, 1,880 MW of wind capacity was installed in Australia, consisting of 1,052 operating wind turbines spread over 52 wind farms. The amount of wind generation capacity has increased by an average of 30% per year over the past decade. While policy uncertainty, the low price of renewable energy certificates and the financial crisis made it difficult for developers to secure financing in 2010, recent changes to the implementation of the Renewable Energy Target should go a long way toward returning stability to the industry.

The Australian wind market in 2010 and beyond

Three new projects, which are all located in South Australia, became fully operational in 2010, adding 167 MW of capacity to the Australian electricity grid: Hallett 2 (71.4 MW), Clements Gap (56.7 MW) and Lake Bonney Stage 3 (39 MW). A further eight projects totalling 1,047 MW are currently under construction and expected to be completed within the next three years.

An additional 8.8 GW of projects are proposed for development in Australia, and have either received planning



© Suzlon

and environmental approvals or are currently applying for them, and another 5 GW of projects are undergoing feasibility studies. There is no shortage of available prime onshore wind sites in Australia, and as a result, there are currently no plans to develop offshore wind farms.

The size of Australian wind farms is increasing, and Acciona's 192 MW Waubra wind farm in Victoria is currently the largest with 128 turbines spread over 173 square kilometres. However, significantly larger wind farms are under

Wind farms under construction

Owner	Name	State	Expected commission	Capacity [MW]
AGL / Meridian Energy	Macarthur	Victoria	2013	420
Roaring 40s	Musselroe	Tasmania	2013	168
AGL	Hallett Stage 4 (Nth Brown Hill)	South Australia	2011	132
Roaring 40s	Waterloo	South Australia	2011	111
Union Fenosa	Crookwell 2	New South Wales	2011	92
AGL	Oaklands Hill	Victoria	2011	67
AGL	Hallett Stage 5 (Bluff wind farm)	South Australia	2012	53
Hepburn Community wind farm	Leonards Hill	Victoria	2011	4

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
MW	32	73	105	198	380	708	817	824	1,306	1,712	1,880

development, including the 420 MW AGL/Meridian Energy Macarthur wind farm in Victoria. The biggest project currently proposed is a 1,000 MW wind farm in New South Wales (Silverton wind farm) by Epuron, which, in its current form, will have 598 turbines and meet 4.5% of the state's total power consumption.

While wind farms are present throughout Australia, South Australia accounts for nearly half of the total national wind capacity.

Installed wind capacity in Australia by state

State	Installed Capacity (MW)
South Australia	907
Western Australia	428
Victoria	202
Tasmania	187
New South Wales	143
Queensland	12
Australian Antarctic Territory	1
Total:	1,880

Vestas dominates the Australian market with a market share of 38%, followed by Suzlon with 25%. Other international turbine manufacturers are also present with smaller market shares, including NEG Micon (11%), Acciona (10%), Repower (8%) and Enercon (6%).

The Renewable Energy Target Scheme

The Australian government's Renewable Energy Target (RET) Scheme¹ started on 1 January 2010, mandating that 20% of Australia's electricity supply be sourced from renewable energy by 2020. The RET expands on the previous Mandatory Renewable Energy Target (MRET), which began in 2001.

The RET is crucial in supporting investment in the renewable energy industry and it provides the main incentive for wind power development in Australia, unlocking an expected investment of more than AUD 20 billion (EUR 15 billion / USD 20 billion) over the next decade. As it is the least expensive large scale renewable energy, much of this target is expected to be met with investment in wind energy.

However, during the last two years, difficulties with the implementation of the RET coupled with the global financial crisis and policy uncertainty surrounding a price on carbon affected the lending practices and risk appetite of banks. This made it difficult for wind farm developers to secure financing in 2010.

In June 2010, the Australian Parliament passed legislation to separate the RET into two parts – the Large-scale Renewable Energy Target (LRET) and the Small-scale Renewable Energy Scheme (SRES) – and this legislation entered into force on 1 January 2011. Separating the two parts is intended to provide greater certainty for large-scale renewable energy projects and small-scale renewable energy systems by addressing the oversupply of certificates.

Other policy measures

Other policy measures for renewable energy development include the GreenPower schemes, which allow consumers to purchase renewable energy from their electric utility, as well as state-based feed-in tariff or buyback schemes for domestic scale wind technology that provide some level of payment or credit towards electricity bills.

In July 2010, the Environment Protection and Heritage Council released its draft National wind farm Development Guidelines² for a period of 12 months to provide jurisdictions with the opportunity to assess how these guidelines would be incorporated within their existing planning and development processes. The guidelines aim to outline best practice for industry and planning authorities in areas including heritage, threatened species and turbine noise.

The Australian Wind Energy Forecasting System³ was launched in 2008. This is a centralised system that provides predictions of wind energy generation using weather forecasts from meteorological bureaus and operational data from wind energy generators to forecast expected wind energy generation.

With input from the Clean Energy Council, Australia.

¹ <http://www.climatechange.gov.au/government/initiatives/renewable-target.aspx>

² <http://www.ephc.gov.au/taxonomy/term/25>

³ <http://www.aemo.com.au/electricity/ops/awefs.html>

Brazil

A tremendous wind resource

In 2001, the first Brazilian wind atlas was published, estimating Brazil's wind power potential at around 143 GW at 50m. In 2008 and 2009, new measurements carried out in several states at 80-100 meters indicate that the real potential is considerably higher, at more than 350 GW. This compares to the country's total power generation capacity of 113.4 GW at the end of 2010.

Large unpopulated land areas, a coastline of 9,650 km and excellent resources help secure Brazil's prime position as a potential wind energy giant. The best proven wind resources are in the North/Northeast region of Brazil, and in particular in the states of Rio Grande do Norte, Ceará, Pernambuco and Bahia. The South/Southeast also has good wind resources, especially in the states of Rio Grande do Sul and Santa Catarina.

Wind energy and hydro power – perfect partners

Brazil's windiest areas are located conveniently close to the electricity grid and to demand centers. In addition, in a country mainly powered by hydro energy and increasingly suffering from water shortages, wind power can help alleviate some serious energy security concerns, especially during the dry winters. In addition to seasonal fluctuations, the new hydro power plants that are currently under construction will have very little, if any, water storage due to environmental concerns. This will leave the Brazilian electricity system more vulnerable to climatic variability and climate change. Since 2001, electricity shortages have plagued the Brazilian economy.

To mitigate this risk, over the past decade Brazil has been investing in fossil fuel based power plants, thereby exposing the economy to high and volatile fuel prices.

The Brazilian wind market in 2010

The Brazilian wind market grew by 326 MW in 2010, bringing the total installed capacity up to 931 MW, a growth of 54.2% in terms of total installed capacity, and a 23.8% increase in terms annual capacity additions.



Bons Ventos wind farm, Ceara © Suzlon

These numbers show that the Brazilian wind market has now reached a stable pace of growth, and total installed capacity is expected to reach 1,000 MW during the first few months of 2011.

PROINFA programme extended to end of 2011

Brazil's PROINFA scheme was first established in 2002 by the government to spur renewable energy development and to increase the share of renewable energy to 10% of Brazil's electricity supply by 2020, by stimulating the addition of over 1,100 MW of wind power, which was later expanded to 1,400 MW.

After a slow start, the programme was extended several times, now running until the end of 2011, and it looks increasingly likely that most of the 1,400 MW target will be met. Wind projects awarded through the PROINFA programme account for over 95% of all wind power installations in Brazil.

TOTAL INSTALLED CAPACITY

year	2005	2006	2007	2008	2009	2010
MW	29	237	247	341	606	931

All 14 wind power projects installed and connected in 2010 were PROINFA projects, representing 26% of the total 1,429 MW capacity contracted under the scheme. Overall, 40 PROINFA wind farms are now in operation, totalling 900 MW, while a further 13 projects (394.1 MW) are still under construction, and the majority of these are scheduled to be connected to the grid by mid-2011. Only one remaining 135 MW PROINFA project has not yet started construction.

Wind power auctions in Brazil

RESERVE ENERGY AUCTION LER-2009

In December 2009, the Brazilian energy regulator ANEEL hosted the country's first wind-only auction, contracting 71 wind energy projects for a total capacity of 1,800 MW. Six major wind turbine manufacturers successfully received orders following the auction: GE, IMPSA Wind, Siemens, Suzlon, Vestas and Wobben/Enercon.

At the time, ANEEL established a price ceiling of R\$189 (EUR 83.4/USD 113.1) per MWh. Although this was already lower than expected, the average price achieved in the auction dropped to R\$148 per MWh (EUR 88.6 / USD 65.3) 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.

ALTERNATIVE ENERGY AUCTION LFA-2010 AND RESERVE ENERGY AUCTION LER-2010

In August 2010, ANEEL hosted another auction for small hydro, biomass and wind (Alternative Energy Auction LFA-2010), and the average price realised was below that of the 2009 auction (R\$134 per MWh). 1,519 MW of wind power were contracted at this auction with 20 year PPAs, spread over 50 projects. The developers with the most contracted capacity were Impsa-Energimp (270 MW) and Iberdrola (258 MW), followed by CHESF, Contour Global and Energisa. The contracted projects will have to deliver electricity to the grid by 1 January 2013.

On the same day, a second auction for the same renewable energy sources took place (Reserve Energy Auction LER-2010), awarding contracts to 20 wind power projects totalling 528 MW. The main winning developers here were Renova Energia, Iberdrola and Enel. These projects need to be

online by 1 September 2013. The average price stayed below the previous auctions at R\$ 123/MWh (EUR 54.3 /USD 73.6).

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 began to enter the market included the Argentinean company Impsa, as well as Suzlon and Vestas, which have both sold turbines to PROINFA projects.

More new market entrants that sold turbines in the 2009 and 2010 auctions include Alstom, Gamesa, GE Wind and Siemens. These foreign suppliers have now become eligible for BNDES financing, based on their commitment to manufacture wind turbine generators in Brazil within a short time frame. The initial goal is to reach a local content share of 60%. In order to achieve this, both GE and Alstom Wind are currently building factories in Brazil, while Gamesa and Suzlon have announced local manufacturing plants. Siemens already has a large manufacturing base in Brazil which will allow the company to produce and assemble wind turbines.

Brazil is well positioned to supply the wider Latin American market as well as the market in the United States, either with completed wind turbines or with partly assembled parts.

Outlook for 2011 and beyond

Assuming that the projects contracted in the auction are built according to schedule, the outlook for wind energy in Brazil is very positive.

Together with the remaining 530 MW of PROINFA projects, which are scheduled to become operational in 2011 or 2012, 470 MW of the first projects from the auctions should be built in 2011 and another 1,800 MW by 2012. A further 1,500 MW could be coming online in 2013, according to the schedule of the 2010 auctions. A further two auctions have been announced for June 2011.

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

Canada

Wind Energy in Canada

2010 represented another significant step forward for the wind energy industry in Canada with the addition of 690 MW of wind energy capacity – representing CAD 1.7 billion (EUR 1.3 bn / USD 1.7 bn) in new investment. These new projects, operating in British Columbia, Alberta, Ontario, New Brunswick and Nova Scotia, brought Canada's total installed wind energy capacity to 4,009 MW at the end of 2010.

Ontario is the current provincial leader in installed wind energy capacity accounting for 1,457 MW – roughly one-third- of national wind energy development. Alberta and Quebec follow at 806 MW and 663 MW respectively, and Canada's other seven provinces together account for the remainder. Wind energy has increased almost ten-fold in the last six years in Canada as governments seek ways to meet rising energy demand, reduce environmental impacts of electricity generation, and stimulate rural and industrial economic development. It is expected that wind energy's rapid growth in Canada will continue with production tripling in the next five years.

The policy framework for wind energy

At the federal level, the current government's failure to extend or replace its very successful ecoENERGY for Renewable Power (ERP) incentive program in its 2010 budget was a significant setback. Among countries actively pursuing wind energy, it would be hard to find another where the federal government is playing such a limited role, and the implications for Canadian competitiveness are serious. That is particularly true when it comes to competing for investment with the United States, where the federal government plays a more important role in facilitating the development of wind energy. While the federal government has indicated that it believes it can best support wind energy deployment through the introduction of a regulatory framework and price for greenhouse gas emissions, the details and timing of such a framework remain unclear. Until then, the federal government remains on the sidelines and responsibility for competing for wind energy investment rests with the provinces.

In 2009, the Ontario Government introduced Ontario's new feed-in tariff (FIT) program under the Green Energy and



Wolfe Island wind farm, Kingston, Ontario © Canadian Wind Energy Association

Economy Act, the first of its kind in North America. 2010 saw the awarding of 1,529 MW of wind energy contracts under the FIT.

Nova Scotia's new energy policy, released in 2010, has established a new comprehensive framework for facilitating wind energy development in the province. Among its provisions is the creation of a mandatory target for 25% of the province's electricity needs to be supplied from renewable sources by 2015 and a goal of boosting that to 40% by 2020.

In British Columbia, the provincial government has introduced a Clean Energy Act outlining where it wants to take its electricity sector in the years to come. Wind proved its viability in the market in BC Hydro's 2010 call for clean power, with contracts awarded to six projects totaling 534 MW of capacity, and the government has made it clear it sees the technology as an important player in its future plans.

At the end of 2010, Hydro-Quebec announced the results of a unique tendering process for 500 MW of wind energy from First Nations (indigenous peoples) and regional municipalities. With these new contracts, Quebec will have procured virtually all of the power required to meet its ambitious objective of 4,000 MW of wind energy by 2015. Beyond 2015, however, the Quebec government has only indicated that it will procure 100 MW of wind energy for every additional 1,000 MW of

TOTAL INSTALLED CAPACITY

year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
MW	198	236	322	444	684	1,460	1,846	2,369	3,319	4,009

hydroelectric development, which would leave thousands of megawatts of high quality wind energy resources undeveloped and pose a threat to the long-term viability of the rapidly developing wind energy supply and value chains in Quebec. The Canadian Wind Energy Association (CanWEA) released a WindVision document for Quebec which proposes a viable path forward for wind energy development in the province from 2015-2025.¹

INSTALLED CAPACITY BY PROVINCE



Source: CanWEA

Addressing social acceptance of wind power

As wind energy grows across the country, more and more Canadians are experiencing wind farms for the first time. While an Ipsos-Reid poll² conducted by CanWEA in the summer of 2010 clearly indicated a majority of Ontario residents strongly support increased wind energy development, the industry is facing a vocal minority of opposition at the local level, and does not take support for granted.

In response, CanWEA has developed a comprehensive series of Best Practices in Community Engagement and Public

Consultation³ to help guide the local activities of its members. The guidelines are designed to support wind energy project developers in continuously improving their work with local communities while ensuring that they meet and strive to exceed provincial requirements for public consultation.

Outlook for 2011 and beyond

Canada remains on track to have a minimum of 12,000 MW of wind energy in place by 2015 – keeping it on the path required to meet CanWEA's goal to supply 20% of Canada's electricity demand with wind energy in 2025.

It is expected that 2011 will see a record level of new wind development with more than 1,000 MW likely to be installed in Canada. In addition, more than 6,000 MW have already been contracted to be built over the next five years. This growth will be augmented by recent requests for proposals for more wind energy in Saskatchewan, New Brunswick and Prince Edward Island as well as future awards of feed-in tariff contracts in Ontario.

Challenges for the industry

While the prospects for Canada's wind energy industry over the next few years are very promising, and some positive initial steps have been taken to support the development of a long-term market for wind energy, some of the challenges for the industry include

- Policy: Establishing long-term targets and stable and sustained policy supporting wind energy deployment is critical to keeping investment in Canada;
- Grid infrastructure: Facilitating the planning and construction of wind friendly transmission in jurisdictions across Canada as transmission constraints are already preventing wind projects from proceeding in some parts of the country;
- Public acceptance: Engaging communities where wind energy development is proposed in a meaningful and effective manner is important because wind energy projects cannot succeed without broad community support.

*With input from the
Canadian Wind Energy Association (CanWEA)*

¹ CanWEA: WindVision 2025 – A strategy for Quebec, 2010. <http://www.canwea.ca/pdf/canwea-quebec-windvision-e-web-final.pdf>
² Ipsos Reid: Wind Energy in Ontario, July 2010. http://www.canwea.ca/pdf/ipsosreid_ontariosurvey.pdf
³ CanWEA: Best Practices for Community Engagement and Public Consultation, January 2011. <http://www.canwea.ca/pdf/canwea-communityengagement-report-e-final-web.pdf>

Chile

About 65% of Chile's electricity is currently generated in thermal plants burning imported fossil fuels, mostly natural gas and coal, while 34% is generated from domestic hydropower. It is expected that in the coming decade, the country's power consumption will increase by 6-8% per year.

Unlike many of its South American neighbors, Chile has limited indigenous fossil energy resources. This dependence on imported fossil fuels has created periods of electricity shortage over the past decade, for example when Argentina started reducing its natural gas supply to Chile in 2004. Chile is also vulnerable to long dry spells during the summer such as the droughts in 2007, 2008 and 2010. As a result, energy prices in Chile have nearly tripled in the last five years. Fortunately, Chile is blessed with other renewable energy resources, including wind, solar and geothermal, but to date they represent less than 1% of the energy mix.

Chile has good wind resources from the northern deserts to the extreme south, including the south-central zone which is home to around 80% of the country's population and two thirds of its industry. Chile's wind energy potential is estimated at around 40 GW. The areas of greatest potential have been identified by the Ministry of Energy and the Department of Geophysics at the University of Chile in Santiago¹ and include the coastal zones of Atacama, Coquimbo in north Chile, and Maule in the center; as well as Calama and the high plateau zones in the region of Antofagasta, and around the headlands along the entire coast of the north and central zones

In 1982 Chile pioneered the privatization of the electricity market. As a consequence, investment decisions are based on the marginal cost of electricity production of the available technology portfolio, with a reduced short term energy price as the main objective. Unfortunately, this policy has, against expectations, led to very high electricity prices and an insecure power supply.

Wind farms in Chile

Chile currently has 561 MW of non-hydro renewable energy capacity, which is 3.7% of the country's total installed capacity, and of this, 171.6 MW is wind power.

The first 2 MW wind project (Alto Baguales) was installed in Chile in 2001, in Aysén, in the far south, and for a number of years this was the only wind farm operating in the country.

In 2007, the Canela 1 wind farm was constructed by Endesa Eco (Endesa Chile's renewable energy subsidiary) in the coastal region near Coquimbo, 300 km north of Santiago de Chile, with 18.2 MW of capacity using Vestas 1.65 MW turbines. This project was expanded in 2009 by a further 60 MW (Canela II) with Acciona 1.5 MW turbines.

Also in 2009, a number of other large scale wind farms were installed in Chile, including Chile's largest wind farm to date, the 46 MW El Totoral project, which is operated by Norvind, a subsidiary of Norwegian power company SN Power. This wind farm is also located in Coquimbo, and it uses 2 MW Vestas turbines.

Another project which came online in 2009 was the Monte Redondo 1 wind farm in the Ovalle municipality, 300 km north of Santiago with a capacity of 38 MW, using 2 MW Vestas turbines. This project is owned by a subsidiary of French GDF Suez.

The 3.6 MW Lebu wind farm in the Arauco province was also installed and grid connected in 2009, by Chilean developer Cristalerías Toro.

Large power consumers invest in own wind farms

In 2010, two smaller projects came online, both providing power directly to industrial installations.

The first was the 2.3 MW Cabo Negro wind farm, which was installed in the region of Magallanes in Southern Chile by the Canadian methanol producer Methanex in order to boost power production at its methanol plants, reducing its exposure to increasing natural gas prices.

The second was the 1.5 MW wind farm for the Canadian mining company Breakwater Resources to provide power for its El Toqui zinc mine. The El Toqui wind farm uses 275 kW Vergnet turbines and is operated by UK developer Seawind.

¹ Explorator Wind - Solar de Chile, see <http://condor.dgf.uchile.cl/EnergiaRenovable/Chile/>

TOTAL INSTALLED CAPACITY

year	2006	2007	2008	2009	2010
MW	2	20	20	168	172



Canela wind farm © Endesa

Other examples of self-supply wind farms include the gold mining company Barrick, which is constructing a 36 MW wind farm (Punta Colorada), and Australia's Pacific Hydro, which is planning to build wind farms for the mining operations of BHP Billiton in northern Chile. Furthermore, Codelco (the main state-owned mining company and the world's largest copper producer), has started the tendering process for the construction of its Calama wind power project.

The policy framework for wind energy in Chile

Chile does not have a specific policy to encourage wind power development, and renewable energy projects must compete in the market with conventional power generation. For the past 30 years, energy policy in Chile has been founded on the principles of free market competition between private companies, regulation of natural monopolies and a limited role of the state.

In 2008, the Chilean government introduced a Renewable Energy Law (law 10.257), which obliges power companies who sell directly to final customers to source 5% of their power from renewable energy sources for new contracts. This percentage will increase gradually to 2024, and non-compliance will lead to penalties.

In 2009, the Chilean government created the Centre for Renewable Energy (CER) to support the development of a

renewable energy industry in the country. The CER is expected to take a leading role in promoting renewable energy technologies and to serve as a bridge between research entities and private companies. Its activities focus on accelerating investment in non-hydro renewable energy and becoming a knowledge and technology transfer hub.

Obstacles to wind energy development

Apart from the lack of policy support, grid infrastructure is one of the main limiting factors for wind power development in Chile. In addition, electrical engineers and other renewable energy professionals are urgently required to evaluate and develop the country's renewable energy potential, and to provide expertise on grid integration issues.

Outlook for 2011 and beyond

According to the Chilean Energy Ministry, around 2,000 MW worth of wind power projects have been submitted into the environmental impact assessment system, with most of them expected to start operations between 2012 and 2014, assuming that the technical and financial conditions are met to complete these projects as scheduled.

With input from the Center for Renewable Energy (CER), Chile



Nanao wind farm, Guangdong © Greenpeace

Wind energy potential in China

According to the third National Wind Energy Resources Census, China's total exploitable capacity for both land-based and offshore wind energy is around 2,580 GW.¹ Compared to the other leading global wind power markets, China's wind resources are closest to that of the United States, and greatly exceed resources in India, Germany or Spain.

Due to varied wind resources across China and differing technical and economic conditions, wind power development to date has been focused on a few regions and provinces, including: Inner Mongolia, the Northwest, the Northeast, Hebei Province, the Southeast coast and offshore islands.

Market Developments in 2010

China's wind market doubled every year between 2006 and 2009 in terms of total installed capacity, and it has been the largest annual market since 2009. In 2010, China overtook the United States as the country with the most installed wind

energy capacity by adding 18,928 MW over the course of the year, a 73% increase on 2009 in terms of cumulative capacity, reaching 44.7 GW in total.

According to Bloomberg New Energy Finance, the growth in installed capacity was driven by a record level of investment in wind power in China, which exceeded USD 20 billion in 2009. In the third quarter of 2010, China's investment in new wind power projects accounted for half of the global total.

In addition, the Chinese government report "Development Planning of New Energy Industry" calculated that the cumulative installed capacity of China's wind power will reach 200 GW by 2020 and generate 440 TWh of electricity annually, creating more than RMB 250 billion (EUR 28 bn / USD 38 bn) in revenue.²

¹ China Meteorological Administration: China Wind Energy Resource Assessment 2009.

² CREIA/Greenpeace/GWEC: China Wind Energy Outlook 2010. <http://www.gwec.net/index.php?id=169>

TOTAL INSTALLED CAPACITY

year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
MW	404	470	568	765	1,272	2,559	5,871	12,024	25,828	44,733

The Chinese wind power sector

2010 was also an important year for Chinese wind turbine manufacturers, as four companies (including Sinovel, Goldwind, Dongfang Electric and United Power) are now in the top ten largest wind turbine manufacturers, and are beginning to expand into overseas markets.

Driven by global development trends, Chinese firms, including Sinovel, Goldwind, XEMC, Shanghai Electric Group and Mingyang, have entered the competition to manufacture wind turbines of 5 MW or more.

China's wind power generation market is mainly shared among the 'Big Five' power producers and several other major state-owned enterprises. These firms account for more than 70% of the total wind power market. The largest wind power operators, Guodian (Longyuan Electric Group), Datang and Huaneng expanded their capacity by 2-3 GW each during the year, while Huadian, Guohua and China Guangdong Nuclear Power are following close behind. Most of the local state-owned non-energy enterprises, as well as foreign-owned and private enterprises have retreated from the market. Access to finance is generally not a problem for wind power projects.

Progress on the Wind Base programme

In order to drive wind power development, the Chinese National Energy Administration selected locations from the provinces with the best wind resources and set targets for each of them to be reached by 2020.

According to the plan, wind power bases will add up to 138 GW of wind power capacity by 2020, on the assumption that a supporting grid network is established. So far the Chinese government has confirmed seven GW-scale Wind Power Bases, which amount to 83 projects. In 2010, the Wind Power Base in Gansu Jiuquan reported the fastest growth - more than 5 GW- while others followed with growth of 1.8 GW to 4.2 GW (see table below).

Annual installed capacity planned for Wind Power Bases (MW)

Wind Power Base	2010 (installed)	2015 (planned)	2020 (planned)
Hebei	4,160	8,980	14,130
Inner Mongolia East	4,211	13,211	30,811
Inner Mongolia West	3,460	17,970	38,320
Jilin	3,915	10,115	21,315
Jiangsu	1,800	5,800	10,000
Gansu Jiuquan	5,160	8,000	12,710
Xinjiang Hami	0	5,000	10,800
Total	22,706	69,076	138,086

Offshore developments in China

Offshore wind power's attractiveness stems from strong policy support and the desire to access large electricity markets along the eastern coast of China. The first offshore wind power demonstration project, which is also the first offshore wind project outside of Europe, the Shanghai Donghai Bridge Offshore wind farm, began generating power in June 2010.

At the same time, the government launched public bidding for the first round of offshore wind concession projects in May 2010, and this was completed in November 2010, adding 1 GW of planned capacity in four projects along the coastline of Jiangsu Province. The winning prices for these projects ranged between 0.62 and 0.74 RMB/kWh (USD 9.4-11.2 cents / EUR 6.9-8.2 cents). These projects have to be finished in four years.

In 2010, the National Energy Administration and the State Oceanic Administration jointly published "Interim Measures for the Administration of Development and Construction of Offshore Wind Power", which should give impetus to China's offshore wind power development. The Interim Measures set out provisions for project approval procedures, as well as criteria for project development and construction. They also stipulate that tender procedures will be the preferred method for selecting project developers for offshore projects, and that foreign investors can only hold a minority stake in offshore wind developments.

The Renewable Energy Law and the Chinese feed-in tariff

The breathtaking growth of the Chinese wind energy industry has been driven primarily by national renewable energy policies. The first Renewable Energy Law entered into force in 2006, and gave huge momentum to the development of renewable energy. In 2007, the first implementation rules for the law emerged, giving further impetus to wind energy development. In addition, the "Medium and Long-term Development Plan for Renewable Energy in China" from 2007 set out the government's long term commitment and put forward national renewable energy targets, policies and measures for implementation, including a mandatory market share of 1% of non-hydro renewable energy in the total electricity mix by 2010 and 3% by 2020.

In 2009, the Renewable Energy Law was amended to introduce a requirement for grid operators to purchase a certain fixed amount of renewable energy. The amendment also requires grid companies to absorb the full amount of renewable power produced, also giving them the option of applying for subsidies from a new "Renewable Energy Fund" to cover the extra cost related to integrating renewable power if necessary.

Also in 2009, China finally introduced a feed-in tariff for wind power generation, which applies for 20 years of a wind farm's operation. There are four different categories for the tariff, depending on the region's wind resources, ranging from 0.51 RMB/kWh (EUR 5.7 cents) to 0.61 RMB/kWh (EUR 6.8 cents).

Clean Development Mechanism

A total of 869 Chinese projects have been approved as CDM projects by the United Nations, accounting for 39% of the total number of CDM projects registered, and income from the CDM has made an important contribution to investors' return. This has now been threatened, however, by challenges to the way in which Chinese projects have interpreted the rule that any CDM project must be 'additional' to what would have happened otherwise. This issue needs to be resolved to maintain the growth of the Chinese wind industry. There is also uncertainty about whether the CDM will continue in the



Xiao Yan Kau wind farm, Rudong © Wind Power Works

same form after the expiry of the current Kyoto Protocol emissions reduction period at the end of 2012.

Grid connection problems

The rapid development of wind power in China has put unprecedented strain on the country's electricity grid infrastructure. This has become the biggest problem for the future development of wind power in the country, as some projects have to wait for several months before being connected to the national grid.

There are reports that a large share of China's wind power capacity is not grid connected, but this is based on a fundamental misunderstanding, which has its source in the methodology used for calculating installed capacity. The China Electricity Council has published a much lower figure for operational capacity, which only counts entire wind farms that have been connected to the grid with a Power Purchase



Agreement, have undergone a testing procedure and have been accepted; and for which the national grid operator State Grid has started to pay electricity bills. All of these result in a time lag of several months. The installed capacity counted by the wind power associations CREIA and CWEA, however, also includes turbines which are grid connected and are delivering electricity, even before they have completed the commissioning and acceptance procedure, which can take several months. This explains the much reported 'gap' between installation and grid connection which is often reported from China. In other markets, it is common practice to count all turbines as soon as they are grid connected and producing electricity.

Due to a lack of incentives, the Chinese grid operator State Grid has been reluctant to accept large amounts of wind power into their systems. However, an agreement has recently been reached to connect 100 GW of wind power by 2015 and 150 GW by 2020. According to figures by State

Grid, at the end of 2010, 40 billion RMB (EUR 4.5 bn / USD 6.1 bn) had been invested to facilitate wind power integration into the national power grid.

Outlook for 2011 and beyond

Despite its rapid and seemingly unhampered expansion, the Chinese wind power sector continues to face significant challenges, including issues surrounding grid access and integration, reliability of turbines and a coherent strategy for developing China's offshore wind resource. The twelfth Five-Year Plan, which was passed by the Chinese Parliament in March 2011, reflects the Chinese government's continuous and reinforced commitment to wind power development, with a target of building a total of 90 GW of wind energy by 2015.

With input from the Chinese Renewable Energy Industry Association (CREIA) and the Chinese Wind Energy Association (CWEA)

Egypt



Zafarana wind farm © Wind Power Works

Egypt's renewable energy sector has gained momentum over the last two decades, thanks to government commitment and successful international cooperation. The New and Renewable Energy Authority (NREA) was set up in 1986 to assess the country's renewable energy resource and to investigate technology options through studies and demonstration projects. Another aim of NREA is to introduce mature technologies into 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 were installed in Egypt, and 120 MW were added in 2010, taking the total installed wind capacity to 550 MW.

An excellent wind resource

In 2003, a detailed wind atlas was published for Egypt's Gulf of Suez coast, concluding that the region has an excellent wind regime with wind speeds of 10 m/s, and the potential to host several large-scale wind farms. This atlas was expanded in 2005 to cover the entire country, indicating that large desert regions both to the east and the west of the Nile River,

as well as parts of Sinai, have average annual wind speeds of 7-8 m/s. Large areas with high wind potentials are already earmarked for wind power development on the west of the Gulf of Suez and along the Nile River.

The policy environment for wind power in Egypt

In 2008 the Egyptian government approved an ambitious plan to produce 20% of total electricity from renewable energy sources by 2020, including a 12% contribution from wind energy (around 7,200 MW). In order to achieve this target, the government has earmarked 7,600 square kilometers of desert land for implementing new wind energy projects.

A draft for a new electricity act was also published in 2008, and is still undergoing consultation with stakeholders. The draft act aims to reflect ongoing market reforms, strengthen the regulatory agency and encourage private investment. In addition, it guarantees third party access and priority dispatch for renewable electricity.

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
MW	5	5	68	98	145	145	230	310	365	430	550

While 2010 saw no progress on this act, the Egyptian Cabinet approved some policies to support wind energy projects to be implemented by private developers, including the following measures:

- For the 7,600 square kilometers of desert lands that have been earmarked for future wind projects, all permits for land allocation have already been obtained by NREA, and an Usufruct Agreement (lease) for the area assigned to individual projects will be signed with the investors;
- Environmental impact assessments, including bird migration studies, will be prepared by NREA;
- 20-25 year Power Purchase Agreements are available with government guarantees;
- Renewable energy equipment will be exempt from customs duties;
- The projects will benefit from carbon credits under the CDM.

The government has outlined two phases for fostering wind power development in Egypt:

Phase I: A competitive bids approach through international tenders. A first tender was launched in May 2009, a second tender in January 2011, and a further tender is expected for July 2011.

Phase II: A feed-in tariff system will be applied taking into consideration the prices achieved in the tendering process. According to the Egyptian Wind Energy Association, Egypt is set to introduce a feed-in tariff in 2012.

Operating and planned wind farms in Egypt

ZAFARANA WIND FARM

The Zafarana wind farm by the Red Sea coast has been constructed in stages since 2001, in cooperation with Germany, Denmark and Spain. 120 MW of wind capacity were added to Zafarana in 2010 in cooperation with the Danish International Development Agency (DANIDA), taking the total installed capacity to 545 MW. In 2010, the wind farm generated 1,147 GWh.

HURGAHDA WIND FARM

An area north of Hurgahda in the Gulf of El Zayt has an excellent wind regime, and in addition to 5 MW already

operating, there are currently about 1,120 MW at various stages of development in cooperation with Germany, the European Investment Bank (EIB), Japan and Spain. These include:

- 200 MW in cooperation with KFW, EU and the EIB. After a tender in 2010, the contractor is expected to be selected at the beginning of 2011 and the project is scheduled to start operations by the end of 2012.
- 220 MW in cooperation with Japan and 120 MW in cooperation with Spain are in the pipeline.
- Further projects in preparation include: 180 MW in cooperation with Spain; 200 MW in cooperation with Abu Dhabi's MASDAR programme; and 200 MW in cooperation with Germany, the EU and the EIB.

WESTERN BANK OF THE NILE

A further 200 MW are planned on the Western Bank of the Nile in cooperation with Japan.

GULF OF EL ZAYT

In May 2009, the Egyptian government, in cooperation with the World Bank, published an international tender for a wind farm at the Gulf of El Zayt, inviting private international and local developers to submit their prequalification documents for the first competitive bid to plan, build and operate a 250 MW wind farm. The project will benefit from the conditions outlined above.

Following the tender, 34 offers were received and a short list of ten qualified developers was announced in November 2009. A second stage of the tender calling for final bids will be issued mid-2011 and the project is scheduled to start operations by 2014.

GULF OF SUEZ

The Egyptian government aims to develop 2,000 MW of wind power in the Gulf of Suez region, in four stages. A first tender was published in January 2010 for two projects of 250 MW each, again on a build, own and operate basis and a 20 year PPA. A second tender for the same amount of wind power – two projects of 250 MW each – is expected for July 2011.

*With input from the
New & Renewable Energy Authority, Egypt*

European Union

Offshore wind and Eastern member states drive growth in 2010

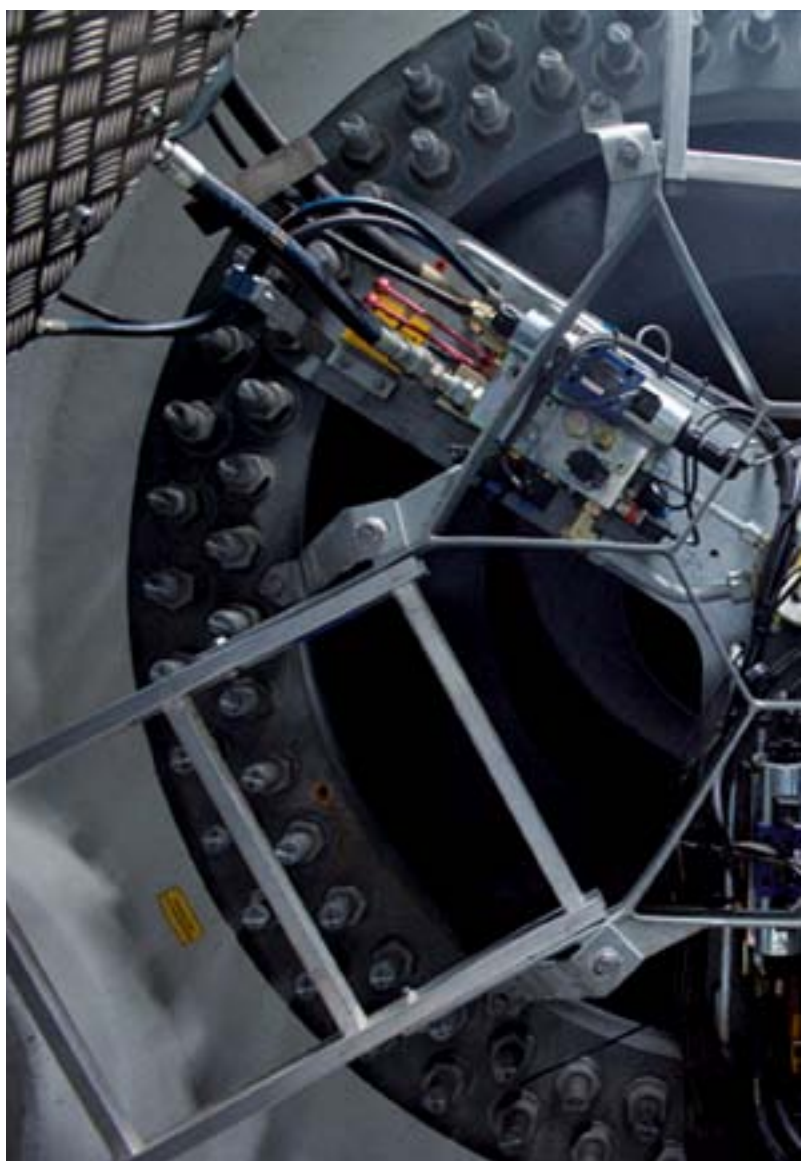
During 2010, 9,883 MW of wind power were installed across Europe, with European Union countries accounting for 9,259 MW of the total. This represents a decrease in the EU's annual wind power installations by 10% compared to 2009. Of the 9,259 MW installed in the EU, 8,377 MW were installed onshore and 883 offshore. This means that in 2010, the annual onshore market decreased by over 13% compared to 2009, while the annual offshore market grew by 51%, and accounted for 9.5% of all capacity additions.

In terms of annual installations, Spain was the largest market in 2010, installing 1,516 MW, followed by Germany with 1,493 MW. France was the only other country to install over 1 GW (1,086 MW), followed by the UK (962 MW), Italy (948 MW), Sweden (603 MW), Romania (448 MW), Poland (382 MW), Portugal (345 MW) and Belgium (350 MW). For the first time ever, two new EU Member States were among the top ten largest annual markets.

The total wind power capacity installed by the end of 2010 will, in a normal wind year, produce 181 TWh of electricity (up from 163 TWh), meeting 5.3% of overall EU electricity consumption (up from 4.8% in 2009).

2010 was a record year for new power generation installations in the EU, with 55.3 GW of new capacity added to the grid. However, for the first time since 2007, wind power did not lead the newly installed generation capacity, but only accounted for around 17% of new installations. The natural gas sector, on the other hand, represented 51% of all new installed power capacity in 2010.

Despite the slight slowdown in the EU's wind power market, more renewable energy generating capacity was installed in the EU than ever before, mainly driven by strong growth in the solar PV sector. With almost 23 GW of new generating capacity, renewables represented 41% of total new installed capacity across the EU. Although renewables' share of newly installed capacity decreased in 2010 due to the exceptional year for gas, it is the fifth year running that renewables have represented more than 40% of total new electricity generating installations.



Burbo Bank wind farm, Liverpool Bay, UK © Wind Power Works

The EU Renewable Energy Directives

For the past decade, the EU and certain member states have shown strong support for renewable deployment and 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, which included an indicative target for 21% of the EU's overall electricity to come from renewable energy sources by 2010, gave an important boost to the sector, although just over 18% were actually reached by that deadline.

TOTAL INSTALLED CAPACITY

year	2001**	2002**	2003**	2004*	2005*	2006*	2007	2008	2009	2010
MW	17,315	23,159	28,598	34,371	40,511	48,031	56,517	64,713	74,919	84,074

**EU 15 *EU 25



At the end of 2010, the EU's new Renewable Energy Directive (2009/28/EC) entered into force, setting an EU renewable energy target of at least 20% of final energy consumption by 2020. Each EU Member State has a national legally binding target for the share of renewable energy it must achieve by that date. The member states were required to submit National Renewable Energy Action Plans (NREAPs) detailing sectoral targets and measures necessary for them to reach their overall binding RES target.

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.

The Directive also 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 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.

The National Renewable Energy Action Plans: EU set to exceed 20% target

In their NREAPs, 15 member states say they will exceed their targets, ten consider they will meet their targets, and only two expect to not meet their target domestically. Consequently, aggregating the NREAPs, the EU is expected to exceed its 2020 20% target by 0.7%.

Electricity from renewables will play the largest role in meeting the 2020 target, covering over a third of total electricity consumption. With a capacity forecast of 213 GW, of which 43 GW will be offshore, producing 495 TWh of electricity covering about 14% of total consumption, wind comes out as the technology of choice in the NREAPs.

While much remains to be done to achieve the 20% target, the European Wind Energy Association (EWEA) believes that it will be exceeded. Indeed, EWEA's baseline scenario assumes a total installed capacity of wind power in the EU by 2020 of 230 GW, producing 582 TWh of electricity, meeting 14.2% of EU electricity demand (depending on demand growth over that period). EWEA's high scenario assumes that total installed wind power capacity will reach 265 GW by 2020, producing 681 TWh of electricity and meeting 16.7% of the EU's electricity demand by 2020.¹

With input from the European Wind Energy Association (EWEA)

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

EU offshore

The status of the European offshore market in 2010

2010 was a record year for offshore wind development in Europe, with 308 new wind turbines fully grid connected, totalling 883 MW, a 51% increase on 2009, and bringing cumulative capacity to 2,946 MW.

During the year, work was carried out on 18 offshore wind farms in European waters. Nine wind farms were completed and eight were fully grid connected. One wind farm was partially completed and grid connected, whereas in four further offshore wind farms work has begun but no turbines were connected.

Over half of all new offshore capacity in 2010 was added in the United Kingdom (458 MW), while just under a quarter was installed in Denmark (207 MW), followed by Belgium (165 MW), Germany (50MW) and Finland, where one 2.3 MW turbine was installed near shore.

In terms of cumulative capacity, the UK (1,341 MW) and Denmark (854 MW) remain the two biggest markets for offshore wind, followed by the Netherlands (247 MW), Belgium (195 MW) and Sweden (163 MW).

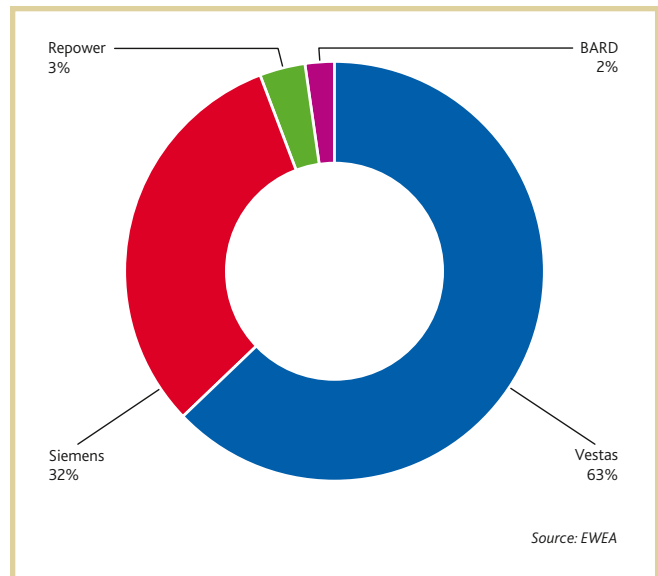
A further ten offshore projects are currently under construction. When these are fully grid connected over the coming years, Europe's installed offshore capacity will rise to 6,133 MW.

Industry and technology

Vestas and Siemens have been the main suppliers to the offshore wind market since the first turbines were connected in the early 1990s, and these manufacturers still dominate the market, with Vestas installing 555 MW and Siemens 278 MW in 2010. REpower (30 MW) and BARD (20 MW) are the other two main manufacturers whose offshore turbines came online in 2010. A small floating GAIA turbine (0.033 MW) was also installed off the Danish coast.

In terms of utilities active in the offshore wind market, Vattenfall and E.On installed most new offshore capacity in 2010, 308 MW and 305 MW respectively, followed by DONG (68 MW), BARD (20 MW) and EWE, which owns

SHARE OF EU OFFSHORE MARKET IN 2010



14.25 MW of the Alpha Ventus project. Suomen Hyotytuuli installed a 2.3 MW turbine near shore in Finland and Floating Wind Power Plant connected its 0.033 MW project in Denmark to the grid.

However, utilities did not play as dominant a role as they did in 2009, with the Belwind consortium, which is made up of Dutch and Belgian investors under the project company Evelop, successfully completing its first 165 MW phase.

Water depths and distance to shore

European offshore turbines are being installed in ever deeper waters, and increasingly far from shore.

The average water depth of wind farms which were fully or partially grid connected in 2010 was 17.4 metres, an increase on 2009 when the average depth was 12 metres. Without the experimental turbines, the 2010 average is 18.8m. Four out of the nine projects fully or partially grid connected in 2010 are located in waters 20m deep or more, with one of them 40m deep.

Average distance to shore also increased considerably in 2010. The nine wind farms fully or partially grid connected averaged 27.1 km from shore, almost 13 km further than the

TOTAL INSTALLED CAPACITY

year	2000**	2001**	2002**	2003**	2004*	2005*	2006*	2007	2008	2009	2010
MW	36	86	256	515	605	695	787	1,106	1,479	2,064	2,946

**EU15 *EU25

2009 average of 14.4 km. Excluding the experimental turbines the 2010 average distance to shore increases to 30.1 km.

The project installed furthest from the shore in 2010 was the first cluster of turbines connected at the BARD 1 offshore wind farm at an average of 100 km from shore, and Belwind installed turbines at an average of 48.3 km off the Belgian coast.

Looking ahead at the wind farms currently under construction, both average water depths and distance to shore are set to increase further to reach an average 25.5 m of water depth and an average distance of 35.7 km.

Offshore super grid development

Connecting offshore wind farms to national electricity grids continues to present a challenge, and a dedicated offshore grid is needed to provide access for the more remote offshore wind farms. A future transnational offshore super grid will have many functions and benefit Europe in different ways. Not only will it provide 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.

In December 2010, ten countries bordering the North Sea signed a memorandum of understanding on joint co-ordination of an offshore grid in Europe's northern seas. Under this intergovernmental initiative Belgium, Denmark, France, Germany, Ireland, Luxembourg, the Netherlands, Norway, Sweden and the UK agreed to work together to coordinate investments in interconnections, setting out deliverables with deadlines up to 2012.

They also agreed to set up a governance structure including three working groups on grid configuration and integration, market and regulatory issues, and planning and authorisation procedures in which the European TSO association ENTSO-E, the regulators and the European Commission will be involved, together with input from stakeholders.

Furthermore, in November 2010, the European Commission published its communication "Energy infrastructure priorities



Burbo Bank wind farm, Liverpool Bay, UK © Wind Power Works

for 2020 and beyond – A blueprint for an integrated European energy network”¹

The communication outlines four priority corridors for electricity including an offshore grid in the Northern Seas and a connection to north and central Europe. These projects of “European interest” will also benefit from an accelerated permitting process with a time limit for the final decision. The European Commission aims to propose a new financial instrument in June 2011 to support the priority projects.

With input from the European Wind Energy Association (EWEA)

¹ http://www.energy.eu/directives/com-2010-0677_en.pdf

France

The French government has set the objective to install 25 GW of wind power, including 6 GW offshore, to meet its obligation under the EU Directive to cover 23% of final energy demand from renewable sources by 2020. 25 GW of wind energy would produce 55 TWh every year, thereby accounting for 10% of the country's total electricity consumption.

France is blessed with Europe's second largest wind potential, and the wind resource is well distributed across the country.

French wind energy capacity reached 5,660 MW at end of 2010, up from 4,574 MW in 2009, which represents 1,086 MW of new installations. The total number of wind turbines operating in France is now close to 3,500. Overall, wind power now produces 1.8% of the country's electricity demand, but at one point in November 2010, this share reached 7%.

Since 2007, France has added around 1,000 MW to its wind capacity every year, but this pace will have to pick up over the coming years to meet the 25 GW target.

The wind power industry in France

The French wind energy sector now employs around 11,000 people, according to the French Environment and Energy Management Agency (ADEME), spread over more than 180 companies.

The main wind power manufacturers in France are Enercon, Vestas, Nordex and Repower, and EDF Energies Nouvelles, Eole-RES and GDF-Suez subsidiaries are the leading project developers.

The policy framework for wind energy

A feed-in tariff was introduced in France in 2001 and this was revised in 2006 and reconfirmed in 2008. The level of tariff is EUR 8.2 cent/kWh for onshore installations and EUR 13 cent/kWh for offshore installations for the first ten years of operation, and then adjusted for the following ten years depending on the actual wind conditions and corresponding turbine performance.



Hétomesnil wind farm, Picardie © Wind Power Works

In the *Grenelle de l'environnement*¹ process, a 25 GW target was set for wind energy development by 2020. This would take the country a quarter of the way towards meeting its EU target of 23% of final energy demand from renewables.

However, several changes in French legislation and regulations have put new obstacles in the way of wind power development, making it uncertain whether the 2020 target can be met. In particular, administrative procedures have been changed, and wind farm developers now need to obtain

¹ The Grenelle de l'environnement is a national consultation process involving a large range of actors debating on environmental issues. It was started in 2007.

TOTAL INSTALLED CAPACITY

year	2002	2003	2004	2005	2006	2007	2008	2009	2010
MW	148	253	390	757	1,567	2,454	3,404	4,574	5,660



a higher number of authorizations before being granted permits, and stricter criteria will apply. In particular wind turbines installation in France will be submitted to regulation covering “dangerous and polluting installations”.

In 2005, a change in legislation stipulated that in order to be eligible for the feed-in tariff, wind farms must be built in special wind power development zones (ZDE). These ZDEs were introduced in 2007 and defined by regional authorities. In addition, so-called “zones favorables” will have to be defined by each region by June 2012, out of which it will not be possible to build wind farms. The problem with these regional schemes is that there are no precise recommen-

dations for the criteria for these favorable zones for wind power development, and each region has a high level of autonomy to set the borders for the ZDEs. As a result, due to environmental, visual or other concerns, these zones might not be sufficient to meet the 25 GW target.

In addition, a number of new pieces of legislation are expected to be introduced in 2011, including new permitting processes and rules governing the dismantling of wind power installations.

Offshore wind energy in France

The French government has set a target of 6,000 MW of offshore wind power installations by 2020 through a tender process. In order to get this process started, in 2010 the French government announced a call for tender for 3,000 MW for offshore wind development, and this call is expected to be launched in early May 2011. The selection of the winning tenders will be made during 2012. The objective of this call is to spur domestic investments in the offshore wind manufacturing industry, and to make the French offshore wind sector competitive in Europe.

A second call for offshore capacity was announced for the coming years.

Obstacles to wind energy development

The constant changes in legislation and regulation and the addition of new authorization requirements continue to hinder the pace of wind energy development in France. Moreover, there are still significant delays between the application for permits and their actual delivery, and in some cases litigation has caused further delay.

All these factors lead to a level of uncertainty regarding future wind power developments in France. The current pace of 1,000 GW of additions every year would have to increase considerably to reach the 2020 objective, but changes in regulation and legislation may slow down permitting processes, which will lead to delays in new wind farm construction.

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

Germany



Marienkoog, Niebüll © Wind Power Works

Germany continues to lead Europe as the number one wind energy country with 27,214 MW of installed capacity. In 2010, the country added 1,493 MW, including 108 MW offshore. The annual market was smaller than in 2009, when 1,917 MW was installed. This was mainly a consequence of the financial crisis, as well as investment insecurity created by government decisions in 2010 to prolong the lifetime of nuclear plants in Germany.

Wind energy generated 37.3 TWh of electricity in 2010, which accounted for 6.2% of the country's power consumption. In total, 17% of electricity was generated from renewable sources in Germany in 2010, with wind being the single largest contributor.

The leading German federal state in terms of wind power deployment is Lower Saxony with 6,664 MW of wind power capacity. A number of states now generate more than 40% of their electricity from wind energy: Saxony-Anhalt (52.14%), Mecklenburg-Vorpommern (45.37%) and Schleswig-Holstein (44.1%).

In 2011, the German wind industry expects new installations of about 1,800 MW including 300 MW of offshore wind. According to the Germany Wind Energy Association (BWE), the country could host 45,000 MW of onshore and 10,000 MW of offshore wind by 2020. Generating approximately 150 TWh/year, wind energy would then deliver about 25% of German electricity consumption.

According to the EU Renewable Energy Directive, Germany has a target of 18% renewable energy in final energy consumption. For the electricity sector, the government's target is 38.6% of renewable electricity by 2020.

The German feed-in tariff

An early feed-in tariff for wind-generated electricity has existed in Germany since 1991. The Renewable Energy Sources Act (EEG) came into force in 2000 and still provides the main stimulus for the German wind market, stipulating a feed-in tariff for each kWh produced and priority grid access for renewable power. The EEG is regularly amended to adapt feed-in tariffs to current market conditions and new technological developments.

For wind energy an "initial tariff" is fixed for at least five and up to 20 years, after which it is then reduced to a "basic tariff", depending on how local wind conditions compare to a reference yield. Wind installations on very good sites (reference yield of 150%) receive the initial tariff for only five years. For turbines on sites with lesser wind conditions this period can be extended. In total, tariffs are paid for 20 years. No compensation is granted for turbines with a reference energy yield of less than 60% to discourage installation of wind turbines on unfavourable sites.

The amended EEG entered into force in January 2009, including an increased initial tariff for onshore wind energy - EUR 9.2 cent/kWh (USD 12.5 cent), up from 8.7 cent/kWh. The basic tariff was set at 5.02 cent/kWh. There is an annual

TOTAL INSTALLED CAPACITY

year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
MW	8,754	11,994	14,609	16,629	18,415	20,622	22,247	23,903	25,777	27,214

digression of 1% for new installations. Hence, since 1 January 2010, the initial tariff for onshore wind was 9.02 cent/ kWh.

The tariff for offshore wind energy was increased to 13 cent/kWh, plus an additional “sprinter bonus” of 2 cents/kWh for projects which start operation before the end of 2015. The initial 15 cents/kWh will be paid for a period of 12 years, and then decreased to 3.5 cent/kWh. There is an additional prolongation if the offshore site is located in deep waters and at a large distance from the coast. Offshore tariffs will annually decrease by 5% for new installations starting in 2015.

A bonus for improved grid compatibility of 0.5 cent/kWh was also introduced, and the special tariff (repowering bonus) was kept for replacing turbines that are ten years or older with new turbines, if the project doubles in rated capacity. In 2010, 56 MW were repowered to reach 183 MW.

Furthermore, the new EEG requires grid operators not only to expand the grid, but also to optimise and enhance it. Failure to comply can lead to claims for damages by any renewable power producer willing but unable to feed in their electricity.

The new government announced that it will shorten the periods between EEG amendments from four to three years, and a new amendment is now expected in 2012.

Other relevant policy measures

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 or preferential zones for wind projects. They can also restrict construction in specific areas (exclusion zones).

The new German conservative-liberal government adopted a new energy concept in autumn 2010, which reversed a decision by a previous government to phase out nuclear energy in Germany by prolonging the life time of many nuclear plants. The wind industry fears that this step could jeopardise the future development of wind power, with renewable energy sources having to compete with nuclear energy in the power grid.

Future Trends – Repowering and offshore wind

Repowering can and will play a larger role in Germany in the future, and it is estimated to have the potential to double the amount of onshore wind capacity and to triple the energy yield in Germany with significantly fewer turbines deployed.

However, repowering is only slowly gaining pace because in most cases it is only economical after 15 or more years of operation of a turbine. Only 183 MW were installed in repowering projects in 2010, but this rate should increase significantly and by 2015, 6,000 MW will be older than 15 years and ready for repowering.

Offshore wind energy in Germany grew to 108 MW in 2010, and this is expected to reach 3,000 MW by 2015. To date, 24 projects have been licensed by the national maritime authority and the Federal States, bringing the overall capacity close to 7,000 MW. The costs for connecting offshore wind farms to the mainland grid are taken over by transmission systems operators, and they have started to plan for connection lines for clusters of offshore projects. Three 400 MW HVDC light lines have already been completed.

Obstacles for wind power development

In many regions, height restrictions inhibit the production of turbines yielding the maximum amount of energy. In 2010, the government and some states (for example North Rhine-Westphalia and Schleswig-Holstein) have started rethinking their framework conditions to allow for continuous onshore development and have entered into discussions with local and regional planning authorities at a broader level.

Another key challenge for expanding renewable energy is speedy grid expansion, which includes underground cabling in critical areas. In the meantime, it will be important to improve the overall grid transport capacity in Germany through soft measures such as temperature monitoring of overhead lines, high temperature conductors, load flow management and other smart grid options.

With input from the German Wind Energy Association (BWE)

India

India had a record year for new wind energy installations in 2010, with 2,139 MW of new capacity added to reach a total of 13,065 MW at the end of the year. Renewable energy is now 10.9% of installed capacity, contributing about 4.13% to the electricity generation mix, and wind power accounts for 70% of this installed capacity. Currently the wind power potential estimated by the Centre for Wind Energy Technology (C-WET) is 49.1 GW, but the estimations of various industry associations and the World Institute for Sustainable Energy (WISE) and wind power producers are more optimistic, citing a potential in the range of 65-100 GW.

Historically, actual power generation capacity additions in the conventional power sector in India have been significantly short of government targets. For the renewable energy sector, the opposite has been true, and it has shown a tendency towards exceeding the targets set in the five-year plans. This is largely due to the booming wind power sector.

Given that renewable energy was about 2% of the energy mix in 1995, this growth is a significant achievement even in comparison with most developed countries. This was mainly spurred by a range of regulatory and policy support measures for renewable energy development that were introduced through legislation and market based instruments over the past decade.

The states with highest wind power concentration are Tamil Nadu, Maharashtra, Gujarat, Rajasthan, Karnataka, Madhya Pradesh and Andhra Pradesh.

Main market developments in 2010

Today the Indian market is emerging as one of the major manufacturing hubs for wind turbines in Asia. Currently, seventeen manufacturers have an annual production capacity of 7,500 MW. According to the WISE, the annual wind turbine manufacturing capacity in India is likely to exceed 17,000 MW by 2013.

The Indian market is expanding with the leading wind companies like Suzlon, Vestas, Enercon, RRB Energy and GE now being joined by new entrants like Gamesa, Siemens, and WinWinD, all vying for a greater market share. Suzlon, however, is still the market leader with a market share of over 50%.



Kutch wind farm, Gujarat © Wind Power Works

The Indian wind industry has not been significantly affected by the financial and economic crises. Even in the face of a global slowdown, the Indian annual wind power market has grown by almost 68%. However, it needs to be pointed out that the strong growth in 2010 might have been stimulated by developers taking advantage of the accelerated depreciation before this option is phased out.

Policy support for wind power in India

Since the 2003 Electricity Act, the wind sector has registered a compound annual growth rate of about 29.5%. The central government policies have provided policy support for both foreign and local investment in renewable energy technologies. The key financial incentives for spurring wind power development have been the possibility to claim accelerated depreciation of up to 80% of the project cost within the first year of operation and the income tax holiday on all earnings generated from the project for ten consecutive assessment years.

In December 2009 the Ministry for New and Renewable Energy (MNRE) approved a Generation Based Incentive (GBI) scheme for wind power projects, which stipulated that an incentive tariff of Rs 0.50/kWh (EUR 0.8 cents/USD 1.1 cents) would be given to eligible projects for a (maximum) period of ten years. This scheme is currently valid for wind farms installed before 31 March 2012. However, the GBI and the accelerated depreciation are mutually exclusive and a developer can only claim concessions under one of them for

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
MW	220	1,456	1,702	2,125	3,000	4,430	6,270	7,845	9,655	10,926	13,065

the same project. Although the projected financial outlay for this scheme under the 11th Plan Period (2007-2012) is Rs 3.8 billion (EUR 61 million/USD 84 million), the uptake of the GBI has been slow due to the fact that at the current rate it is still less financially attractive than accelerated depreciation.

Currently 18 of the 25 State Electricity Regulatory Commissions (SERCs) have issued feed-in tariffs for wind power. Around 17 SERCs have also specified state-wide Renewable Purchase Obligations (RPOs). Both of these measures have helped to create long-term policy certainty and investor confidence, which have had a positive impact on the wind energy capacity additions in those states.

Support framework for wind energy

There has been a noticeable shift in Indian politics since the adoption of the Electricity Act in 2003 towards supporting research, development and innovation in the country's renewable energy sector. In 2010, the Indian government clearly recognised the role that renewable energy can play in reducing dependence on fossil fuels and combating climate change, and introduced a tax ("cess") of Rs.50 (~USD1.0) on every metric ton of coal produced or imported into India. This money will be used to contribute to a new Clean Energy Fund.

In addition, the MNRE announced its intention to establish a Green Bank by leveraging the Rs 25 billion (EUR 400 million / USD 500 million) expected to be raised through the national Clean Energy Fund annually. The new entity would likely work in tandem with the Indian Renewable Energy Development Agency (IREDA), a government-owned non-banking financial company.

In keeping with the recommendations of the National Action Plan on Climate Change (NAPCC) the MNRE and the Central Electricity Regulatory Commission (CERC) have evolved a framework for implementation of the Renewable Energy Certificate (REC) Mechanism for India.¹ This is likely to give renewable energy development a further push in the coming years, as it will enable those states that do not meet their RPOs through renewable energy installations to fill the gap through purchasing RECs.



Kutch wind farm, Gujarat © Wind Power Works

Obstacles for wind energy development

With the introduction of the Direct Tax Code², the government aims to modernize existing income tax laws. Starting from the fiscal year 2011-12, accelerated depreciation, the key instrument for boosting wind power development in India, may no longer be available.

Another limitation to wind power growth in India is inadequate grid infrastructure, especially in those states with significant wind potential, which are already struggling to integrate the large amounts of wind electricity produced. As a result, the distribution utilities are hesitant to accept more wind power. This makes it imperative for CERC and SERCs to take immediate steps toward improved power evacuation system planning and providing better interface between regional grids. The announcement of India's Smart Grid Task Force by the Ministry of Power is a welcome first step in this direction.

*With input from the
Indian Wind Turbine Manufacturers Association (IWTMA)
and the World Institute of Sustainable Energy (WISE)*

¹ http://nlcd.in/docs/REC/MNRE_REC_Report.pdf

² http://www.incometaxindia.gov.in/archive/BreakingNews_RevisedDiscussionPaper_06152010.pdf

Iran

Despite boasting some of the best wind resources in the region, Iran's wind energy market has not yet realized its potential. The mountainous landscape of Iran holds unique wind corridors, and preliminary studies have shown an estimated practical wind power potential of at least 6,500 MW, according to the Iran Renewable Energy Organisation (SUNA)¹, an executive arm of the Ministry of Power. Iran's best wind resources are located in the mountainous part of the country, along the Alborz and Zagros mountain chain (see map).

To date, the total capacity of wind turbine installations in Iran stands at 92 MW.

Iran's electricity industry is dominated by the government, but there are serious attempts at privatizing the power generation sector and allowing private investment.

Iran is the sole manufacturer of wind turbines in the Middle East, thus increasing the industrial capacity of the country and facilitating the fast expansion of wind energy around the entire region.

The policy environment for renewable energy in Iran

Iran has abundant oil and gas reserves, and the income from fossil fuels dominates the economy and affects Iran's energy policy. Iran's energy strategy is currently undergoing a transformation, driven by the elimination of energy subsidies that took place at the end of 2010, and the diversification of energy sources.

The elimination of energy subsidies frees up over USD 60 billion of public funds, some of which can potentially be channeled into the renewable energy sector. In addition, a more level playing field makes renewable electricity production more competitive with fossil fuels. As a result, renewables are attracting a great amount of investor interest.

Iran aims to diversify its energy mix, and the government also has a clear strategy to develop the country's industry into a wind energy hub for the Middle East.

The Iranian authorities are privatizing the power sector, and 20,000 MW of thermal power capacity, as well as the two major wind farms (Binalood and Manjil) have been floated on the stock market.

In addition, the Iranian Ministry of Power has undertaken considerable efforts to develop a legal and financial framework to support wind power growth in Iran.

In 2009, the Renewable Energy Power Purchase Act was adopted, which increased the tariff for renewable electricity from 900 rial (EUR 6 cents) to 1,300 rial (EUR 9 cents) per kWh for on peak and off-peak hours².

Power generated from renewable energy sources is purchased through a 20-year Power Purchase Agreement (PPA) signed with SUNA, and this is backed by a letter of credit. All foreign investments in Iran are covered by the Foreign Investment Promotion and Protection Act, which protects investors against political risks. However, as a result of the economic sanctions against Iran, no technical or financial foreign investment is possible, which in turn hampers renewable energy development.

Existing wind farms and market developments in 2010

Iran's wind power capacity now stands at 92 MW, spread across four sites:

- Manjil wind farm (2002-2009): 62.08 MW
- Binalood wind farm (2006/2007): 28.38 MW
- Loutek wind site, Tabriz (2009): 0.66 MW
- Eouibnali wind site, Zabol (2009): 0.66 MW

For the first time in a decade, no new wind power capacity was added in Iran in 2010, and the current installed wind capacity is a long way behind the government target of 500 MW by 2009. Wind power generated 220 GWh of electricity over the year, which was slightly lower than the figure in 2009 (230 GWh) due to some technical difficulties. The Iranian government set a new target of 1,500 MW of wind power by 2013, but it seems unlikely that this target can be met.

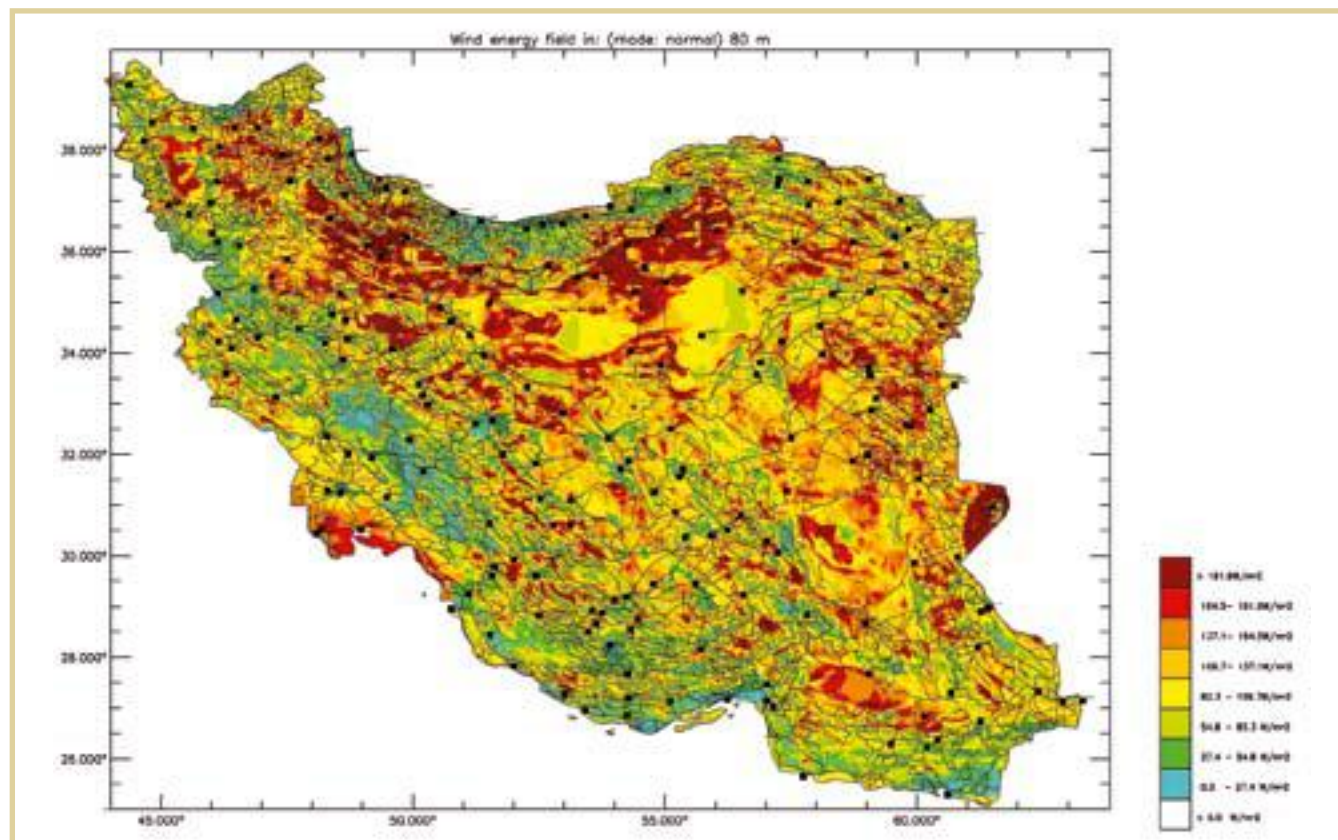
¹ See www.suna.org.ir, also for legal texts concerning renewable energy in Iran

² http://www.suna.org.ir/suna_content/media/image/2009/09/867_orig.pdf

TOTAL INSTALLED CAPACITY

year	2002	2003	2004	2005	2006	2007	2008	2009	2010
MW	12	12	15	20.5	48	74	84	92	92

WIND MAP FOR IRAN (AT 80 M HEIGHT)



Source: SUNA

Outlook for 2011 and beyond

Despite the sluggish growth of wind energy in Iran, there is infrastructure capacity for rapid deployment. To date, more than 120 data collection sites are feeding detailed information into the Iranian wind database. A wind atlas is available for three different altitudes (40m, 60m and 80m) and 42 sites have been identified as appropriate for wind power development, spread over 26 regions across the country.

The outlook for 2011 is good: The first private wind farm in Iran, with a capacity of 300 MW, will be installed by early 2011, and more private wind projects are expected.

The wind industry in Iran

In an economy affected by international sanctions, Iran considers its technological know-how a key opportunity for developing the renewable energy sector across the entire

region. Iranian wind turbine manufacturer Saba Niroo was also hit by economic sanctions, which stopped the supply of some parts needed for its 660 KW turbine in 2008, but the company now manufactures these parts in-house, and in 2010, the production line started to meet demand again. Overall, the Iranian wind industry now employs more than 1,000 people.

Iran has started exporting its technology into neighbouring countries, including Armenia, for the country's first 2.6 MW wind farm, and Pakistan, which signed a contract with the Iranian power company SUNIR for a 40% investment in the 50 MW Jhampir wind farm, worth EUR 85 million. Besides financing, SUNIR is handling engineering, design, procurement, and civil works of the project. Another potential market for Iranian wind technology is Georgia, where prospective projects are currently being examined.

Wind input from the Iran Renewable Energy Association

Mexico

Renewable energy sources accounted for around 27% of Mexico's total installed power generation capacity in 2010, but this was mainly from large hydro plants. Wind energy development has only recently started, and in 2010, Mexico installed 316 MW of new wind power capacity, taking the total up to 519 MW, which represents a 156% increase over 2009.

This growth was spurred by a more supportive legal and regulatory framework, the availability of new transmission capacity in the Oaxaca region, significant wind turbine price reductions, and renewed access to financing, which had been extremely limited after the financial crisis.

A wind potential of 71 GW

The Mexican government estimates the country's wind power potential at around 71 GW, which takes into account 10% of the total potential area in 22 out of 32 states, and includes sites with capacity factors above 20%. For higher capacity factors (more than 30%), the estimated potential is around 11 GW.

The regions with the best prospects for wind power development include:

1. Isthmus of Tehuantepec, State of Oaxaca, where the vast majority of operating wind farms (508 MW) are located, and a further 19 projects are under construction or in development. Capacity factors are in the range of 40%, and a total of 10 GW could be developed in this region alone. In 2010, three new projects came online here: Eurus (II phase) with 212.5 MW; Bii Nee Stipa I with 26.35 MW, and La Mata – La Ventosa with 67.5 MW.
2. La Rumorosa, State of Baja California, has an estimated wind potential of more than 5 GW. So far, there is only one 10 MW state-owned wind farm which was built in 2010, but a further six projects totaling 4,570 MW are under development and scheduled to come online in the next five years. However, project development schedules in this area have been dampened by legal uncertainty in land lease contracts between private developers and communal land owners, in the area.



EURUS I wind farm © AMDEE

3. The northern coast on the Gulf of Mexico, the Bay of Campeche, States of Tamaulipas and Veracruz where a 161 MW project is planned to be built in 2011.
4. The Yucatán Peninsula, where considerable wind potential was identified at 50 and 80 meters.
5. The northern and central regions of Mexico in the states of Nuevo León, Coahuila, Chihuahua and Sonora, with lower capacity factors in the range of 20% to 30%.

The policy environment for renewable energy

Since the 1992 amendment of the "Electric Energy Public Service Law"¹, the private sector can 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 (the national utility) interconnection point and then be transported to the consumer. Under the IPP scheme, private producers with plants over 30 MW must sell their power to the CFE through long-term power purchase agreements (PPA).

The 2008 Energy Reform bill

In 2008, the Mexican government adopted an Energy Reform package, which included the Law for the Development of Renewable Energy and the Financing of the Energy Transition

¹ Ley del Servicio Público de Energía Eléctrica

TOTAL INSTALLED CAPACITY

year	2005	2006	2007	2008	2009	2010
MW	3	85	85	85	202	519

("Ley para el Aprovechamiento de Energías Renovables y el Financiamiento de la Transición Energética"- LAERFTE) to reduce the country's dependence on fossil fuels by fostering renewable energy development.

The bill put the Energy Ministry, 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, which also involves the private sector.

SENER was also charged with creating a "Special Program for the Use of Renewable Energy", setting the objective of increasing the share of non-hydro renewable energy in the total national installed generating capacity from 3.3% (1,900 MW) to reach 7.6% (4,500 MW) by 2012 and the share of non-hydro renewable power generation from 3.9% to 6.6%.

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 (USD 220 million) have been allocated for this on an annual basis from 2009 to 2011. However, this fund has been used more for energy efficiency programs than for renewable energy technologies.

During 2010, a series of new regulations were issued by SENER to strengthen the regulatory framework for renewable energy, including reductions in the transmission charges for private renewable energy developers. Also new models of interconnection contracts and agreements for renewable energy small scale projects have created new opportunities for larger investments.

Obstacles to wind power development

The Mexican wind energy industry still faces several obstacles. The regulatory framework is still incomplete and often unclear, the rules for the Renewable Energy Fund remain undefined, and there are no financial incentives for renewable energy development. While the current regulatory framework is suitable for sites with high capacity factors, as in the State of Oaxaca, most potential sites do not boast the same wind regime. For this reason, a change in the secondary regulation is needed.



La Mata-La Ventosa wind farm © AMDEE

Administrative procedures are often lengthy and cumbersome, and it is difficult to implement long-term contracts for land leasing. While the average time for the development of new projects has already come down from ten years to between three and five years, delays still occur in the complex cycle of permits, interconnection negotiations and problems with long-term land leasing.

In addition, transmission infrastructure in the windiest regions is insufficient and a new interconnection contract for lower wind class zones needs to be developed.

Also, more accurate wind resource assessments should be developed at both the regional and state levels.

Outlook for 2011 and beyond

In 2011, an additional 717.2 MW of wind projects are expected to become operational in Mexico, which would take the country's total installed capacity to more than 1,200 MW. Some 3,500 MW are in the pipeline for development in Oaxaca, Baja California and Tamaulipas in the next three to four years.

With input from the Mexican Wind Energy Association (AMDEE)

Morocco



Tetouan wind farm © ADEERE

Morocco relies on oil and coal imports for 95% of its energy needs, and its expanding economy drives an approximately 8% annual increase in electricity demand, which stood at about 25 TWh in 2009. The government is pursuing a strategy of developing renewable energy as well as liberalising the energy sector to ensure its energy security and diversify energy sources.

To date, Morocco's electricity is predominantly generated by oil (60%), followed by coal (23%) and gas (4%). Renewable energy sources (wind and hydro) contribute around 5% to the mix, while 8% of the electricity consumed is imported.

The government budget includes about EUR 4.4 bn for oil imports annually, and with growing electricity demand, which is projected to double by 2020, the bill for foreign oil is starting to impose a real burden on the national economy.

In a bid to alleviate the country's expensive dependence on energy imports and to improve energy security, in the 1980s the Moroccan government began promoting renewable energy, and the country is now one of the leading wind power nations in Northern Africa.

In 2010, 33 MW of new wind power capacity were installed in Morocco, taking the total up to 286 MW.

Wind power potential in Morocco

With 3,500 km of coast line 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 Laayoune, Dakhla, and Taza (with annual average wind speed between 7.5 and 9.5 m/s at 40 metres).

The total potential for wind power in Morocco was estimated at around 7,936 TWh per year, which would be equivalent to about 2,600 GW, by a study undertaken by CDER and GTZ in July 2007. However, the technical potential is set at around 4,896 TWh, or 1,600 GW.¹ This compares to a total electricity consumption of just 25 TWh in 2009.

Targets for renewable energy development

In 2020, the total installed electrical capacity in Morocco is projected to rise from the current 6,135 MW to reach 14,580 MW. The Moroccan government has set targets for renewable energy development, which, if implemented, would mean that renewable energy sources would represent 42% of the total installed capacity (2,000 MW each from

¹ CDER/GTZ : Etude sur le cadre organisationnel, institutionnel et organisationnel pour la promotion des énergies renouvelables au Maroc, 2007

TOTAL INSTALLED CAPACITY

year	2004	2005	2006	2007	2008	2009	2010
MW	54	64	64	124	134	253	286

wind, solar and hydro) and provide more than 20% of the country's total electricity consumption by 2020.

Half of the 2,000 MW of wind energy are planned to be installed by the national utility ONE, with the other half coming from private investment through the "EnergiPro" initiative, which encourages industrial players to reduce their production costs by producing their own energy with projects up to 50 MW. As part of this initiative, ONE guarantees access to the national grid, and the purchase of any excess electricity produced at an incentive tariff, with different tariffs for each project.

Support framework for wind energy

In January 2010, the Moroccan Parliament adopted new legislation for the promotion of renewable energy deployment. This included provisions for authorising electricity generation from renewable energy sources by companies other than the ONE (law 13-09), and the establishment of a new agency for renewable energy and energy efficiency (ADEREE) to replace the existing Renewable Energy Development Centre CDER (law 16-09).

Existing wind farms in Morocco

EL KOUDIA EL BAIDA (53.9 MW)

The first wind farm in Morocco was installed in 2000 with a capacity of 50.4 MW in El Koudia El Baida (Tlat Taghramt - Province of Tetouan), situated 17km from the town of Fnidek.

The initial project was carried out by the company CED (Compagnie Eolienne du Détroit, a subsidiary of French company Tholia) by installing 84 Vestas turbines of 600 kW each, which are connected to the national grid.

With average wind speeds of about 10 m/s (at 42 meters height), the annual production of the project is around 200 GWh, accounting for 1% of the national annual electricity consumption. An additional 3.5 MW were installed at the same site in 2001.

LAFARGE WIND FARM (32 MW)

Another project was carried out between 2005 and 2009 by the cement company Lafarge for the electricity supply of its factory near Tetouan.

The project started operations with 12 turbines of 850 kW each in September 2005. An additional 10 MW were added to this project in December 2008, and a further 12 MW in June 2009, bringing the capacity up to 32 MW, with a production of 115 GWh per year. Any excess power not consumed by the Lafarge factory is fed into the Moroccan grid.

AMOGDOUL WIND FARM (60 MW)

In April 2007, the Amogdoul wind farm came online, situated on Cap Sim south of Essaouira. The site is famous for its strong and regular winds with an average annual wind speed of 9.45 m/s at 40 metres. The 60 MW wind farm is composed of 71 Gamesa turbines of 850 kW and it was realised by the ONE. The estimated production is about 210 GWh/year.

TANGIER (140 MW)

In April 2009, 107 MW came online at a project at the sites of Allak, El Haoud and Beni Mejmél, near Tangier and Tetouan, and a further 33 MW were added to this in June 2010, bringing the total capacity of the project to 140 MW. The project is 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/year.

In total, at the end of 2010, Morocco's installed wind power capacity stood at 286 MW.

Market outlook for 2011

There is a strong pipeline of wind power projects currently under development in Morocco. This includes a 300 MW wind farm to be installed near Tarfaya, following an international call for tenders, which resulted in the selection of the energy company NAREVA to construct and operate the project. NAREVA is a company fully owned by Morocco's leading private equity industrial and financial group ONA.

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

With input from the Moroccan Agency for Renewable Energy and Energy Efficiency (ADEREE)

New Zealand

New Zealand's wind generation capacity has increased 12 fold in the last ten years. In late 2010, the wind industry reached a significant milestone when wind capacity surpassed 500 MW, and wind power now supplies over 4% of New Zealand's electricity.

The country's onshore wind resource alone is sufficient to meet total annual electricity demand several times over. The quality of this resource is such that New Zealand's wind farms operate at an average annual capacity factor of about 40%.

New Zealand is strong in other renewable resources as well, with hydro and geothermal currently supplying about 70% of generation, while only 26% comes from thermal energy (mainly gas).

Opportunities missed, but others to follow

2010 was a time of uncertainty in New Zealand's electricity sector. Factors including the ministerial review of the electricity industry that resulted in asset swaps between state-owned generators, weak electricity demand growth, a surplus of water in the hydro lakes and the global recession combined to create conditions unfavourable to investment in new electricity generation – wind or otherwise. As a result, despite the strong New Zealand dollar, New Zealand could not take advantage of lower turbine prices.

However, important progress was still made during 2010. Several wind farms are under construction and the wind industry is focussing on ensuring that a positive policy, regulatory and market framework is in place to enable wind's contribution to grow as and when new generation is required.

Installed capacity set to expand

Installed wind energy capacity stood at 506 MW at the end of 2010, up only 9 MW from 2009. A further 110 MW is under construction.

Meridian Energy and Trustpower operate the majority of New Zealand's wind capacity. Both companies are expanding their portfolios, with Meridian's Te Uku (64.4 MW) and Trustpower's Mahinerangi (36 MW) wind farms expected to be fully operational by mid 2011.

Strong activity in the assessment of potential sites confirms that wind energy is an important and viable long-term industry for New Zealand, and there are currently more wind projects proposed than any other form of generation, with potential wind farms ranging from a few MW to 600 MW in size.

In terms of equipment, global turbine manufacturers Vestas and Siemens dominate the New Zealand market.

Policy environment

There are no direct incentives for investment in renewable electricity generation in New Zealand. As a result New Zealand is leading the world in demonstrating that wind energy is a cost-effective and competitive source of electricity, with new wind farms competing successfully with other forms of generation without any form of subsidy – a unique global achievement.

Both the New Zealand government and the electricity sector are increasingly recognising the role that wind energy can play. In July 2010, the government released its draft New Zealand Energy Strategy for public consultation, and the final version is expected to be released during the first half of 2011. The draft strategy reinforces the existing target of 90% renewable electricity by 2025, and the role of wind and other renewables in providing a secure domestic energy supply. While the 90% target is aspirational rather than mandatory, it is set to influence the policy and regulatory environment.

One policy that could help achieve the country's renewable energy target is the Emissions Trading Scheme, which came into force during 2010, signalling that investors need to consider the cost of carbon emissions when making decisions about new generation. The scheme is currently being reviewed in light of global developments and the actions of New Zealand's trading partners. While the scheme is expected to continue, the review will influence the timing of New Zealand's transition to applying the full cost of carbon on emitters.

Following the ministerial review of the electricity market conducted by the government in 2009 and early 2010, the Electricity Authority replaced the Electricity Commission as the market regulator. The wind industry is looking to discuss with the authority how market design and system operations

TOTAL INSTALLED CAPACITY

year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
MW	36	36	36	168	168	171	322	326	497	506

need to evolve to ensure maximum benefit is obtained from wind generation. The impact of wind's variability on the electricity system will need to be managed as its penetration increases. But there is also the potential to explore how modern wind turbine technology can assist with system reliability and security in areas such as voltage and frequency support.

In October 2010, the government released its plans for reforming the Resource Management Act (RMA), the act under which planning permission is granted for wind farm development. The proposed reforms focus on urban and infrastructure development. In general, they should smooth the consent process for wind farms, and detailed policy proposals are expected to be released in mid 2011.

The new National Policy Statement on Renewable Electricity Generation (NPS) is expected to be released in early 2011. It will provide guidance for decision making under the RMA. The NPS accords greater significance to the benefits of renewable energy projects. It should result in more consistent assessment of proposed projects and decision making – a welcome outcome given the increasing requirements for assessing project effects placed on developers.

Obstacles for wind energy development

There are no incentives or support mechanisms for wind energy in New Zealand. This makes managing costs and optimising design and yield critical to the success of projects.

One area where costs have increased in recent years is the consent process. The New Zealand Wind Energy Association's wind farm Development Guidelines project, currently underway, should help to control costs in this area. The guidelines will provide a common and robust set of guidance for decision makers, industry, councils and other stakeholders, enabling the consistent and timely assessment of proposed wind farms. The guidelines are being funded by industry, and are expected to be complete by mid-2012.

Outlook for 2011 and beyond

With 110MW currently under construction, New Zealand's installed capacity will increase by nearly 25% in 2011 to reach 615MW.



Te Uku wind farm, Waikato © Meridian Energy

Market conditions make it difficult to predict the timing of further wind farm development. The economic slowdown has caused electricity demand to ease, reducing the immediate need for investment in new generation.

As the economy improves, demand is expected to grow. Limits to gas supply, geothermal and hydro resources and the price on carbon emissions will make wind energy increasingly attractive in the future. By 2030 wind could supply 20% of New Zealand's electricity.

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

Portugal



Cabeço Alto wind farm © Nordex Energy

Portugal is one of the leading countries in Europe in terms of wind power penetration, with 17.1% of its electricity demand covered by nearly 4,000 MW of installed wind power capacity in 2010.

According to the EU Renewable Energy Directive, Portugal is to increase its share of renewables in final energy consumption to 31% by 2020, up from 20.5% in 2005. In order to meet this target, the Portuguese government plans to increase wind power capacity to 6,875 MW by 2020.

Main market developments in 2010

In 2010, 345 MW of wind power were connected to the Portuguese electricity grid, spread over 21 new wind farms and taking the total installed capacity to 3,898 MW. Existing and planned wind farms are mainly concentrated in the northern part of the country.

The financial and economic crises, which have greatly affected Portugal, have had an important impact on the development of new wind projects. Project finance is more difficult to obtain, forcing companies to shift to corporate financing instruments. This effect is expected to be felt even more in the future and slow down market development for 2011 and beyond.

In terms of wind turbine manufacturers supplying the Portuguese market, Enercon dominates with nearly a 50% market share in 2010, followed by Vestas (16%), Gamesa (11%) and Nordex (10%).

The policy framework for wind power in Portugal

The first feed-in tariff for wind power was introduced in Portugal in 1999. The formula for calculating the feed-in tariff takes into account the avoided costs of investing in conventional power plants, the avoided costs of operating and maintaining a conventional power plant, avoided environmental costs in terms of CO₂ emissions, and the inflation rate.

In 2001, the feed-in tariff formula was adjusted by introducing a coefficient Z that affects the environmental savings differently for each technology. In 2005, new changes limited the feed-in-tariff to apply to only the first 33 GWh produced per each MW installed, or 15 years, whatever is reached first. Once this threshold has been reached, it is expected that operators will receive the market price. Wind farms licensed before 2005 receive today around EUR 94/MWh, but new onshore wind projects contracted in the 2005 tender only receive EUR 73/MWh. In addition, since 2001, 2.5% of the total revenue must be paid to the local municipality. Offshore wind power plants receive the same tariff, which is far below current electricity generation costs, and does not make offshore wind economically viable in Portugal.

Also in 2001, new legislation gave a further boost to the wind energy sector by defining a system to obtain grid access.

In 2005, a tender for 1,800 MW of wind power was released in three phases, but the construction of wind installations

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
MW	100	131	195	296	522	1,022	1,716	2,150	2,862	3,537	3,702

contracted in this tender only began in 2008 and will continue until 2014.

At the beginning of 2010, the Portuguese government issued a National Energy Strategy, which indicates a target of 8,500 MW of wind power by 2020, of which 500 MW would be offshore. However, the National Renewable Energy Action Plan (NREAP) as presented to the European Commission in accordance with the EU Renewables Directive included only 6,875 MW, with only 75 MW of offshore wind.

The implementation of the Large Hydro National Plan is expected to increase Portugal's pumped storage capacity, and thus reduce the limitations of wind production during off-peak hours, ensuring the economic feasibility of the installation of the new capacity.

In 2010, new legislation also simplified the procedure for installing additional equipment in existing wind farms and reviewed the respective tariffs. It is expected that 400 MW will be installed as a result of this regime. It also stipulated the obligation to install equipment in all wind generators to support voltage drops (fault ride-through).

New rules for the power transmission and distribution grids were also approved in 2010, changing the payment mechanism for injecting reactive power into the grid, introducing severe penalties if the amount of reactive power exceeds certain limits, and at the same time requiring the installation of more control equipment.

Outlook for 2011 and beyond

Portugal's NREAP mentions the government's intention to revise the support scheme for renewable energy. The economic crisis and pressure on electricity prices might lead to a cut in tariffs, which is expected to affect future wind projects.

In addition, with the increase in installed wind power capacity, excess production situations may occur in periods of lower consumption, which may require curtailment measures for wind farms. A procedure for the allocation of wind power under these circumstances and the remuneration of the affected power plants is starting to be discussed, and will be important in the future.



Lomba da Seixa wind farm © Nordex Energy

In order to reach the 6,800 MW of installed power outlined in the NREAP for 2020, approximately 1,000 MW still need to be permitted. These will be contracted by future competitive tenders, which are expected to attract bids with a considerably lower tariff than the official feed-in tariff. This already happened in the third phase of the last wind tender in 2005, for which the reference tariff was around EUR 73/MWh but the lowest bid was only EUR 56/MWh.

Long and complicated administrative and permitting procedures, and the intricate integration of renewable energy projects into spatial planning instruments, are other barriers that wind power developers need to face.

With input from the Portuguese Renewable Energy Association (APREN).

Romania

Romania's power generation mix is dominated by fossil fuels, which accounted for 46% of production in 2010, followed by hydro at 34%, and nuclear at 20%. The high share of hydro in 2010 was due to an unusually rainy year, and hydro's usual share is between 20–25% of the country's electricity mix. Although Romania has a strong potential for wind energy development, wind power to date only accounts for around 0.45% of the national electricity production.

Romania's 462 MW of operating wind farms are mainly located in Dobrogea, on the Black Sea coast, which boasts average wind speeds of 7m/s at 100m altitude. The region is flat and sparsely populated, allowing for the installation of a large number of wind turbines. Moldova and Caras Severin are two other regions in Romania with a large wind potential (see map).

WIND MAP FOR ROMANIA



Source: RWEAA

Wind capacity increases 33-fold in 2010

At the end of 2009, Romania had an installed wind capacity of just 14 MW. 2010 was an excellent year for Romania's wind sector, with installed capacity increasing 33-fold to reach 462 MW. Wind power produced around 280 GWh in 2010, but given the fact that most of the new installed capacity became operational only towards the end the year, a much higher production can be expected in 2011.

The Fantanele wind farm operated by Czech multinational CEZ started operations in August 2010, using 2.5 MW GE turbines. By the end of the year, 300 MW were operational, with another 37.5 MW to be added in 2011.

A 90 MW wind farm with 3 MW Vestas turbines and operated by EDP came online in November 2010, and was followed by a 30 MW Enel wind farm using 2 MW Gamesa turbines in December. The Monsson Alma 21.8 MW wind farm also became operational in 2010, as well as 6.2 MW from various smaller players.

Renewable energy targets in Romania

According to the EU Renewables Directive, Romania has to source 24% of its final energy demand from renewable sources by 2020, up from 17.8% in 2005. For electricity production, this means that renewables have to account for 38% of Romania's total power demand. Since hydro power alone will not meet this target, the contribution of other renewable energy sources is crucial.

Policy support for wind power in Romania

While the first incentives for wind power development were introduced in 2007, a major step came from the national law 220 to promote renewable energy production, introduced in November 2008. This legislation introduced a green certificates scheme for renewable electricity for a period of 15 years, as well as loan guarantees and tax exemptions for renewable energy investments.

The 2008 renewable energy law had three major consequences: first, it boosted investor interest in the Romanian wind power sector; second, it reiterated the choice of a green certificates scheme (rather than a feed-in tariff); and third, it fixed the value of a green certificate to a range of EUR 27 to EUR 55 per MWh (in addition to the wholesale price of EUR 35–40 per MWh).

In 2010, the Romanian renewable energy law was fundamentally amended in favour of renewable power producers. It reiterated the previous renewable energy target of 8.3% (excluding large hydro) for total gross electricity produced in Romania by 2010, and also introduced a 20% target for 2020. However, the share reached for renewable

TOTAL INSTALLED CAPACITY

year	2006	2007	2008	2009	2010
MW	3	8	11	14	462



Fantanele wind park © RWEA

electricity in 2010 was just 1.25%, including 0.45% for wind power.

The most important points of the amended law are:

- Wind power will receive two green certificates per MWh produced until 2017 and one certificate for the rest of the promotion scheme, which is set for 15 years. This encourages early deployment.
- The value of the green certificates is adjusted yearly, applying the inflation index of the EU-27 (approximately 2% per year) both for the cap and the floor
- The 2020 quota of renewable electricity (excluding large hydro) increased from 16.8% to 20%
- The penalties for suppliers for each non-procured certificate increased from EUR 70 to EUR 110
- A monitoring principle was inserted in the law, but it is as yet unclear how this will be used by the regulator, and if it will be beneficial for the wind industry.

In addition, the energy regulator has drafted secondary legislation, but this has not been adopted officially while the renewable energy law awaits approval from the European Commission. At the end of 2010, the Romanian authorities sent six pre-notifications to the Commission related to the approval of the law, and a positive decision is expected to be issued in April 2011 at the earliest.

Obstacles to wind power development in Romania

There are mainly two obstacles to wind development in Romania. The first obstacle is the unpredictable legal situation. While the law was enacted in 2008 and amended

in 2010, the amendment is still pending approval by the European Commission, which creates uncertainty and reluctance from both banks and producers to invest in renewable energy.

The second obstacle is the grid, especially in the wind rich region of Dobrogea, where current grid capacities could only integrate around 400 MW of wind power, which will already be met by existing and contracted wind farms. The grid in this region was designed 30-40 years ago and urgently needs to be upgraded in order to accommodate the growing wind power capacity and transport the electricity to the rest of the country.

Outlook for 2011 and beyond

In 2011, more than 3.5% of Romania's electricity demand will come from renewables, up from just 1.25% in 2010, with wind alone accounting for around 3%. In addition to the 452 MW of wind capacity currently operating, another 600-800 MW are expected to come online during 2011.

Depending on how the legal framework for renewable energy evolves in Romania, the Romanian Wind Energy Association predicts that 3,000-3,500 MW of wind power will be installed by 2013, and 6,000 MW by 2020. This optimism is grounded in a strong pipeline of approved projects, already at 4,632 MW at the end of 2010. This promising development sets Romania on the path to becoming one of the main wind power markets in Central and Eastern Europe.

*With input from the
Rumanian Wind Energy Association (RWEA)*

South Korea



Samdal wind farm, Jeju Province © KWEIA

Wind energy in South Korea is still in its infancy, but the Korean government has made "green growth" with low carbon emissions one of its priorities for national development. The existing feed-in tariff, which was too low to support wind power development, was recently replaced with a Renewable Portfolio Standard (RPS) scheme. In addition, several Korean heavy manufacturers have started to include wind turbines in their portfolios in order to compete both domestically and in the international marketplace.

Installed capacity increased from 5.9 MW at the end of 2000 to 379.3 MW at the end of 2010, with generation growing from 16.7 GWh to 812 GWh. With total power generation of 461.7 TWh in 2010, wind power accounted for just 0.176% of the total electrical power generation. The major electricity sources in Korea are nuclear (31.4%), coal (41.9%), and natural gas (21.2%).

The policy framework

In April 2010, the regulatory framework for renewable energy changed from a feed-in tariff scheme to an RPS scheme, effective from 2012. According to the new regulatory scheme the tariff for power generated by renewable energy sources

will result from the system marginal price plus a renewable energy certificate (REC), which aims to compensate for the higher capital cost of renewable energy. Wind farm operators will receive one REC per kWh of wind power produced, and two RECs for offshore wind farms. The current price of a REC is 40 won (EUR 2.6 cents / USD 3.5 cents). RECs have a 20 year life span, helping to create long-term investor certainty.

Under the RPS scheme, the 13 largest public and private utilities are required to purchase or to generate renewable energy as a share of their total generation, starting at 2% in 2012 and gradually increasing to 10% by 2022. According to the RPS target, and assuming that wind power will provide 70% of all renewable power, 2,390 MW should be built in 2012, and Korea's cumulative wind power capacity would reach 15,660 MW by 2022. However, it remains to be seen if this is achievable, and the Korean Wind Energy Industry Association has a more modest goal of 13.5 GW by 2025.

The Korean government is also aiming to improve the regulatory system by simplifying permitting processes, increasing possibilities for tax exemptions and providing easier access to the power grid, for both onshore and offshore wind farms

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
MW	6	8	13	18	68	99	178	196	236	349	379



The wind turbine manufacturing market

The Korean wind market has failed to take off to date partly due to the low feed-in tariff and partly due to public opposition. Recently, however, companies have come to realise the business opportunities in the wind power industry, which in turn has attracted increased investment.

Four Korean heavy industry companies have announced their intention to start manufacturing wind turbines using international technology:

- Hyundai Heavy Industry, with a production portfolio of 1.65 MW, 2 MW and 2.5 MW turbines for onshore and 5.5 MW turbines for offshore use;
- Samsung Heavy Industry with a production portfolio of 2.5 MW turbines for onshore and 5 MW or bigger for offshore;
- Daewoo, Shipbuilding & Marine Engineering, with a portfolio of 1.25 MW and 2 MW turbines and 6 MW or larger;
- STX with 2 MW and 7MW turbines.

Both Hyundai and Samsung already set up manufacturing facilities in 2010, and because of their extensive marine engineering experience are looking at partnerships or consortia with international wind turbine manufacturers.

In addition, several other indigenous manufacturers such as Hyosung, Doosan Heavy Industry, Hanjin and Unison have now developed their own wind turbine technology, and their models are currently undergoing testing or further development.

The Korean industry for wind turbine components is also flourishing, with companies supplying or planning to supply towers, blades, main shafts, generators, transformers, gearboxes, nacelle control systems and cables.

The small wind turbine manufacturing sector is also very active and aiming to provide equipment to small and island grid systems.

Offshore wind power in Korea

The Korean government has set an ambitious strategy for offshore wind power development, and has announced a strategy to attract investments worth USD 8.2 billion (EUR 5.8 billion) in developing offshore wind farms with a total capacity of 2.5 GW over the next nine years. The government is aiming to set up a private-public partnership (PPP) to install about 500 turbines off the country's west coast. Under this PPP, 100 MW of wind projects should be operational by 2013, a further 900 MW by 2016 and the final 1.5 GW by 2016.

In addition, local governments are promoting another 4.5 GW of offshore wind projects across the country.

Given these strategies, the Korea wind power industry has an aggressive target of reaching 23 GW of wind power by 2030, which would, with a production of around 50 TWh, provide around 10% of the country's total energy demand.

*With input from the
Korean Wind Energy Industry Association (KWEIA)*

Spain



© AEE

Main market developments in 2010

Despite the financial crisis, the Spanish wind market maintained a healthy pace of development and cumulative installed capacity grew by 7.9% in 2010. According to the Spanish Wind Energy Association (AEE), 1,516 MW of new capacity were added, bringing total installations up to 20,676 MW. Spain thereby remains Europe's largest annual market and home to the second highest total wind capacity after Germany. The leading region in Spain in terms of installed capacity is Castilla y León with almost 4,000 MW.

2010 was a windier year than average in Spain, and the country's wind farms generated 42.7 TWh of electricity, accounting for 16.6% of the national net power consumption. All renewable energy sources combined produced around 38% of Spain's electricity needs, with wind being the largest single contributor within the renewable energy mix.

The average size of the turbines installed during 2010 in Spain was above 2 MW, and the leading manufacturers supplying

the Spanish market are Gamesa, Vestas and Alstom Wind. The majority of Spanish wind farms are operated by Iberdrola Renovables, Acciona and EDP Renovables.

9 November 2010 – A record wind day in Spain

On 9 November 2010 at 2.46 pm, wind power production in Spain reached 14,962 MW. During one hour that afternoon, a record of more than 14,700 MWh of wind power were generated in Spain, covering 45% of the country's power demand, and the production for that day reached 315,258 MWh. This is 13.2% higher than the previous record of 278,507 MWh, registered on 4 May 2010.

During this windy time, in order to balance supply and demand, 1,498 MW of power was exported, while 1,951 MW were stored in pumped storage. This experience highlights the importance of being able to count upon robust international interconnections and the need to increase pumped storage power stations, thereby contributing to the safe integration of wind power into electricity grids.

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
MW	2,235	3,337	4,825	6,203	8,263	10,027	11,623	15,145	16,689	19,160	20,676

The policy environment for wind power in Spain

The Spanish feed-in tariff system was first introduced in 1997, and then amended in 2004, 2006, 2007 and 2010. The 2007 modification (Royal Decree 661/2007) introduced two alternative remuneration options for wind power:

- A regulated tariff, which is a fixed amount paid for each kWh of wind generated electricity;
- 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 the chosen formula or change to the other option.

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

Revision of the feed-in tariffs in 2010

After a two month negotiation, the wind power sector and the Spanish Ministry of Industry reached an agreement in July 2010 on the revision of the feed-in tariffs from 1 January 2011 to 1 January 2013.

According to the agreement that was finally approved in December 2010 (Royal Decree 1614), the reference premium for those wind farms which chose the premium option will be temporarily reduced by 35% (from 30.98 to 20.13 EUR/MWh). This reduction affects only installations covered by this option under the Royal Decree 661/2007. As a result, around 25% of the existing wind farms will receive a lower feed-in tariff if the sum of the market price plus the premium is above the threshold of 75.4 EUR/MWh.

The cut in the tariff is motivated by the need of the Ministry of Industry to reign-in the costs for the power sector, mainly following unexpectedly strong growth in the solar PV sector, which received a much higher feed-in tariff than wind.

The Royal Decree also includes a provision to limit the yearly hours of operation for wind power installations that can qualify for the feed-in tariff or premium. According to the legislation, when in a given year the average number of equivalent hours for the whole Spanish fleet of wind power installations is above 2,350 hours, those wind farms that have produced above 2,589 hours will only receive the market price for the hours above the limit. This has been repeatedly fought by the sector, as it creates an incentive for less efficient wind turbines.

The future of the Spanish wind power sector

At the end of June 2010, the Spanish Government sent its National Renewable Energy Action Plan (NREAP) to the European Commission, as it was required to do under the European Renewables Directive, in order to outline its strategy to achieve the binding target of reaching 20% of its final energy demand from renewables.

According to the Spanish NREAP, wind power will become the most important power technology in terms of installed capacity (29.6%) by 2020, with 38 GW of installed capacity, out of which 35 GW will be onshore and 3 GW offshore. Wind power would then provide 19.5% of national electricity demand, second only to natural gas (35.4%).

The figures in the NREAP came as a disappointment to the wind power sector, as the potential for 2020 had been estimated at 45 GW (40 GW on-shore and 5 GW offshore) by the Spanish wind power association (AEE) and the renewables association (APPA). However, given the economic problems that the country is experiencing, even the moderate objectives in the NREAP could prove difficult to achieve if the regulatory framework is not clear and sufficiently funded for the period from 2011 to 2020.

Therefore, the two Spanish associations believe that 2011 will be crucial for the establishment of the conditions that will lead the sector towards the 2020 objectives.

With input from the Spanish Wind Energy Association (Asociación Empresarial Eólica)

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 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 in 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 2010, 528 MW of new wind energy capacity was added in Turkey, bringing the total up to 1,329 MW. This represents a year-on-year growth rate of 66%. According to TEIAS (the state-owned transmission company and system operator) it is projected that up to 415.8 MW of wind projects might be added in 2011.

Recent years have seen the start of a wind energy boom in Turkey. Even before the groundbreaking tender in November 2007 (see below), EMRA had received applications for more than 6,300 MW worth of wind projects, more than half of which are still under evaluation today. To date, close to 3,000 MW of wind power projects have been licensed by EMRA.

Following the call for tender in November 2007, applications for 751 projects were received by EMRA in one day, totaling 78 GW. According to EMRA, all the projects have been considered and 695 of them are eligible for a license. Out of these, 616 (with a total installed capacity of 29,152 MW) will



Cesme Kores wind farm © Dost Energy

need to go through a tender process because they applied to concurrent areas, and TEIAS will hold a tender for each application area. Only 63 projects (with a total installed capacity of 1,378 MW) will not need to go through this process since they are stand-alone projects in their respective application areas.

Installed wind capacity is expected to grow at between 500-1,000 MW per year reaching more than 5 GW by 2015. Turkey hopes to install up to 20 GW by 2023, helping the country to source 30% of its electricity generation from renewable sources by that date. In order to reach this target, however, the transmission infrastructure will require substantial upgrades to allow such large scale developments to be connected to the power grid. This issue will need to be addressed in the near future.

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
MW	19	19	19	20	20	20	50	147	458	801	1,329

Players in the Turkish wind market

Currently the Turkish wind energy market is mostly dominated by local developers. Although large international companies such as CEZ, Verbund and EnBW announced and/or undertook plans for building their own wind energy capacity with local partners, these initiatives were small compared to their large thermal and hydro investments. The reluctance of international groups to invest in wind energy essentially stems from the lack of long term fixed price PPAs with viable buyers, but the recent privatization of distribution companies may change this situation.

Enercon continues to be the supplier with the largest market share, followed by Vestas, Nordex, GE and Suzlon. Vestas, however, leads in terms of cumulative installed capacity (30%), followed by Enercon (28%). New suppliers such as Gamesa and Alstom are also entering the market, and GE is considering local turbine manufacturing.

The policy environment for wind power in Turkey

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

Turkey has a target of increasing the country's installed wind power capacity to 20 GW by 2023. In order to boost the uptake of renewable energy, in May 2005 the Turkish government enacted its first Renewable Energy Law¹, 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, and in a 2010 amendment, this was converted to USD 7.3 cent/kWh.

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



Soma wind farm © Polat Energy

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 2010, a local content element was introduced to the Renewable Energy Law, which envisages an addition to the feed-in tariff of a maximum of USD 3.7 cent / kWh depending on how much locally produced content was used. Currently, local manufacturing of wind farm components is limited to blades and towers. It is anticipated that in the short term the local content element will not provide an additional incentive for new wind development.

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>

United Kingdom



Barrow wind farm © Centrica and DONG

The UK has long been regarded as one of the best places in Europe for wind energy development, and after a slow start, development over the last few years indicates that the UK has started to realise its wind power potential.

From January to December 2010, around 40 new wind farms came online, totalling 962 MW of additional capacity and taking the country's total installed wind power capacity to 5,204 MW. The pipeline of projects also looks healthy, with 2,506 MW under construction, 6,177 MW with consent and a further 9,202 MW in the planning system.

The majority of wind farms in the UK are located in Scotland (2,374 MW), in the North West (1,009 MW) and in Wales (530 MW). Scotland alone installed a third of all new wind power capacity in 2010 (376 MW).

In December 2010, figures compiled by the Department of Energy and Climate Change revealed that in the 3rd quarter of the year, the contribution from renewables to the UK's electricity supply was at an all time high, reaching 8.6%.

Leading the way in offshore wind

With 1,341 MW of installed capacity offshore, the UK continues to be the world's leading offshore wind market. A further 1,154 MW of offshore capacity are under construction, the majority of which may come online as early as 2011.

A milestone in 2010 was the opening of Thanet, the world's largest offshore wind farm with 300 MW and a 65 MW extension to Scotland's Crystal Rig onshore wind farm.

In October 2010, the offshore sector welcomed the government's decision to use a fund worth GBP 60 million (EUR 71 million / USD 97 million) to support the massive pipeline of offshore wind projects. This fund had been earmarked by the previous administration for vital upgrades to British port infrastructure. RenewableUK (formerly the British Wind Energy Association) had long campaigned for its retention, highlighting the potential for the creation of 70,000 new jobs as a result. The decision sent a very clear message to investors that the British government is committed to exploiting the country's massive wind resources.

Thanks to positive government signals, Siemens, General Electric and Gamesa committed to build manufacturing facilities for wind turbines in the UK. The announcements signal more than GBP 300 million (EUR 355 million / USD 484 million) in investment and this was closely followed by Mitsubishi announcing plans to invest up to GBP 100 million (EUR 188 million / USD 161 million) in an engineering facility in Scotland for research and development into offshore wind technology.

In January 2010, over 32 GW worth of sites were leased as part of Offshore Round 3 by the Crown Estate, the agency that manages the seabed on behalf of the government. This brought the total offshore development pipeline to a staggering 49 GW, which would translate into 150 TWh of electricity or just under half of today's UK power consumption.

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
MW	406	474	552	648	888	1,353	1,962	2,406	2,974	4,245	5,204

The Renewables Obligation

The UK's Renewables Obligation (RO) has been the main financial instrument for stimulating growth in renewable energy since April 2002. The RO requires power suppliers to derive a specified portion of the electricity they supply to customers from renewable sources. Eligible renewable generators receive Renewables Obligation Certificates (ROCs) for each MWh of electricity generated and these certificates can then be sold to power suppliers in order to meet their obligation. In 2010 the obligation on suppliers stood at 10.4% and during that year 2.3 million ROCs were issued for both offshore and onshore wind projects.

The UK's feed-in tariff for small renewable energy systems

In April 2010, the government introduced its long-awaited feed-in tariffs for renewable energy projects up to 5 MW, helping to stimulate a significant increase in domestic and small-scale deployment of renewable energy systems. The feed-in tariffs were set at 34.5 pence (EUR 41 cents / USD 56 cents) for installations smaller than 1.5 kW to 4.5 pence (EUR 5.3 cents / USD 7.3 cents) for installations of 1.5-5 MW. This has stimulated the installation of more than 14,000 small wind systems across the UK.

The Annual Energy Statement

In June 2010, the new government's Annual Energy Statement set out plans for energy and climate change policy, which represented a major step towards building long-term confidence in UK energy policy. The planned Renewables Delivery Plan will map out the path to delivering the UK's 2020 target of 15% of final energy consumption from renewable sources.

Other measures included a proposed review of energy regulator OFGEM and a commitment to improving grid access for renewables.

Electricity market reform

In December 2010, the UK government announced its decision to undertake an Electricity Market Reform (EMR), which is set to be the biggest shake-up of the electricity

market in decades and is intended to promote greater investment in energy infrastructure and encourage growth in low-carbon technologies. The consultation will focus on the introduction of a carbon floor price, an emissions performance standard and a capacity support mechanism.

There is some concern amongst wind industry players that as part of the consultation the government may look to move away from the Renewables Obligation scheme in order to stimulate all forms of low carbon energy, including nuclear power and carbon capture and storage, not just renewables. There is concern that dismantling the system may create a climate of uncertainty for investors causing a pause in the project pipeline. To date the RO has been responsible for bringing forward 20,000 MW of onshore wind applications and positioning the UK at the forefront of the global offshore wind industry.

Obstacles for wind power development in the UK

The current UK government came to power with a pledge to be the greenest government ever and whilst this sentiment is applauded, the industry remains deeply concerned by the impact of some of the government's legislative plans for the years ahead.

The Localism Bill, published at the end of 2010, includes some proposals that could be challenging for the onshore wind sector, such as plans for local referendums, neighbourhood planning, pre-application consultation, the abolition of regional spatial strategies and a community infrastructure levy.

Public opposition to wind farms in the UK certainly remains a key issue for renewable energy developers despite countless surveys indicating high levels of support for wind farms from the general public. Unfortunately the small minority of anti-wind farm campaigners continue to have a strong public voice, especially in certain sections of the UK media. A report released in October 2010 revealed that over the previous 12 month period there had been a 50% drop in planning approvals in England, partly attributed to increasing local objections.

With input from RenewableUK

United States

Slowdown in US market in 2010

The US wind industry installed 5,115 MW of wind power in 2010, a number that would represent a major accomplishment just a few years ago, but which is barely half of 2009's record pace. Prior to 2010, the US industry went through an unprecedented period of growth supported by more predictable federal tax policies. It culminated in 2009, when the industry set a domestic record for new installations, with over 10,000 MW deployed that year.

The story of 2010 was quite different. At the end of the year, total capacity stood at 40,180 MW, and the US was surpassed by China as the country with the largest installed wind capacity.

Costs for wind power installations in the US have dropped over the past two years, with power purchase agreements being signed in the range of USD 5 to 6 cents (EUR 3.7 to 4.4 cents) per kWh recently, making wind competitive with new natural gas fired power plants.

Wind power generation now in 38 US states

38 states now have utility-scale wind projects, and 14 states have now installed more than 1,000 MW of wind power.

The top five states for cumulative wind energy capacity at the end of 2010 were Texas (with 10,085 MW installed), Iowa (3,675 MW), California (3,177 MW), Minnesota (2,192 MW), Oregon and Washington state (both 2,104 MW). All these states have ambitious renewable energy targets in place, and some of them now generate considerable shares of their electricity needs from wind power. In Iowa, for example, wind power provides close to 20% of the total power consumption, while Texas now generates 7.8% of its electricity with wind, more than in Germany.

Other US states active in pursuing targets for renewable energy during 2010 were Illinois (498 MW added in 2010), California (455 MW), South Dakota (396 MW) and Minnesota (396 MW). Other states, such as Delaware, Maryland, Idaho, South Dakota and Arizona, got a late start in wind power development but are now growing rapidly.

The wind industry in the US

The US manufacturing sector, meanwhile, appears to view 2010's slowdown as short-term. In spite of slower project activity, new component suppliers continued to enter the wind energy industry in 2010. Domestic content in US-deployed turbines stands at around 50%, and over 400 US manufacturing plants now serve the industry, with ample capacity to fuel another acceleration of the US industry in 2011. The US wind industry employs around 85,000 "green collar" workers.

20% of US electricity from wind in 2030

Wind energy now is generating around 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 2030¹. A more recent analysis of wind integration in the eastern region of the US drew similar conclusions.²

The policy environment in the US

The US wind industry has frequently been characterized by up-down cycles, largely because of the lack of consistent policy. The Production Tax Credit (PTC), which has been the key support mechanism for renewable energy development at the national level, has been allowed to expire several times, leaving investors uncertain about the future of the sector.

In February 2009, however, 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 slow economic climate. Measures included a three-year extension of the PTC through to 2012 and an option to elect a 30% Investment Tax Credit (ITC) in place of the PTC. In the final days of the last Congress, in December 2010, the ITC was extended by a further year, to the end of 2011.

¹ www.20percentwind.org

² NREL 2010: Eastern Wind Integration and Transmission Study <http://www.nrel.gov/wind/systemsintegration/ewits.html>

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
MW	2,578	4,275	4,685	6,372	6,725	9,149	11,575	16,824	25,237	35,086	40,180



Horse Hollow wind farm, Texas © Wind Power Works

The US wind industry has long called for a national Renewable Energy Standard to provide long-term investor confidence in the sector, but a draft law was not approved by the Senate in 2010, and its future now looks uncertain.

While uncertainty over national policies continues to hamper development, targets for renewable energy in 29 of the 50 states continue to drive wind installations in many regions.

Outlook for 2011 and beyond

Multiple factors contribute to a more favorable outlook for wind energy growth in the US in 2011.

The sector finished 2010 with a strong fourth quarter with 3,195 MW of new installations, and entered the new year with over 5,600 MW under construction. This is above construction activity at the same time in 2009, and given such indicators, the industry could finish 2011 well ahead of 2010 numbers.

Secondly, wind power generation is now cost-competitive with natural gas for new electric generation in the US, which motivates utilities to lock in more wind power at favorable long-term rates.

Thirdly, the industry enters 2011 with the benefit of the extension of the ITC. New wind power projects are expected to start operations in time to meet the new construction deadline for the tax credit, which is now set to expire at the end of 2011. The alternative PTC currently extends through 2012.

The US wind industry continues to call for a strong federal energy policy to drive renewable energy development, and at the same time works on defending and improving renewable energy targets at the state level. In addition, AWEA promotes other sources of demand, such as more distributed and community wind projects and corporate purchasing.

With input from the American Wind Energy Association (AWEA)

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:

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