GLOBAL WIND **2008** REPORT

WIND POWER WORKS

GWEC
GLOBAL WIND ENERGY COUNCIL

TABLE OF CONTENTS

Foreword

Early in 2008, when we celebrated the 100 GW mark in total global installed wind energy capacity; we felt we were on our way to another good year. In fact, we had little idea how dramatic the second half of the year would be.

First, the good news: due to stunning growth in the US and Chinese markets, the industry exceeded all expectations to end up with an annual market of more than 27 GW, bringing the global to more than 120 GW. The sector now employs more than 400,000 workers around the world and the value of new power generation equipment installed in 2008 exceeded €36 billion (nearly $US 50 billion).

The US installed a record 8.4 GW, catapulting it past Germany to the number one spot in terms of global installed capacity, and creating 35,000 new jobs in the process. In China, installed capacity doubled again – for the fourth year in a row – to reach a total of more than 12 GW, and the country will soon challenge the US for the top spot.

Europe's industry continues to broaden and deepen, and although in 2008 it was still led by perennial market leaders Germany and Spain, there are now ten countries on the continent with more than 1,000 MW of installed capacity.

Already during the first half of 2008, as the price of crude oil climbed steadily towards $US 150/barrel, there was growing unease over the mess in the financial sector. As the financial crisis started to spill over into the 'real' economy, credit started to tighten. By the time banks started falling like dominoes in the autumn, it became very difficult for anyone to get financing for any new projects, including for wind power. Newspaper headlines started predicting the collapse of the renewable energy boom, and those companies exposed to public markets have had a rough ride in the past few months.

There is no doubt that 2009 (at least) is going to be a tough year as we continue to wait for the bottom of the economic downturn and as governments seek to shore up the fundamentals in the banking sector.

The medium and long-term outlooks, however, remain positive. All of the fundamental drivers that have made wind power the technology of choice for those seeking to build a secure, clean energy future are still in place. Wind power is clean, indigenous, fast to deploy, creates many jobs, uses virtually no water and is economically competitive. Neither the threat of climate change nor the macroeconomic insecurity due to reliance on imported fossil fuel is going to go away because of a recession.

The governments of China, the US and the EU seem to agree with this assessment, as their recent stimulus packages all emphasize the development of renewable energy in general, and wind power in particular. The Chinese wind industry, at least, continues to power ahead, largely unaffected by the financial crisis. In Europe, the legally binding target of 20% of final energy consumption from renewable energy by 2020 will keep the focus on wind energy. The big question mark is the US, as President Obama seeks to fix the banking sector and stimulate the flagging economy while tackling energy security and climate change (and unfortunately, those are not his only big problems). Good luck to him.

Finally, we did it again: we significantly underestimated the size of the 2008 wind power market. Last year at this time, we predicted a global market of about 23 GW, but the reality was 17% higher – at 27 GW. Let's hope we have the same surprise this time next year!

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

Arthouros Zervos
Chairman
Global Wind Energy Council

Steve Sawyer
Secretary General
Global Wind Energy Council

The Road to Copenhagen

The first commitment period of the Kyoto Protocol is coming to an end in 2012. While this agreement is not perfect, it is the only international policy tool we have to curb carbon emissions and combat climate change, and reaching an agreement for the period post-2012 is essential.

In Bali in 2007, governments agreed to negotiate a follow-up climate deal by the time the UNFCCC conference takes place in Copenhagen in December 2009. However, the last 14 months have seen little progress, and there is now pressure to meet the December deadline.

Danish authorities expect up to 18,000 people in Copenhagen for two weeks. In addition to the negotiators, this includes Heads of State and Government; Environment, Energy and Finance Ministers; thousands of reporters from outlets around the world and advocates representing business and industry, environmental groups, research NGOs, trade unions and indigenous people's groups. In the midst of this, officials are supposed to come up with a comprehensive agreement to set the global economy on a path to a sustainable future.

Even in this time of financial crisis and economic downturn, the climate issue remains high on the agenda. Everyone with a stake in this issue is geared up for a punishing schedule of workshops, seminars and at least four sets of formal negotiating sessions between March and December. The wind power industry has mounted the Wind Power Works[1] campaign during this 'Year of the Climate', to highlight the key role of wind power in meeting greenhouse gas emission reduction targets.

As outlined in GWEC's Global Wind Energy Outlook 2008,[2] wind power is on track to supply 10-12% of global electricity demand by 2020, reducing CO2 emissions by 1.5 billion tonnes per year, far more than any other power

1 See http://www.windpowerworks.net

2 See http://www.gwec.net/index.php?id=92

sector technology. It will help revitalise our economies, and create millions of jobs in the process. But this will not happen by itself.

Climate change is a difficult problem to come to grips with because of the time scales involved. The discourse is generally in terms of the projected impacts for the coming decades, centuries, or even millennia of increasing temperatures, rising sea levels, heat waves, droughts, reduced crop yields and species extinction. But urgent action must be taken immediately to head off the worst impacts, and governments must get ready for urgent action to address fundamental, long term structural changes to the global economy.

The one clear message from the IPCC's 4th Assessment Report is that if we are to have any chance of avoiding the worst and irreversible damages of climate change, then global greenhouse gas emissions must peak and begin to decline before 2020. Unfortunately, it also means that the climate situation is going to get a lot worse before it starts getting better.

The UNFCCC is the only international forum that, even if somewhat indirectly, discusses the future of energy and the role that renewable energy can and must play in that future. While energy experts and policy makers have come a long way to understand the importance of renewables, climate policy makers still need convincing.

Unfortunately, most of the input in the climate discussions comes from the conventional energy sector, looking not only to protect its own existing interests and save the status quo, but to carve out a future niche for itself with yet unproven technologies such as carbon capture and storage. The wind energy sector has a massive challenge at hand to counteract lobbying efforts of this kind.

What matters to the wind industry?

The wind industry has a direct stake in three specific issues in the climate negotiations.

Targets – The emission reduction targets for industrialised countries under consideration (minus 25-40% in 2020 compared with 1990 levels) are much greater than those under the Kyoto Protocol's first commitment period. If targets in this range are agreed and enforced, this will have an immediate impact on the framework conditions of the wind sector.

Firstly, the price of carbon will rise substantially and drive energy investment decisions. We are already beginning to see this as a result of the modest targets agreed by the EU, most clearly in the recent decision by a major German utility to cancel a series of new coal-fired power plants in the wake of the EU's landmark '20/20/20' decision agreed in December 2008. Under the new emissions trading rules where electricity producers need to buy emission reduction credits at auction to compensate for their emissions, the price risk of new coal-fired generation capacity was deemed too high.

We have also seen plans for dozens of new coal-fired power plants cancelled in the US, merely in the anticipation of a price for carbon. With a new climate agreement in place, this trickle should turn into a flood.

In reality, reaching an international agreement on substantial targets will be hard. Although negotiators in Bali agreed to negotiate in the 25-40% reduction range, only the EU has to date agreed to a 20% cut by 2020 (to be increased to 30% as part of a new international agreement), and to sourcing 20% of its final energy demand from renewable sources by the same date.

Australia has announced very disappointing national targets – 4% below 1990 levels (5% below 2000 levels) by 2020.

In the US, President Obama pledged to return the country to 1990 levels by 2020, which would mean an approximately 16% reduction below today's levels. This may be ambitious given the recent history of the US, but nowhere near enough.

Denmark, Horns Rev II, North Sea (Photo: Wind Power Works)

Japan, Canada and Russia, the other notable players among industrialized countries, have yet to lay their cards on the table.

The flexible mechanisms – The Kyoto Protocol's Clean Development Mechanism (CDM) has already had a substantial impact on wind energy development in China and India. The CDM also impacts to a lesser extent other developing countries, and income from Certified Emission Reductions (CERs) can make a substantial contribution to a project's profitability. There are more than 25,000 MW of wind power projects currently in the CDM pipeline[3].

Wind CDM projects

COUNTRY	PROJECTS	MW
India	270	5,072
China	314	16,977
Mexico	12	1,272
Brazil	11	687
South Korea	11	317
Cyprus	4	207
Dominican Republic	3	173
Egypt	3	285
Philippines	2	73
Morocco	2	70
Costa Rica	2	69
Nicaragua	2	60
Panama	1	81
Mongolia	1	50
Jamaica	1	21
Colombia	1	20
Israel	1	12
Argentina	1	11
Chile	3	73
Vietnam	1	30
Ecuador	1	2
Total	647	25,560

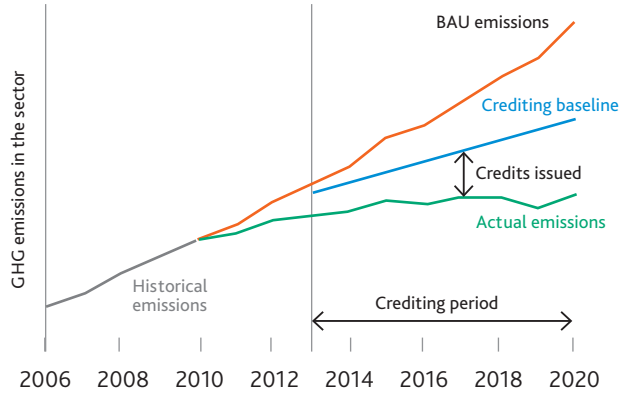
(Source: UNDP Risoe Center CDM pipeline. Updated on 1st Feb.2009)

While this unique mechanism has made a good start, it can and must be expanded and improved, creating the conditions for wind energy and other clean development in a much broader range of developing and emerging economy markets.

To achieve this, GWEC is arguing in favour of a Sectoral Crediting Mechanism which would provide a much broader means for industrialising countries to use the carbon markets and private finance to decarbonise their power sectors. For developing countries, preliminary analysis has shown that such a mechanism could leverage hundreds of billions of dollars for clean energy investment in the developing world between now and 2020, and result in emissions reductions of many hundreds of millions of tons.

3 See http://www.cdmpipline.org

The basic concept for the sectoral mechanism is quite simple[4]:



- define a voluntary 'no regrets' target on the basis of national efforts with some assistance from international funding for the electricity sector in a given industrialising country; the target would be 'no regrets' in the sense that there would be no penalty for not reaching the target.
- any reductions *below* the 'no regrets' target would generate tradable credits;
- technology cooperation and other funding could be utilised to create the conditions which would facilitate both domestic and international capital investments in clean energy technologies.

Technology transfer **–** The discussion surrounding technology transfer has been going on in various UN forums for 20 years, but has been largely abstract. Discussion was based on the notion that a) governments owned technology; and b) they would give it away; and c) that there is some theoretical model from which a mechanism could be derived to achieve this.

There is some indication that this discussion might now be changing. But there is a fundamental confusion between the relative roles of public and private sector which needs to be overcome before the UN system can come up with anything that will be useful in the real world.

4 For more information, see GWEC's submission to the UNFCCC at http://unfccc.int/resource/docs/2008/smsn/ngo/087.pdf

New Zealand, Hau Nui wind farm (Photo: Genesis Energy)

The aim must be to reach an agreement that works to support the rapid and widest possible diffusion of existing renewable energy and energy efficiency technologies, as well as adaptation technologies.

Some say that reaching robust agreements in all four pillars laid out in the Bali Roadmap (mitigation, adaptation, technology and finance) is too much to achieve in time for Copenhagen, and there is indeed a lot of work ahead in the next nine months.

But with the right political leadership it can be done. For the first time in a very long time, there is hope in the US, as the new Congress and President Obama turn their attention to domestic greenhouse gas emission reduction legislation, the *sine qua non* for engagement by the US in the international negotiations. With the US on board, anything is possible.

Whatever the outcome in Copenhagen, we are at a crossroads in relation to our energy future, the design of which will be fundamental to the future of the wind energy industry. Policy makers have the choice between the path of sustainability, energy security, clean air and water, which would strengthen our economies and reduce our dangerous dependence on imported fuels, or they can continue our disastrous business as usual.

The future of our planet depends on making the right choice, and the wind industry stands ready to play its part in a sustainable energy future.

The status of global wind power in 2008

USA, Horse Hollow wind farm (Photo: Wind Power Works)

US and China in race to the top of global wind industry

In another record year for new installations, global wind energy capacity surged by 28.8% in 2008. The US passed Germany to become the number one market in wind power, and China's total capacity doubled for the fourth year in a row.

The world's total installed capacity reached 120.8 GW at the end of 2008, over 27 GW of which came online in 2008 alone, representing a 36% growth rate in the annual market. These figures show that there is huge and growing global demand for emissions-free wind power, which can be installed quickly, virtually everywhere in the world.

Wind energy has become an important player in the world's energy markets, with the 2008 market for turbine installations worth about € 36.5 billion. The wind industry also creates many new jobs; over 400,000 people are now employed in this industry, and that number is expected to be in the millions in the near future.

Wind energy is the only power generation technology that can deliver the necessary cuts in CO_2 emissions from the power sector in the critical period up to 2020, when greenhouse gas emissions must peak and begin to decline if we are to have any hope of avoiding the worst impacts of climate change. The 120.8 GW of global wind capacity installed by the end of 2008 will produce 260 TWh of electricity and save 158 million tons of CO_2 every year.

Three regions are continuing to drive global wind development: North America, Europe and Asia, with the majority of 2008's new installations evenly distributed between them.

Record breaking performance of US market

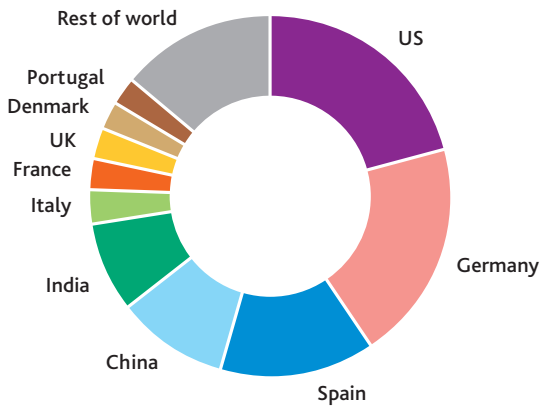
In North America, the **US** market broke all previous records with new installations of 8.5 GW, reaching a total installed capacity of over 25 GW. In 2008 the US was the number one market both in terms of new capacity and in terms of total wind generation capacity. The massive growth in the US wind market in 2008 increased the country's total wind power generating capacity by half. The new wind projects completed in 2008 accounted for about 42% of the entire new power producing capacity added in the US last year, and created 35,000 new jobs, bringing the total employed in the sector up to 85,000.

At year's end, however, financing for new projects and new orders for turbines and components slowed as the financial crisis began to hit the wind sector, taking a serious toll on financing available for new projects. This in turn is dampening orders for new turbines, with repercussions throughout the supply chain.

Looking ahead, in spite of the concerns about the financial crisis and its spillover into the real economy, the wind industry continues to be in a strong strategic position. All of the fundamental drivers behind its growth remain in place. In 2008, the US Department of Energy released a ground-breaking report, finding that wind power could provide 20% of US electricity by 2030. With the wind energy industry's strong performance in 2008 and the support of the new Obama Administration, the industry is in a position to turn this scenario into reality, or even surpass it.

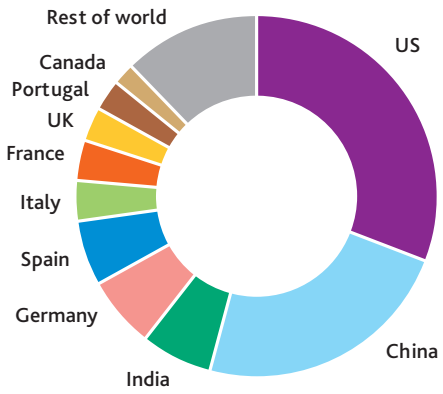
Canada in 2008 surpassed the 2 GW mark for installed wind energy capacity, ending the year with 2.4 GW. Canada's wind farms now produce enough power to meet almost 1% of Canada's total electricity demand.

TOP 10 TOTAL INSTALLED CAPACITY 2008



	MW	%
USA	25,170	20.8
Germany	23,903	19.8
Spain	16,754	13.9
China	12,210	10.1
India	9,645	8.0
Italy	3,736	3.1
France	3,404	2.8
UK	3,241	2.7
Denmark	3,180	2.6
Portugal	2,862	2.4
Rest of world	16,693	13.8
Total top 10	**104,104**	**86.2**
World total	**120,798**	**100.0**

TOP 10 NEW CAPACITY 2008



	MW	%
USA	8,358	30.9
China	6,300	23.3
India	1,800	6.7
Germany	1,665	6.2
Spain	1,609	5.9
Italy	1,010	3.7
France	950	3.5
UK	836	3.1
Portugal	712	2.6
Canada	526	1.9
Rest of world	3,285	12.2
Total top 10	**23,766**	**87.8**
World total	**27,051**	**100.0**

2008 was Canada's second best ever year for new wind energy installations with ten new wind farms coming online, representing 526 MW of installed wind energy capacity. Included in this total were the first wind farms in the provinces of New Brunswick, Newfoundland and Labrador. In British Columbia, the only Canadian province without a wind farm, construction began on the first wind farm with completion expected in early 2009.

China doubles its wind capacity, driving growth in Asia

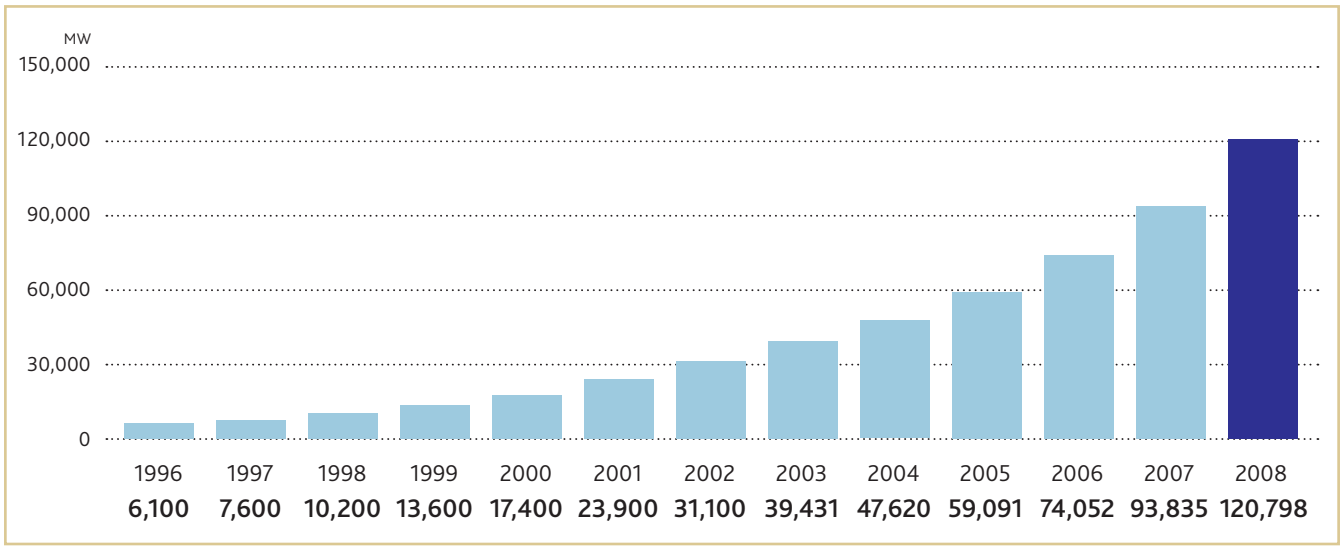
The growth in Asian markets has been breathtaking, as nearly a third of the 8.6 GW installed in 2008 was installed in Asia.

China continued its spectacular growth in 2008, once again doubling its installed capacity by adding about 6.3 GW, to reach a total of 12.2 GW.

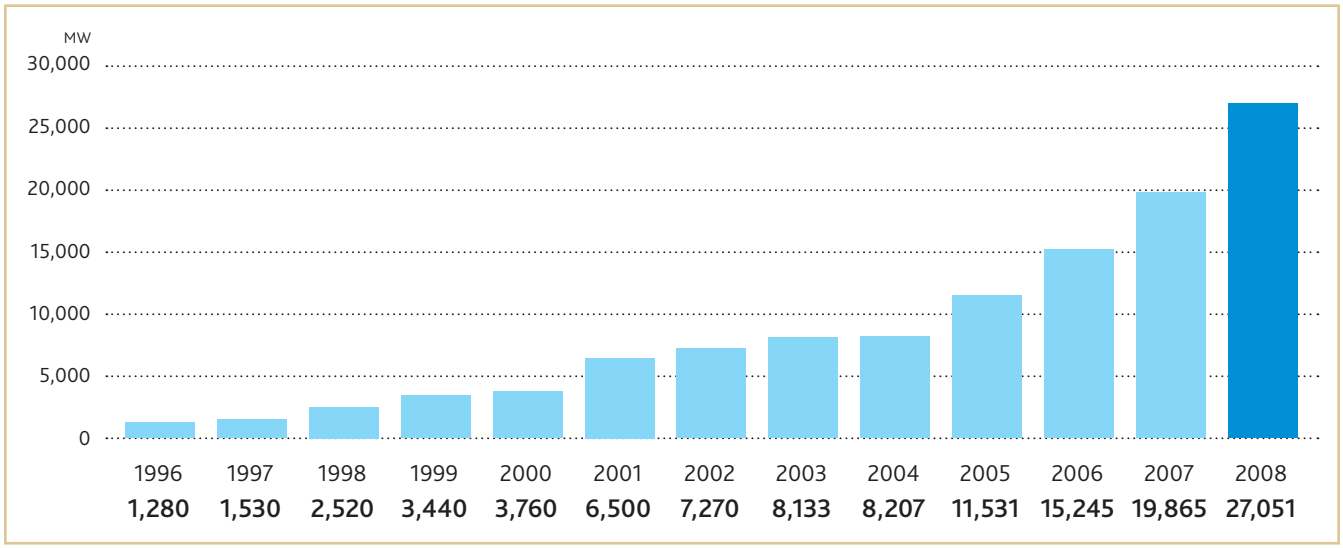
The prospects for future growth in the Chinese market are very good. In response to the financial crisis, the Chinese government has identified the development of wind energy as one of the key economic growth areas, and in 2009, new installed capacity is expected to nearly double again. At this rate, China is on its way to overtake Germany and Spain to reach second place in terms of total wind power capacity in 2010. This means that China would have met its 2020 target of 30 GW ten years ahead of time.

The growing wind power market in China has also encouraged domestic production of wind turbines and components, and the Chinese manufacturing industry is becoming increasingly mature, stretching over the whole supply chain. According to the Chinese Renewable Energy Industry Association (CREIA), the supply is starting to not only satisfy domestic demand, but also meet international needs, especially for components. In 2009, Chinese

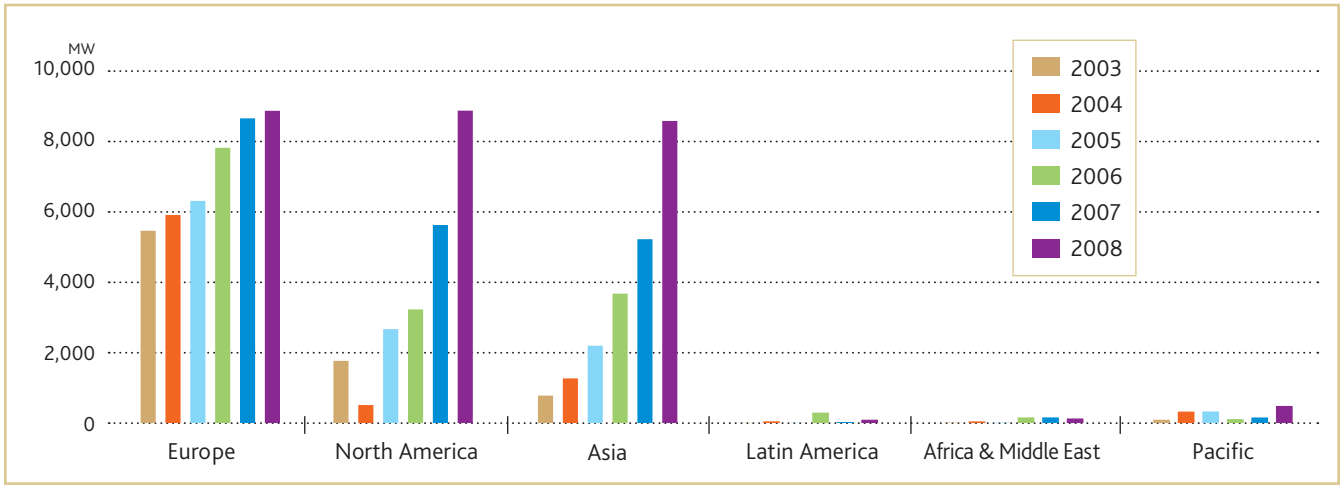
GLOBAL CUMULATIVE INSTALLED CAPACITY 1996-2008



GLOBAL ANNUAL INSTALLED CAPACITY 1996-2008



ANNUAL INSTALLED CAPACITY BY REGION 2003-2008



companies are set to start entering the UK and Japanese markets. There are also ambitions for exploring the US market in the coming years.

In 2008, the newly-established National Energy Bureau established wind energy as a priority for diversifying China's energy mix away from coal, and it implemented the 10 GW-Size Wind Base Program (Wind Base) in order to achieve this. The bureau selected six locations for Wind Base projects; Xinjiang, Inner Mongolia, Gansu, Hebei and Jiangsu. The objective is to install of 10 GW or more of new wind generating capacity by 2020 on each of these Wind Base sites.

India is continuing its steady growth, with 1,800 MW of wind energy capacity added in 2008, bringing the total up to 9.6 GW. The leading wind producing state in India is Tamil Nadu, which hosts over 4 GW of installed capacity, followed by Maharashtra with 1.8 GW and Gujarat with 1.4 GW.

Other Asian countries with new capacity additions in 2008 include **Japan** (346 MW, taking the total to 1.9 GW), **Taiwan** (81 MW for a total of 358 MW) and **South Korea** (43 MW for a total of 236 MW).

Wind is the fastest growing power technology in Europe

Although Europe was home to only one third of the world's new installed capacity in 2008, the European market continues its steady growth, and wind power is now the fastest growing power generation technology in the EU. Indeed, more than 35% of all new energy installations in 2008 were wind power, which meant that renewable energy accounted for more than half of all new power generation capacity in the EU.[1]

Overall, almost 8.9.GW of new wind turbines brought European wind power generation capacity up to nearly 66 GW. There is now clear diversification of the European market, relying less and less on the traditional wind markets of Germany, Spain and Denmark. 2008 saw a much more balanced expansion, with a 'second wave' led by Italy, France and the UK. Ten of the EU's 27 member states now have more than 1 GW of wind power capacity.

In 2008 the European wind turbine market was worth €11 billion. The entire wind fleet will produce 142 TWh of electricity, or about 4.2% of EU demand in an average wind year. This will save about 100m tons of CO_2 each year.

While at the global level, **Germany** has been surpassed by the US, it continues to be Europe's leading market, both in terms of new and total installed capacity. Over 1.6 GW of new capacity was installed in 2008, bringing the total up to nearly 24 GW.

Wind energy is continuing to play an important role in Germany's energy mix. In 2008, 40.4 TWh of wind power were generated, representing 7.5% of the country's net electricity consumption. In economic terms too, wind power has become a serious player in Germany, and the sector now employs close to 100,000 people.

Spain is Europe's second largest market, and has seen growth in line with previous years (with the exception of 2007, when regulatory change brought about a higher than usual amount of new wind capacity). In 2008, 1.6 GW of new generating equipment was added to the Spanish wind fleet, bringing the total up to 16.8 GW. This development confirms Spain as a steadily growing market, which at this rate is likely to reach the government's 2010 target of 20 GW of installed wind capacity. In 2008, wind energy generated more than 31,000 GWh, covering more than 11% of the country's electricity demand.

One noteworthy newcomer among the growing European markets in 2008 was **Italy**, which experienced a significant leap in wind power capacity. Over 1,000 MW of new wind turbines came on line in 2008, bringing total installed capacity up to 3.7 GW. At the end of 2008, the Italian government passed an important decree that resolves many of the main problems related to the value of green certificates. This measure is designed to avoid speculative fluctuations in the price of green certificates that negatively affected the Italian market in the past.

France is also continuing to see strong growth, after progressing steadily in recent years. In 2000, France had

1 This includes a preliminary figure for solar PV installations of 4.2 GW for 2008 (source: EPIA).

only 30 MW of wind generating capacity, mostly small wind turbines in the French overseas territories. At the end of 2008, the total installed capacity stood at 3.4 GW, representing an annual growth rate of 38%. Wind power is now France's fastest growing energy source; in 2008, around 60% of all new power generation capacity in France was wind energy.

The biggest potential in the coming years is estimated to be in the north and the north east of the country. Out of 4,000 MW of approved wind power projects, more than 700 MW are in the region Champagne-Ardennes and 500 MW is in Picardy.

Latin America: only Brazil installs new wind capacity

The Latin American market, despite the tremendous wind resources in the region, saw only slow growth in 2008. The only country installing substantial new capacity was **Brazil**, which added 94 MW of wind energy across five wind farms, mostly located in Ceará in the north east of the country.

Brazil's PROINFA program was initially passed in 2002 in order to stimulate the addition of over 1,400 MW of wind energy capacity and other renewable sources. The first stage was supposed to finish in 2008, but it has now been extended. Although substantial installations are expected this year, it is unlikely to achieve the overall goal. The Brazilian government is now looking at establishing an auctioning scheme to increase the country's wind capacity, and a first auction is expected in late 2009.

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

Australia is back on wind energy radar

After several years of stagnation in **Australia's** wind market, the speed of development picked up again in 2008, with 482 MW of new installations, a 58% leap in terms of total installed capacity. Australia is now home to 50 wind farms, with a total capacity of 1.3 GW. Six additional projects totalling 555 MW are currently under construction and

France, Fauquembergues wind farm (Photo: Régis Lombart)

expected to become operational in 2009. At the end of 2008, Australia's new labour government expanded the country's Renewable Energy Target (RET) from 9,500 GWh by 2010 to 45,000 GWh by 2020. While this development was much applauded by the renewables sector, a simultaneously released White Paper set a very low target for cutting the country's CO_2 emissions. The target aims to cut emissions by a mere 4% by 2020 and sets a carbon price cap at $ 40 AUD (€ 20) per ton. Critics of this scheme fear that this undermines the government's renewable energy targets and damages investor confidence.

130 MW installed in Africa and Middle East

In North Africa, the expansion of wind power continues in **Egypt**, **Morocco** and **Tunisia**, with 55 MW, 10 MW and 34 MW of new capacity installed respectively. In the Middle East, Iran installed 17 MW of new capacity. The total for Africa and the Middle East now stands at 669 MW.

Wind energy must be key climate change solution

The global wind industry has set itself a target of displacing 1.5 billion tons of CO_2 emissions per year by 2020, amounting to a total of 10 billion tons saved in this period.

While developments in 2008 show that the sector is on track to meet this target, a strong signal from national governments is needed to show that they are serious about moving away from fossil fuels and protecting the climate. A new global climate change agreement needs to come out of the COP 15 meeting in Copenhagen in December 2009. An agreement is needed to send the right signals to industry, investors and the finance sector in order for wind power to reach its full potential.

GLOBAL INSTALLED WIND POWER CAPACITY (MW) – REGIONAL DISTRIBUTION

		End 2007	New 2008	Total end 2008
AFRICA & MIDDLE EAST	Egypt	310	55	365
	Morocco	124	10	134
	Iran	67	17	85
	Tunisia	20	34	54
	Other[1]	17	14	31
	Total	**539**	**130**	**669**
ASIA	China	5,910	6,300	12,210
	India	7,845	1,800	9,645
	Japan	1,538	346	1,880
	Taiwan	281	81	358
	South Korea	193	43	236
	Philippines	25	8	33
	Other[2]	5	1	6
	Total	**15,795**	**8,579**	**24,368**
EUROPE	Germany	22,247	1,665	23,903
	Spain	15,145	1,609	16,754
	Italy	2,726	1,010	3,736
	France	2,454	950	3,404
	UK	2,406	836	3,241
	Denmark	3,125	77	3,180
	Portugal	2,150	712	2,862
	Netherlands	1,747	500	2,225
	Sweden	788	236	1,021
	Ireland	795	208	1,002
	Austria	982	14	995
	Greece	871	114	985
	Poland	276	196	472
	Norway	326	102	428
	Turkey	147	286	433
	Rest of Europe[3]	955	362	1,305
	Total Europe	**57,139**	**8,877**	**65,946**
	of which EU-27[4]	*56,531*	*8,484*	*64,948*
LATIN AMERICA & CARIBBEAN	Brazil	247	94	341
	Mexico	87	0	87
	Costa Rica	70	0	70
	Caribbean	55	0	55
	Argentina	29	2	31
	Other[5]	45	0	45
	Total	**533**	**95**	**629**
NORTH AMERICA	USA	16,824	8,358	25,170
	Canada	1,846	526	2,372
	Total	**18,670**	**8,884**	**27,542**
PACIFIC REGION	Australia	824	482	1,306
	New Zealand	322	4	326
	Pacific Islands	12	0	12
	Total	**1,158**	**486**	**1,644**
	World total	**93,835**	**27,051**	**120,798**

Source: GWEC

1 South Africa, Cape Verde, Israel, Lebanon, Nigeria, Jordan;
2 Thailand, Bangladesh, Indonesia, Sri Lanka;
3 Belgium,Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Faroe Islands, Finland, Hungary, Latvia, Lithuania, Luxembourg, Romania, Russia, Slovakia, 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;

Please note: project decommissioning of 89 MW and rounding affect the final sums

Market forecast for 2009-2013

Germany, Marienkoog wind farm (Photo: Wind Power Works)

No slow-down in global wind developments as China continues expansion

Every year in the annual report, GWEC presents a forecast for the development of the global wind energy market for the coming five years.

Each of these projections has in the past been exceeded by the actual market growth. In 2006, we predicted that 16.8 GW would be installed in 2007 – it turned out to be close to 20 GW. Last year, the forecast was for 23.1 GW, but the reality was 27 GW.

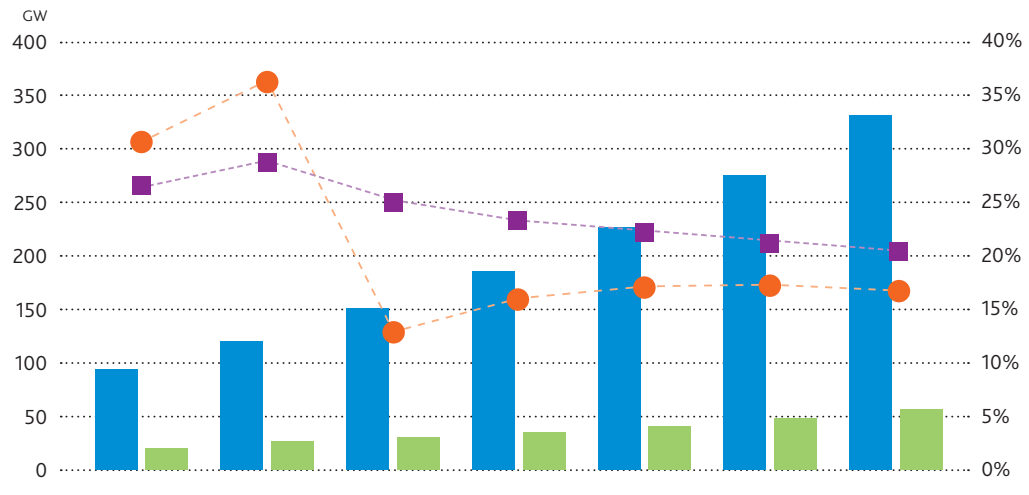
Prognostication is always difficult, and even more so in times of economic uncertainty. However, despite the financial crisis and its ramifications for the 'real' economy, which of course also includes the wind sector, we will once again raise our projections for the coming period.

Over the past three or four years, two markets have continuously outperformed our most optimistic expectations – the US and China. For the next year or two, developments in the US will be hampered by a lack of financing and the overall economic downturn. At the same time, growth in China is set to continue at a breathtaking rate, and this will drive a substantial increase in global wind energy installations in the coming years.

GWEC predicts that in 2013, five years from now, global wind generating capacity will stand at 332 GW, up from 120 GW at the end of 2008. During 2013, 56.3 GW of new capacity will be added to the global total, more than double the annual market in 2008.

The annual growth rates during this period will average 22.4% in terms of total installed capacity, and 15.8% for the annual market. These rates are modest compared to

MARKET FORECAST 2009-2013



	2007	2008	2009	2010	2011	2012	2013
Annual installed capacity (GW)	19.9	27.1	30.4	35.2	41.2	48.2	56.3
Cumulative installed capacity (GW)	93.8	120.8	151.2	186.4	227.6	275.8	332.1
Annual install capacity growth rate	30.7%	36.2%	12.5%	15.7%	17.0%	17.0%	16.8%
Cumulative capacity growth rate	26.7%	28.7%	25.2%	23.3%	22.1%	21.2%	20.4%

past developments: in the last ten years, we have seen an average increase of 28.2% for total capacity and 28.3% for annual capacity.

Regional distribution

The continued expansion of global wind generation capacity is driven by three regions: Asia, Europe and North America.

Asia is expected to be the fastest growing region in the world as of this year, driven mainly by China, which has been doubling its installed capacity every year for the past four years, and is set to continue the rapid upscaling of its wind capacity to become the world's largest annual market. Annual additions are expected to reach more than 20 GW in China by 2020. This development is underpinned by a very aggressive government policy supporting the diversification of the electricity supply, supporting the growth of the domestic industry, and making significant investments in the transmission needed to get the electricity to market.

Sustained growth is also expected in India, which will increase its capacity steadily by 1.5-2 GW every year, and be complemented by growth in other Asian markets, including Japan, Taiwan, South Korea and the Philippines.

For Asia as a whole, the annual market is expected to triple in the next five years, reaching 25.5 GW by 2013, which translates into 93 GW of new wind capacity to be installed in the region in five years – far more than in any other region of the world. This will take the cumulative wind capacity up to 117.4 GW by 2013, almost on a par with Europe by that time.

Wind energy development in **North America**, especially in the US, will see a small drop in 2009 as a result of tightening project finance. It will recover quickly to its 2008 size on the basis of the package of measures just agreed by the US Congress, and the prospect of national emissions reduction

India, Kutch wind farm (Photo: Wind Power Works)

Brazil, Rio do Fogo wind farm (Photo: Wind Power Works)

legislation. By 2013, the annual market in North America will have grown to 15 GW, up from 8.9 GW in 2008. This means that a total of 55 GW of wind power capacity will be added in the US and Canada over the next five years.

Europe will continue to have the largest installed capacity up to 2013, closely followed by Asia. It is expected that by 2013, the total capacity in Europe will stand at 118 GW, 52 GW more than at the end of 2008. By 2013, the annual market will reach 12.5 GW.

At the end of the period under consideration, large scale offshore developments will start to have an impact on growth rates in Europe, and this will lend new momentum to developments in the following years.

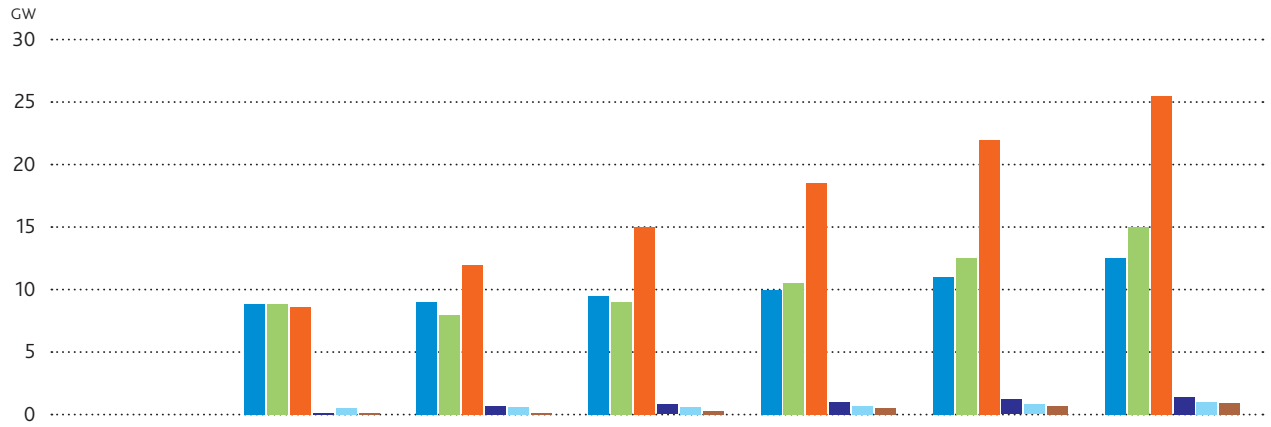
Germany and Spain are expected to remain the leading markets in Europe, but the trend towards a larger number of strong markets will become more pronounced in the coming years as Italy, France, the UK and Portugal continue expansion of their wind capacity. There are also encouraging signs from growing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

Latin America will continue its steady growth, with expected capacity additions of an average of 1 GW per year for the next five years, bringing the total installed wind capacity up to 5.7 GW by 2013. The growth will mainly be driven by Brazil, Mexico and Chile. However, given the tremendous wind resource in many countries both in Central and South America, this development is a far shot from the region's full wind potential. The lack of the right policy frameworks and lack of political commitment continues to hamper market development. However, it should also be said that there are signs that things are changing and that this region could hold some big surprises over the next five years.

The **Pacific region** is also forecasted to grow at a steady pace, with the annual market growing from its current 500 MW to reach 1 GW by 2013. This results in a total installed capacity of 5.3 GW in the region in 2013. Both Australia and New Zealand have spectacular wind resources and a great untapped potential, which is only slowly being developed. In 2008, Australia saw its strongest growth ever, and this development is expected to continue. While the New Zealand market experienced a slow year in 2008, the outlook for 2009 is brighter and more in line with what we saw in 2007, when 151 MW were installed.

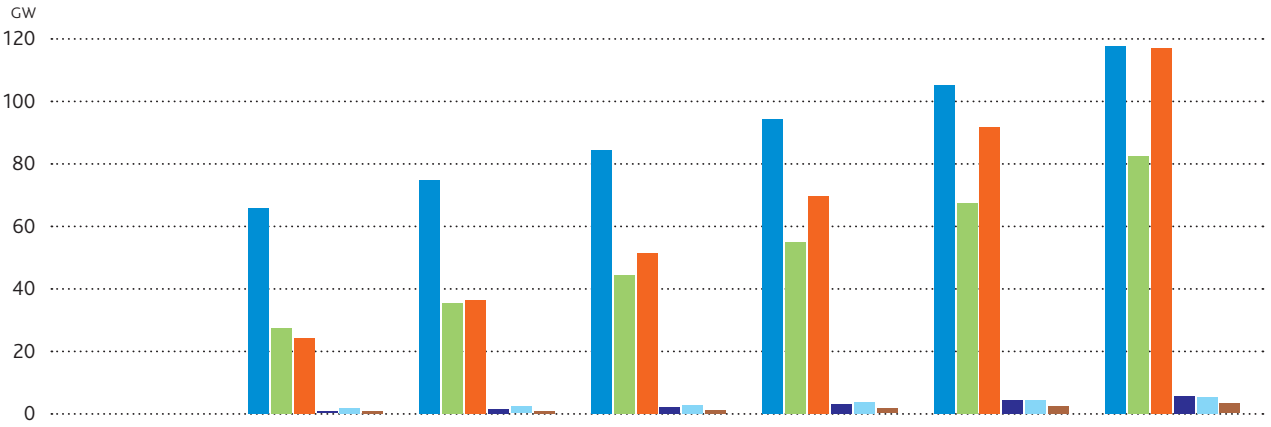
Africa and the Middle East will continue to be small players in the world's wind market, with annual additions reaching 900 MW by 2013, up from just 130 MW in 2008. The main markets here remain Egypt and Morocco, with some developments also expected in Tunisia and Iran. For the first time, it seems that sub-Saharan Africa may see some serious wind energy development, with a new feed-in tariff in South Africa, and big plans in Tanzania and Kenya, but these are at too early a stage to put numbers to. In 2013, the region's total installed wind capacity is expected to reach 3.2 GW.

ANNUAL MARKET FORECAST BY REGION 2008-2013 (GW)



	2008	2009	2010	2011	2012	2013
Europe	8.9	9.0	9.5	10.0	11.0	12.5
North America	8.9	8.0	9.0	10.5	12.5	15.0
Asia	8.6	12.0	15.0	18.5	22.0	25.5
Latin America	0.1	0.7	0.8	1.0	1.2	1.4
Pacific	0.5	0.6	0.6	0.7	0.8	1.0
Middle East & Africa	0.1	0.1	0.3	0.5	0.7	0.9

CUMULATIVE MARKET FORECAST BY REGION 2008-2013 (GW)



	2008	2009	2010	2011	2012	2013
Europe	66.0	75.0	84.5	94.5	105.5	118.0
North America	27.5	35.5	44.5	55.0	67.5	82.5
Asia	24.4	36.4	51.4	69.9	91.9	117.4
Latin America	0.6	1.3	2.1	3.1	4.3	5.7
Pacific	1.6	2.2	2.8	3.5	4.3	5.3
Middle East & Africa	0.7	0.8	1.1	1.6	2.3	3.2

Australia

Woolnorth wind farm (Photo: Roaring 40s)

Australia has some of the world's best wind resources, and benefits from a stable, growing economy and good access to grid infrastructure. After a couple of years of slow growth in Australia's wind market, the speed of development picked up again in 2008, with 482 MW of new installations, a 58% leap in terms of total installed capacity. Australia is now home to 50 wind farms, with a total capacity of 1,306 GW.

Several new projects became fully operational in 2008, adding capacity to the Australian electricity grid.

Another six projects totalling 555 MW are under construction and expected to be commissioned in 2009.

Additional wind energy projects that will provide a combined output of 5,824 MW have been proposed for development in all states of Australia. Most of these are either currently applying for, or have received, government planning approvals.

The policy environment

2008 saw the first full year of leadership from the Rudd Administration, which came to power with significant environmental credentials and a promise of support for industry-based solutions, particularly those involving low emission technologies.

In December 2008, the federal government released its White Paper on carbon emissions, which set a target of an unconditional 5% cut in emissions by 2020. At the community level, this was seen as totally inadequate to combat climate change. The government's chief climate change advisor, Professor Ross Garnaut strongly criticized the policy, saying it would not create the incentive for investment.

Newly added wind power capacity in 2008

LOCATION	WIND FARM	OWNER	CAPACITY
South Australia	Hallett, Stage 1	AGL	95 MW
South Australia	Lake Bonney, Stage 2	Babcock & Brown Wind Partners	159 MW
South Australia	Mt Millar	Transfield Services Infrastructure Fund	70 MW
South Australia	Snowtown, Stage 1	TrustPower	99 MW
Victoria	Portland Stage 2 – Cape Bridgewater	Pacific Hydro	58 MW
Western Australia	Kalbarri	VerveEnergy	1.6 MW

Projects in pipeline for 2009

LOCATION	WIND FARM	OWNER	CAPACITY
New South Wales	Capital Wind Farm	Babcock & Brown Wind Partners	140 MW
New South Wales	Cullerin Range	Origin Energy	30 MW
South Australia	Hallett Stage 2	AGL	71 MW
South Australia	Clements Gap	Pacific Hydro	58 MW
Victoria	Waubra	Acciona Energy	192 MW
Victoria	Portland Stage 3 – Cape Nelson	Pacific Hydro	64 MW

TOTAL INSTALLED CAPACITY

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

The government's White Paper outlining Australia's emissions trading scheme includes a plan to subsidize traditional energy generating companies – including brown coal generators – through the payment of AUD$3.9 billion (almost 2 billion Euros) in compensation.

In 2007 the government committed to ensuring that 20% of Australia's electricity supply would come from renewable energy sources by 2020 by establishing the expanded national Renewable Energy Target (RET) scheme. The national RET scheme will increase the existing MRET, which was introduced in 2001 with a target of 9,500 GWh by 2010, by more than four times, to 45,000 GWh in 2020. This will ensure that Australia reaches its 20% renewables target by 2020.

Draft legislation on the design of the RET was released in December 2008. The final legislation to implement the RET is expected to be in place by mid-2009.

The release of Australia's RET legislation represents an important step towards investor certainty. It has the potential to unlock more than AUD$20 billion worth of zero emission, clean energy investments and create thousands of new green job opportunities across the country.

Drafts of the new federal legislation, the Renewable Energy (Electricity) Amendment Bill 2008 and the Renewable Energy (Electricity) Amendment Regulations 2009, were also released in December 2008. Final legislation is expected by mid-2009.

This new legislation will combine existing state and federal schemes under the administration of a single independent renewable energy regulator. The regulator will also administer the Carbon Pollution Reduction Scheme and the National Greenhouse and Energy Reporting System.

Certified Wind Farms Australia

The wind industry has continued its work on the Certified Wind Farms Australia (CWFA) scheme originally developed by Auswind (now Clean Energy Council) in 2006-2007. This scheme encourages wind developers to demonstrate their compliance with environmental and social standards and best practice with respect to wind farm development, construction and operation.

Woolnorth wind farm (Photo: Roaring 40s)

A number of key wind energy companies in Australia have joined the CWFA, including Pacific Hydro, Roaring 40s, Wind Power and Wind Prospect. These companies will be independently audited by a panel of internationally recognized certification bodies including SAI Global, Global Mark, BSI Benchmark, DLIQ, SGS and NCIS.

National wind farm guidelines

The Commonwealth Government and State Governments will draft guidelines for wind farm development in 2009. The wind industry will be involved in the scoping and development of these guidelines to ensure that they deliver best practices but do not further impede development.

As part of the movement towards greater consistency and accountability in the industry, a certification process has been developed to build confidence. This process includes the creation of a panel of providers who can carry out independent auditing of participating organisations. Several companies have now undertaken certification audits, including Pacific Hydro, Roaring 40s, Wind Power Pty Ltd and Wind Prospect.

With input from the Clean Energy Council, Australia

Brazil

Rio do Fogo wind farm (Photo: Wind Power Works)

The total electrical generation capacity in Brazil was 105.4 GW at the end of 2007, of which 73% came from renewable sources, including large and small hydro power, wind and biomass.

Historically, Brazil has relied heavily on its abundant hydro resources. However, there is growing acknowledgement today that these resources are stretched due to economic and population growth, demographic expansion into the interior of the country and climate change.

There is a growing interest in Brazil to develop new renewable energy sources, fueled by concerns over energy security and an unwillingness to rely on imported fossil fuels.

A tremendous wind resource

A wind atlas published by the Electric Power Research Centre – CEPEL/ELETROBRÁS in 2001 shows that the potential for onshore wind energy capacity is 143 GW in Brazil (at 50 meters high). New wind maps, which are being prepared by the government based on measurements at 80-100 meters, are expected to demonstrate a capacity which is considerably higher.

The best wind resources in terms of wind speed and capacity factor are in the Northeast, Southeast and Southern Regions.

The policy environment for wind in Brazil

In 2002, the Brazilian government passed the pioneering PROINFA program, designed to foster the uptake of renewable energy sources in the Brazilian electricity mix. Although the programme has not been as successful as originally planned, it continues to add new capacity to the grid.

In 2008, it was decided that new capacity added to the grid from all energy sources should be done by public auction, with contracts awarded to the lowest bidders. Last year there were two major auctions of thermal energy. More recently, there was a formal announcement that auctions will be held by type of generating source, and wind power was chosen to be one of the next auctions.

TOTAL INSTALLED CAPACITY

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

Main market developments 2008

In 2008, five new wind farms were added to the Brazilian system, taking the total installed capacity up to 341 MW. Most of these new wind farms were located in the State of Ceará, in the North East of the country.

Historically, only one manufacturer was present in Brazil. During 2008, however, several other companies entered the market and as a result, there are now four major wind turbine manufacturers:

- Wobben Enercon (the pioneer in this market, with two manufacturing plants in Brazil and more than 340 MW installed, including PROINFA wind farms);
- Suzlon (with more than 300 MW sold for PROINFA wind farms);
- Vestas (with close to 200 MW sold for PROINFA wind farms);
- IMPSA (with orders for 318 MW that will be installed in PROINFA wind farms that belong to the IMPSA Group of Companies; IMPSA also now has one manufacturing plant in Brazil).

The number of qualified developers and operators in the wind energy market has also grown considerably during the last year. Companies that have wind parks under operation or in accelerated construction have established a stronger local presence, thereby increasing their capacity for developing new wind parks.

Organisations that have PROINFA wind parks in operation or at advanced stages of construction include: Iberdrola, Pacific Hydro, AES Tractebel, Servtec Group, IMPSA – Energimp, EDP – Enerbrasil, Siif Energies, Enerfin and Ventos do Sul.

There are also newcomers in the wind market, including Brazilian groups ERSA, Renova, and Brennand Energia. New international players from Portugal, Spain, Italy, France, Norway, Germany and other European countries also have interest in the Brazilian market.

Financing from Brazilian official sources can be obtained from the National Economic and Social Development Bank (BNDES) with nation-wide jurisdiction. For projects located in the Northeastern Region, financing can also be arranged by the Bank of Northeast of Brazil (BNB) and also by Development Agency of the Northeast (ADENE).

Expected developments for 2009

By mid-January 2009, the installed capacity in Brazil reached 360 MW, and it is expected to grow by several hundred MW during the course of the year.

The PROINFA Wind Parks, which suffered a delay in the beginning of this program, had a completion deadline for the end of 2008. At the moment, contracts are under scrutiny between ELETROBRÁS and the project developers, analyzing the reasons for delay on a case by case basis.

A wind energy auction is expected to be held in late 2009, and is expected to call for up to 1,000 MW in generating capacity. More than 4,500 MW of projects are qualified for the auction.

Wind farms in Brazil

WIND FARM	MW
Eólica Prainha	10
Eólica de Taíba	5
Eólica do Morro de Camelinho	1
Eólio-Elétrica de Palmas	2.5
Eólica de Fernando de Noronha	0.225
Mucuripe	2.4
RN 15 – Rio do Fogo	49.3
Eólica de Bom Jardim	0.60
Eólica de Olinda	0.225
Parque Eólico do Horizonte	4.8
Eólica Água Doce	9
Parque Eólico Osório	50
Parque Eólico Sangradouro	50
Parque Eólico dos Índios	50
Eólica Millennium	10.2
Parque Eólico Beberibe	25.6
Eólica Canoa Quebrada	10.5
Eólica Paracuru	23.4
Pedra do Sal	17.85
Taíba Albatroz	16.5

With input from the Brazilian Wind Energy Association (AEEolica)

Canada

In 2008, Canada became the 12th country in the world to surpass the 2,000 MW mark in installed wind energy capacity – ending the year with 2,369 MW. Canada's wind farms now produce enough power to meet almost 1% of Canada's electricity demand.

2008 was Canada's second best ever year for new wind energy installations with ten new wind farms installed representing 526 MW of wind energy capacity. Included in this total were the first wind farms in the provinces of New Brunswick, Newfoundland and Labrador. The only remaining Canadian province without any wind generating capacity, British Columbia, saw construction begin on its first wind farm with commissioning expected in early 2009.

At the end of 2008, Canada's wind energy capacity was distributed across the whole country:

- Ontario: 781 MW
- Quebec: 531 MW
- Alberta: 524 MW
- Saskatchewan: 171 MW
- Manitoba: 103 MW
- New Brunswick: 96 MW
- Prince Edward Island: 72 MW
- Nova Scotia: 61 MW
- Newfoundland and Labrador: 27 MW

Looking ahead: more than 650 MW expected for 2009

Like elsewhere, in Canada the financial crisis has made financing harder to come by and more expensive. This is expected to lead to the delay and cancellation of some projects as well as more consolidation within the industry, but only in the short term. As a result, CanWEA have lowered their expectations for 2009, but still envisage a substantial growth of 650 MW of new capacity additions. This would move Canada past 3,000 MW of installed capacity.

More than 5,000 MW of additional wind energy projects have now signed power purchase agreements and will be constructed in the five year period beyond 2009. This ensures steady growth in the Canadian market going forward.

Melancthon wind farm (Photo: Canadian Wind Energy Association)

In 2009, it is expected that the governments of Ontario, Quebec, British Columbia and Prince Edward Island will sign more power purchase agreements for wind energy projects as a result of competitive procurement processes launched in 2008 and early in 2009.

Looking further ahead, many Canadian provinces now have targets in place for new wind energy development. Ontario is aiming to put in place 4,600 MW of wind by 2020 and is now examining whether or not it can strengthen this target. Quebec is seeking 4,000 MW of wind by 2016 and has now contracted most of this power. Alberta, which only two years ago had put in place a 900 MW cap on wind energy development, is now seeking regulatory approval to build new transmission lines to connect 2,700 MW of wind.

Even Canada's three small Maritime provinces are now seeking a minimum of 1,200 MW of wind by 2015. Canada's smallest province, Prince Edward Island, which has a peak load of only 210 MW, aims to develop 500 MW of wind to provide 30% of the province's electricity needs and to export the remainder to the United States.

Taken together, provincial targets would, if achieved, result in a minimum of 12,000 MW of installed wind energy capacity in Canada by 2015.

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008
MW	137	198	236	322	444	684	1,460	1,846	2,372

A new wind vision for Canada

Despite the rapid growth of the wind energy industry in Canada, the country is losing ground to the global leaders in wind energy, such as the United States. Unlike a growing number of countries, the Canadian government is still not "thinking big" about wind energy.

In order to stimulate such a discussion in Canada, CanWEA released a strategic plan in 2008 entitled Wind Vision 2025 – Powering Canada's Future. The plan argues that Canada can and must ensure that wind energy supplies 20% of the country's electricity demand by 2025, bringing total Canadian wind energy capacity to 55,000 MW. This target would generate $79 billion CDN of investment in Canada by 2025 and would make the Canadian wind power sector a major player in the international wind energy market.

Development on this scale would also have a major impact on the country's economy, creating a minimum of 52,000 full time jobs, and many more if Canada develops a much stronger domestic wind energy supply chain. Furthermore, it would increase the annual revenue for Canadian municipalities and landholders by $165 million CDN. The strategy states that increased wind energy production would stabilize electricity rates for Canadians, ensure a diversity of supply and reduce Canada's annual CO_2 emissions by 17 million tons annually.

Challenges to be addressed

Canada's federal government has played an important role in stimulating wind energy deployment through the provision of production incentive payments under the ecoENERGY for Renewable Power program. This program, which provides a production incentive of 1 cent/kWh for the first 10 years of production, was first enacted in January 2007 and was scheduled to run until March 2011. However, due to strong demand, it will fully allocate all of its funds before the end of 2009 and the federal government has not yet committed to extending and expanding the program. This will be a high priority for the wind energy industry in 2009.

Work continues on a carbon pricing system in Canada.The federal government is currently aiming to put in place a greenhouse gas emissions trading scheme that will establish a price for carbon in 2010, but the design of the system will ensure that the price for carbon does not exceed $15 / tonne for the first couple of years of the program. According to CanWEA, however, this system is not likely to be implemented in 2009.

Wind energy procurement at the provincial level is usually undertaken through competitive tendering processes that are often oversubscribed by a factor of 3-5. In many provinces, there is no clearly defined, long-term procurement strategy. The wind energy industry will be working to seek reforms to procurement systems in order to provide stable and steady wind energy procurement over the long term. Ontario has enacted Standard Offer Contracts (i.e. feed in tariffs) for projects of 10 MW or less. The program was put on hold in 2008 due to overwhelming demand, but is expected to restart in 2009.

In some areas of Canada, wind energy development cannot proceed because of a lack of transmission capacity. While transmission planning processes are increasingly taking wind energy into account, there remains significant uncertainty in some regions of Canada as to how quickly new transmission can be built.

Finally, there continues to be a need to standardize and streamline wind energy permitting and approval processes to speed up regulatory approval for new wind farms.

Canada: With input from the Canadian Wind Energy Association (CanWEA)

People's Republic of China

Xiao Yan Kou wind farm (Photo: Wind Power Works)

2008 was another year of breathtaking wind energy development in China (excluding Taiwan), as the country's total installed capacity doubled for the fourth year in a row. New installed capacity totaled 6.3 GW in 2008, a 91% increase over the 2007 market. The country's cumulative wind power capacity now stands at 12.2 GW, making China the fourth largest wind market in the world.

The 10 GW-Size Wind Base Program

In 2008, the newly-established National Energy Administration highlighted wind energy as a priority for diversifying China's energy mix, which is currently heavily reliant on coal. The bureau selected six locations from the provinces with the best wind resources: Xinjiang, Inner Mongolia, Gansu, Hebei and Jiangsu. Each site will have more than 10 GW of installed capacity by 2020. This large-scale scale wind energy deployment is called the 10 GW Size Wind Base Programme (Wind Base). The Wind Base projects will ensure more than 100 GW of installed capacity producing 200 TWh per year by 2020. This is crucial to reach the Chinese government's National Mid and Long-Term Development Plan of 3% non-hydro renewable electricity production by 2020.

Planning for the six Wind Base sites started in 2008. In August , the first step was taken with an auction for 3,800 MW of wind generating capacity. As of January 2009, the Wind Base projects already have 5,000 MW installed capacity from existing projects, mainly in Gansu and Jiuquan. Other Wind Base projects are also under development: 20 GW at Mengxi (Western Inner Mongolia); 30 GW at Mengdong (Eastern Inner Mongolia); 10 GW in Hebei Province; 20 GW at Xinjiang Hami; and 10 GW in Jiangsu Province, 7 GW of which will be offshore.

Whereas wind projects in Europe are often decentralized and the electricity is consumed locally, the Chinese wind resources are rich in the north west, where the population is sparse and the electricity demand is low. China must build large scale, centralized projects, with high voltage and long distance transmission, and the Wind Base projects are posing huge challenges for transmission and grid construction. In 2008, the State Power Grid Corporation started work on a 750 kV high voltage transmission project in Gansu. The project will transmit the electricity to the east of the country where the electricity demand is high.

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008
MW	346	402	469	567	764	1,260	2,599	5,910	12,210

Price rationalization

CHANGES TO THE PRICING OF CONCESSION PROJECTS

In China, projects of over 50 MW are approved by the NDRC, and concession tendering is one of the most important procedures for project selection. The NDRC carries out tendering procedures for national concession projects, five rounds of which have taken place since 2003. Projects of less than 50 MW are approved by provincial governments, but prices for those projects are checked and approved by the NDRC. The only exception is Guangdong province, which makes its own decisions on prices for wind power. Some of the projects under 50 MW go through the concession process but are not included in the five rounds of national concession tendering.

The aim of the concession scheme has been to encourage a reduction in the price of wind power in China. However, the tariffs offered by winning concessions have been too low to be viable.

To remedy this situation, the rules for evaluating bids were modified for the fifth national concession round to discourage unreasonably low bids. The weight of the price in the overall evaluation of the bid has been reduced to 25%, which means that pricing is no longer the foremost criteria to win a bid. The projects which are closest to the average bidding price are more likely to win the tender.

The results of the fifth concession round, which was held in February 2008, showed that the pricing of wind projects improved, but still has not fundamentally changed the situation; i.e., the price is too low for a developer to cover their costs and make a reasonable profit. There is still a need to establish a sound pricing system for wind energy to further encourage the healthy development of the industry.

THE PRICING OF NON-CONCESSION PROJECTS

For projects that do not go through the concession tendering process, the prices are also approved by the NDRC. In 2008, fixed tariffs were approved for more than 72 projects. The new prices approved are much more realistic, taking into account factors including wind resources, transmission and construction costs.

Xiao Yan Kou wind farm (Photo: Wind Power Works)

THE RENEWABLE ENERGY PREMIUM

The Renewable Energy Law in China stipulates that the price difference between the electricity from renewable energy and that from coal fired power plants should be shared across the whole electricity system. To fulfill this objective and to finance the electricity from renewable energy sources, in the implementation regulations of the Renewable Energy Law published in 2006, there is a 0.001 RMB (0.0001 Euro) Renewable Energy Premium added for each kWh of electricity produced, aiming at covering the difference between electricity from coal-fired power plants and electricity from renewable energy.

The Renewable Energy Premium is collected by the government and pooled together as a fund. When the electricity is fed into the grid, renewable energy project developers get paid only the basic tariff, which is the same level as the local coal fire price. But the premium between the coal fire electricity price and the renewable energy price is paid later by the government from this Renewable Energy Premium.

Rules on how the Renewable Energy Premium should be reimbursed to the developer and grid companies for the added services to satisfy RE needs were released by the government in 2006-2007. The money has been reimbursed to the renewable energy projects operated after 1 January 2006. The total amount of the fund reached 3 billion RMB (300 million Euro) in 2007. In 2008, this premium was raised to 0.002 RMB (0.0002 Euro).

Grid constraints are the main challenge

The ability of China's grid system to incorporate wind-generated electricity continued to be the main problem faced by the industry in 2008. Among wind farms currently in operation, a great number have only limited access to the grid. According to the Renewable Energy Law, renewables should be given priority access to the grid, yet the rule is not being followed due to the physical constraints of grid capacity. In the past, new wind projects were spread throughout the country and close to grid connections. In recent years however, with the boom in wind development, most of the new wind farms are located in north-west China, where the existing grid structure is weak.

In September 2007, the NDRC issued the Renewable Energy Mid and Long Term Development Plan, in which the 2010 target for installed wind capacity was set at 5 GW, and later raised to 10 GW. However, the new installed capacity in 2008 has overshot this target by far, with cumulative capacity by the end of 2008 reaching 12.2 GW. This rapid growth is far ahead of the national plan, which makes it difficult to align grid planning with wind project development.

The variability of wind also poses challenges to grid operation, and China needs to solve the associated technical issues, such as grid dispatching. To ensure stable operation of the grid, there is a need to improve the quality of electricity generated by wind, especially for large scale wind farms.

Grid connection for wind energy requires additional services and therefore increases the operational cost and risks for grid companies, which are state-owned monopolies in China. Without market competition and proper incentives, grid operators have little motivation to expand service to match the rapid development of wind energy.

Policies to stimulate domestic manufacturing

In April 2008, the Chinese Ministry of Finance issued a new regulation on tax refunds for importing large wind turbines (2.5 MW and above) and key components. In this new regulation, the tax revenue for the key components and raw materials for large turbines (2.5 MW and above) will be used for technology innovation and capacity building. The tax rebate is not returned directly to the company, but to the state, which will establish special programs to channel the money back into the wind industry. The effects of this policy are hard to predict at this point, as State Owned Enterprises are the only beneficiaries of this investment.

In August 2008, the Ministry of Finance issued another incentive policy on funding support for the commercialization of wind power generation equipment. According to this regulation, for all the domestic brands (with over 51% Chinese investment) the first 50 wind turbines over 1 MW will be rewarded with RMB 600/kW (60 Euro) from the government. The rule specifies that the wind turbines must be tested and certified by China General Certification (CGC), and must have entered the market, been put into operation and connected to the grid. The regulation

Xiao Yan Kou wind farm (Photo: Wind Power Works)

further requires that the rewarded turbines must use domestic manufactured components and share the awards proportionate with component manufacturers.

This new policy has two ground-breaking implications. It is the first time that the government gives subsidies to renewable energy manufacturers and the first time that there is a link between a stimulus policy and a testing and certification system. This policy will have a significant impact on the future promotion of China's domestic industry's technology innovation, improving competitiveness and building domestic branding in the long run.

Increasingly intensive competition for turbine manufacturers

More than 20 new turbine manufacturers entered the Chinese market in 2008, bringing the total number of manufacturers in China to 70. Of these, 30 companies already have turbines in operation. The increasing number of turbine manufacturers could help ease the supply deficit in the market. However, there is sure to be intensive competition in the market, resulting in consolidation. In the coming years, demand will gradually slow, even with the conservative estimate of 20 GW cumulative installation by 2010 and 100 GW by 2020. Demand in the decade between 2011-2020 is forecasted to be 80 GW, or about 8 GW per year. The top three manufacturers in China, Goldwind, Sinovel and DEC (Dongfeng Electric), have an annual manufacturing capacity of 4 GW, and the international brands manufacturing in China (Vestas, Suzlon, GE, Gamesa, Nordex and Repower) have a similar capacity. This means that there will be little market share left for the rest of the more than 60 manufacturers, unless the market expands further or they begin to export turbines in large numbers.

The financial crisis does not pose a significant threat to Chinese wind market development

The financial crisis is beginning to have an impact on the global wind market. The growth of global demand is slowing and competition will lower the cost of wind turbines. International turbine manufacturers will therefore increase their promotional efforts in the Chinese market, bringing intense competition between international brands and domestic manufacturers.

Not only does the global financial crisis not pose a substantial threat to the Chinese wind industry, it actually brings new opportunities. Firstly, it will accelerate the consolidation of Chinese wind industry manufacturing through intensive competition. Secondly, the state owned wind power developers, such as HUANENG and Datang HUADIAN, will receive priority access to low interest loans for wind farm construction.

Power generation companies in China had a difficult year in 2008. In the first half of the year the price of coal increased dramatically, while the electricity price was not allowed to rise accordingly, causing 90% of power generation companies to report huge losses by the end of the year. These losses have encouraged power generation companies to begin to invest further in wind power development.

China: With input from the Chinese Wind Energy Association (CWEA)

Egypt

Zafarana wind farm (Photo: Wind Power Works)

Wind energy in Egypt

During the last two decades, renewable energy has gained momentum in Egypt. Supported by sustained government commitment and fruitful international cooperation, Egypt has passed the stage of initial resource assessment and demonstration projects towards the planning and implementation of large scale grid connected projects.

The New & Renewable Energy Authority (NREA) was set up in 1986, with the establishment of testing & certification laboratories and personnel training. The practical work of NREA began with assessing the renewable energy resource and investigating the choices of different technologies through studies and pilot projects, as well as introducing some of these technologies to the Egyptian market and supporting the initiatives of local industry.

Since then a series of large-scale wind energy projects have been built in Egypt. In 2008, 55 MW of wind power were added, bringing the total installed wind capacity up to 365 MW at the end of 2008. Several additional projects are in the pipeline.

An excellent wind resource

Egypt enjoys an excellent wind regime, particularly in the Gulf of Suez, where average wind speeds reach 10 m/sec. Egypt cooperated with Denmark to produce a Wind Atlas, issued in 1996, for the Gulf of Suez west coast. In 2003, a detailed Wind Atlas for the same area was issued, concluding that the region can host several large scale wind farms.

The atlas was expanded to cover the entire land area of Egypt in 2005, to establish the meteorological basis for the assessment of wind energy resources all over Egypt. The atlas indicates that large regions of the eastern and western deserts of the Nile River and parts of Sinai have average annual wind speeds of 7-8 m/s.

Egypt has large deserts and abundant land mass, only 7% of which is heavily populated. These areas are well suited to host renewable energy projects to increase the country's share of renewable energy as well as to export excess energy to Europe.

Besides the areas already earmarked with high wind potential on the west of the Gulf of Suez, work is underway to earmark other promising areas for future wind projects. Land lease agreements for these areas will be signed with qualified wind project developers.

Grid infrastructure

The Egyptian national grid is extensive, providing over 99% of the population with modern electric energy services. Currently, grid connected renewable energy projects in Egypt enjoy the right of access and priority in dispatching.

TOTAL INSTALLED CAPACITY

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

Policy development and investment opportunities

In February 2008, the Egyptian Supreme Council of Energy approved an ambitious plan to produce 20% of total electricity from renewable energies by 2020, including a 12% contribution from wind energy. This translates into more than 7,200 MW of grid-connected wind farms. The plan gives enough room for private investors to play a major role in realizing this goal, and the government anticipates that about 400 MW/year will be undertaken by the private sector, while the NREA will carry out about 200 MW/year.

A recently drafted new electricity act, which is undergoing consultation with stakeholders, has been designed to reflect the ongoing market reforms and to strengthen the regulatory agency. It includes articles supporting renewable energy through encouraging private investment in the sector. In addition, it guarantees third party access and priority dispatch for renewable electricity.

Polices to foster an increasing wind contribution in the Egyptian electricity mix consist of two phases. Phase one will use a competitive bids approach, through international tenders requesting bids from the private sector to supply energy from renewables. The financial risk for investors is reduced through guaranteed long term power purchase agreements. The prequalification documents for the first tender documents of the competitive bids are presently under preparation. In addition, a preparatory workshop will be held to assess the interest and to consider the inputs and concerns of project developers as well as other stakeholders.

In phase two, a feed-in-tariff will be introduced; taking into consideration the prices achieved in phase one.

The private sector is encouraged to play a key role in achieving the 2020 goal by building wind farms to satisfy their own power needs or to sell electricity to consumers through the national grid. Wind farm developers are asked to coordinate with the Egyptian Electricity Transmission Company (EETC) and the Egyptian Electricity Regulatory Agency for issues such as grid connection, wheeling, backup and power purchase agreements.

The NREA supports private investment in wind energy by providing resource assessment, the necessary data for feasibility studies and technical support for potential project developers.

Large scale projects in Egypt

ZAFARANA WIND FARM

During the last decade a series of wind projects were established in Zafarana, with a total capacity of 360 MW. The farm has been constructed and operated in stages since 2001, in cooperation with Germany, Denmark and Spain.

A partnership with Japan in 2008 added 55 MW, and an additional 75 MW will begin operation in 2009. In 2007, 120 MW were planned in cooperation with Denmark and will be operational by 2010. All in all, Zafarana will host 545 MW of grid connected wind power, to become the largest wind farm in Africa and the Middle East.

From July 2007-June 2008, 840 GWh of electricity were generated by the Zafarana wind farm with an average capacity factor of 35.5%, saving 466,000 tons of CO_2.

GULF OF EL-ZAYT

Further developments are in the pipeline in the Gulf of El-Zayt, including a 200 MW project in cooperation with Germany and the European Investment Bank; a 220 MW wind farm in cooperation with Japan; and a 300 MW wind farm in cooperation with Spain.

In addition to this, an Italian company expressed interest in establishing a 120 MW wind farm in the Gulf of El-Zayt, to be expanded to 400 MW at a later stage. These projects aim to generate electricity for cement factories in the Suez area. An agreement has already been signed with the NREA, and a bird migration study on the proposed site is expected to be finalized by early 2009.

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

European Union

The world's leading regional market

The EU continues to be world's leader in total installed wind energy capacity, and one of the strongest regions for new development, with over 8.4 GW of new installed capacity in 2008. Industry statistics compiled by the European Wind Energy Association (EWEA) show that cumulative wind capacity increased by 15% to reach a level of 64,949 MW, up from 56,535 MW at the end of 2007.

In the EU, wind power continues to be one of the most popular electricity generating technologies. Since 2000, the installed wind capacity has increased almost seven-fold from 9.7 GW to 65 GW. Wind energy is now the fastest growing power technology in Europe: out of around 24 GW of total new power generation capacity built in the EU in 2008, wind energy accounted for more than 35%. As a result, renewable energy represented over 57% of all newly added power capacity in the EU in 2008.[1]

By the end of the year, a total of 160,000 workers were employed directly and indirectly in the wind energy sector[2], which saw investments of about 11 billion Euros in the EU. The wind power capacity installed by the end of 2008 will produce 142 TWh of electricity, equal to about 4.2% of the EU's electricity demand. This will avoid the emission of 108 million tonnes of C02 per year, the equivalent of taking more than 50 million cars off Europe's roads. As a comparison, in 2000, less than 0.9% of EU electricity demand was met by wind power.

While Germany (1,665 MW) and Spain (1,609 MW) are still battling over the top spot for new installations, the 2008 market was much more balanced than in previous years. A group of 'second wave' countries emerged, and are providing real momentum to the surge in wind energy. Italy added 1,010 MW to reach a total of 3,736 MW of installed capacity; France added 950 MW to reach 3,404 MW and the UK added 836 MW to reach 3,241 MW. Ten EU Member States – over one third of all EU countries – now each have more than 1,000 MW of installed wind energy capacity. Austria and Greece are just below the 1,000 MW mark.

A distinct 'third wave' became visible for the first time in 2008 as the new EU Member States had their strongest year ever. Hungary doubled its capacity to 127 MW and Bulgaria tripled its capacity from 57 MW to 158 MW. Poland, one of the fastest growing younger markets, now has 472 MW up from 276 MW at the end of 2007. Outside the EU Member States, Turkey tripled its wind energy capacity from 147 MW to 433 MW.

In terms of offshore wind energy, 357 MW of capacity was added in 2008, to reach a total of 1,471 MW. Nearly 2.3% of total installed EU capacity is now offshore.

The current EU legislative framework for wind energy

Up to now, an important factor behind the growth of the European wind market has been strong policy support both at the EU and the national level. The EU's Renewables Directive (77/2001/EC) has been in place since 2001. The EU aimed to increase the share of electricity produced from renewable energy sources (RES) in the EU to 21% by 2010 (up from 15.2% in 2001), thus helping the EU reach the RES target of overall energy consumption of 12% by 2010. The Directive, which set out differentiated national indicative targets, has been a historical step in the delivery of renewable electricity and constitutes the main driving force behind recent policies being implemented.

In the pursuit of the overall target of 21% from renewable electricity by 2010, the Renewable Electricity Directive 2001 gives EU Member States freedom of choice regarding support mechanisms. Thus, various schemes are operating in Europe, mainly feed-in tariffs, fixed premiums, green certificate systems and tendering procedures. These schemes are generally complemented by tax incentives, environmental taxes, contribution programmes or voluntary agreements.

However, despite the efforts of Member States and despite some improvements to the regulatory frameworks, major barriers to growth and integration of renewable electricity remain. The main causes of the slow development in some Member States are not policy related, but delays in authorization, unfair grid access conditions and slow reinforcement of the electric power grid.

1 This includes a preliminary figure for solar PV installations of 4.2 GW for 2008 (source: EPIA).

2 This figure is based on the methodology used by EWEA it its recent report 'Wind at Work', available on www.ewea.org.

TOTAL INSTALLED CAPACITY

year	2000**	2001**	2002**	2003**	2004*	2005*	2006*	2007	2008
MW	12,887	17,315	23,159	28,598	34,371	40,511	48,029	56,531	64,948

**EU 15 *EU 25

Reports from the European Commission also conclude that the harmonization of support schemes in the EU remain a long term goal on economic efficiency, single market and state aid grounds, but that harmonization in the short term is not appropriate. EWEA is of the opinion that real competition in the conventional power market must precede a harmonized market for renewable electricity. The association also fears that a hasty move towards a harmonized EU-wide payment mechanism for renewable electricity would have a profound negative effect on the markets for wind power and put European leadership in wind power technology and other renewables at risk.

The future EU legislative framework for wind energy

In December 2008, the European Union agreed a new Renewable Energy Directive to implement the pledge made in March 2007 by the EU Heads of State for a binding 20% renewable energy target by 2020.

The EU's overall 20% renewable energy target for 2020 has been divided into legally binding targets for the 27 Member States, averaging out at 20%. In terms of electricity consumption, renewables should provide about 35% of the EU's power by 2020. By 2020, wind energy is set to contribute more than a third of all the power coming from renewables.

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

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

Certain measures to promote flexibility have been built into the Directive in order to help countries achieve their

Germany, Marienkoog wind farm (Photo: Wind Power Works)

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

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

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

With input from the European Wind Energy Association (EWEA)

France

Hétomesnil wind farm (Photo: Wind Power Works)

The fourth largest European market

France enjoys an abundant wind potential, and is continuing to see strong growth. In 2000, France had only 30 MW of wind generating capacity, mostly small wind turbines in the French overseas territories. At the end of 2008, the total installed wind capacity stood at 3.4 GW, representing an annual growth rate of 38%. France now is the fourth largest market in Europe after Germany, Spain and Italy.

The wind market grew by 950 MW in 2008, and this new wind capacity represents about 60% of all new generation capacity installed in France last year. Wind power is now France's fastest growing energy source.

The average size of an installed wind turbine in France has increased from an average of 1.2 MW per turbine in 2005 to 1.95 MW in 2008, and is expected to reach 2.5 MW by 2010. The average size of wind farms has also been continuously increasing, from 4.7 MW to 13 MW between 2002 and 2008. It is estimated that the average wind farm size could reach 20 MW by 2010.

In 2008, French wind farms produced 5.6 TWh, with an average capacity factor of 24%. The wind sector now provides around 7,000 jobs to the French economy.

The biggest potential for growth in the coming years is estimated to be in the north and the north east of the country. By 2010, it is expected that the areas for greatest development would all be in the north of France. Out of 4,000 MW of approved wind power projects, more than 700 MW are in the Champagne-Ardennes region and 500 MW in the Picardy region.

The largest wind park in France is in Fruges, in the north of the country, with 70 wind turbines accounting for 140 MW. Built in 2007, the Cormainville wind farm in Eure-et-Loir has an installed capacity of 60 MW and the La-Voie-Sacré wind farm in Lorraine has 54 MW. The largest manufacturers active in the French market are Enercon, Vestas, REpower, Nordex and Gamesa, accounting for 86% of the total capacity in 2007.

The policy framework for wind energy in France

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

In July 2005, this law was amended to stipulate that in order to be eligible for the feed-in tariff, wind farms must be built

TOTAL INSTALLED CAPACITY

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

in special Wind Power Development Zones (ZDE). These zones are defined at the regional level based on the criteria of electrical production potential, grid connection capacity and landscape protection. The law also did away with the previous size limit of 12 MW for wind farms.

The feed-in tariff in the ZDE was reaffirmed in a decree signed on 17th November 2008, after the previous decree was cancelled by the Conseil d'Etat, the highest administrative court, in August 2008.

Policy developments in 2008: The Grenelle Objectives and the introduction of regional renewable energy schemes

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

This last objective has so far been adopted by the National Assembly and should be adopted by the Senate in the coming months (Grenelle 1 law). The law will finally be approved by the end of 2009 and will come into force shortly thereafter.

Another law from the Grenelle legislative process (Grenelle 2) is expected to be issued in 2009 and will provide for the implementation of renewable energy schemes at the regional level. The schemes should be elaborated both by the executive representative of the state at a regional level (préfet) and by the elected president of the regional council following a consultation process. The aim of these regional schemes is to determine geographical zones for the development of renewable energy, with a specific section for wind energy.

Despite these new provisions, the ZDE will continue to exist, with an additional criterion for the preservation of landscapes. The implementation of regional schemes requires that all ZDEs that are created after the implementation of schemes comply with the regional schemes.

Remaining obstacles to wind energy development

Despite the high wind power potential in France, there are several barriers that remain and hinder the development of wind energy in the country. Barriers include: slow authorization procedure for both ZDE and individual authorizations; inadequate grid connection capacity; and zones in which installation is forbidden.

Rather than promoting wind energy development, the ZDE law has hampered the growth of the French market, since it has resulted in longer and more complex administrative and grid connection procedures. A 2007 study issued by the Ministry of Industry and Economy indicates that nine weeks are necessary to notify the applicant that the application process is launched and the authorization generally takes 22 weeks to be completed.

Adequate grid connection remains a problem in some areas of France, although some commitment has been made towards reinforcing the French grid to accommodate more wind development.

Offshore wind energy in France

Offshore wind development in France is slow, as there is no specific legislative or administrative framework for the development of offshore wind energy, and the framework applying to offshore economic activity is not adapted to wind energy. Preparation for the first offshore wind farm in France began with a government tender in 2005, but due to long authorization procedures, construction has been delayed and is now scheduled to start in 2009 or 2010.

However, there are indications that the principle of exclusion zones will no longer be applicable offshore, and work has begun on simplifying offshore planning procedures.

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

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

Germany

Current market situation

Germany remains Europe's largest wind energy market, both in terms of total installed capacity and in terms of new installations. During 2008, 866 new wind turbines with a capacity of 1,665 MW were installed in Germany, bringing the total up to 23,903 MW. Repowering old machines accounted for 24 MW in 2008, and 5 MW were installed offshore. The largest turbines currently operating in Germany have a rated capacity of 6 MW.

Wind energy generated 40.4 TWh of electricity in Germany in 2008, representing 7.5% of Germany's net electricity consumption. Thanks to a reliable domestic market, German manufacturers and suppliers are continuing to lead the way in developing wind energy worldwide.

In 2007, the revenue from all turbines and components produced worldwide by German companies amounted to 6.1 billion Euros – 21% more than in 2006. Thus in 2007, German manufacturers and suppliers contributed to about a quarter of the total worldwide turnover of 25 billion Euros. The percentage of exported equipment increased from 74% in 2006 to over 83% in 2007. The German wind energy sector now employs close to 100,000 people in direct and indirect employment. This figure includes employment created by a very large German export industry producing components for the global wind market.

Lower Saxony has 6,028 MW of wind power, making it the state with the most installed capacity. A number of states now provide more than one third of their electricity generation from wind energy: Saxony-Anhalt (42.6%), Mecklenburg-Vorpommern (39.4%), Schleswig-Holstein (38.3%) and Brandenburg (34.1%). In leading wind states, about 1% of the total spatial area is dedicated to wind farms and single turbines.

According to the new Renewable Energy Directive of the European Union which will come into force in the summer of 2009, Germany has an overall target of producing 18% of its final energy consumption from renewable energy sources. For the electricity sector, the government announced – in combination with the recent amendment of the Renewable Energy Sources Act (EEG) – its target of reaching 30% of renewable electricity by 2020. The German Renewable Energy Association (BEE) published a study at the beginning of 2009 showing that the share of renewable electricity could be as much as 47% by 2020.

New feed-in tariffs and regulations to take effect in 2009

An early feed-in law for wind-generated electricity has existed in Germany since 1991. The Renewable Energy Sources Act (Erneuerbare-Energien-Gesetz-EEG) came into force in 2000 and still provides the main stimulus for the German wind market. The EEG is regularly amended to adapt tariffs to current market conditions and new technological developments. The most recent amendment took place in 2008 with new tariffs and regulations which took effect on 1 January 2009.

Under the EEG, electricity produced from renewable energy sources is given priority for grid connection, grid access in both distribution and transmission grids, and power dispatch. The EEG stipulates a fixed feed-in tariff for each kWh of power produced and fed into the grid from renewable sources. The 'new' EEG for wind energy includes higher tariffs for on and offshore installations, incentives and regulations for improved grid integration technology of turbines and stricter obligations for grid operators in integrating wind power.

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

As of 1 January 2009 the initial tariff for onshore wind energy was increased to 9.2 cent/kWh. This initial tariff will be reduced by 1% per year for new installations; i.e., projects which become operational in 2010 will receive an initial tariff of 9.2 cent/kWh – 1%, etc. The basic tariff is set at 5.02 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 will come into operation before the end of 2015. The initial 15 cents/kWh will be paid for a period of

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008
MW	6,104	8,754	11,994	14,609	16,629	18,415	20,622	22,247	23,903

12 years. After that, the tariff will decrease to 3.5 cents/kWh. Given that wholesale electricity prices are expected to exceed 3.5 cents/kWh at that time, the idea is that offshore wind power will be sold directly into the electricity markets rather than continuing to rely on feed-in tariffs after 12 years of operation. There is an additional prolongation for projects in deeper waters and further from the coast. For offshore wind farms starting operation after 2015, the initial tariff is reduced by 5% per year, so projects starting operation in 2016 will receive 13 cent/kWh – 5%, etc.

Grid operators are obliged to feed-in electricity produced from renewable energy and buy it at a fixed price within their supply area. Furthermore, the new EEG requires that grid operators not only extend the grid, but also that they optimise and enhance the existing grid. Failure to comply with this can lead to claims for damages by anyone willing but unable to feed-in. In addition, a bonus of 0.5 cent/kWh for improved grid compatibility (system service bonus) was introduced for new turbines.

A special tariff (repowering bonus) was kept for replacing turbines ten or more years old with turbines with at least double the rated capacity in the same or neighboring county.

Future Trends – designation of new sites, onshore repowering

For onshore wind farm development, the number of sites commissioned has been decreasing in past years. Currently, however, a number of states, such as Brandenburg, Schleswig-Holstein and Lower Saxony, have issued new targets for wind energy and have started to commission new sites again.

Repowering (i.e. replacing old turbines with new, bigger ones) can and will play a stronger role in Germany in the future. Studies in coastal areas estimate that repowering has the potential to double the amount of onshore wind capacity in Germany with significantly fewer turbines and to triple the energy yield. Despite the high technical potential, repowering is proceeding at a slow pace in Germany because most turbines are not old enough. In most cases repowering is only economical after 15 or more years of operation. At the end of 2008, only 152 MW of capacity was older than 15 years. In 2008, repowering accounted for only 24 MW of new installed capacity. Nevertheless, it is expected that repowering should increase significantly after 2010. At the end of 2015, more than 6,000 MW of existing capacity will be made up of turbines older than 15 years.

Modern turbines with hub heights above 100 meters and with an optimised ratio between rotor diameter and generator rating can reach capacity factors of 35% (3,000 full load hours) even on the German mainland, and 45% in coastal and mountainous areas. However, in many regions, height restrictions inhibit the production of turbines with the best yields. The government and some states are rethinking the framework conditions to allow for continuous onshore development.

Offshore developments

Projections for offshore wind energy in Germany predict a capacity of 500 MW by 2010, and about 3,000 MW by 2015. The first pilot project, the test site *Alpha Ventus* with 60 MW in the North Sea, is expected to come into operation during 2009. In 2008, a 5 MW 'near-shore' test turbine was installed by the Bard Group in the North Sea.

Most German offshore parks will be 20-60 km offshore in waters 20-40 meters deep. Thus far, the national maritime authority and the Federal States have licensed 23 projects, accounting for more than 6,500 MW.

Future developments: Wind Energy in Germany by 2020

The domestic market has been very stable in recent years but will begin to grow again once the administrative hurdles such as general distance regulations and height limits have been overcome and construction can continue. This is mainly a political issue. National and Federal State targets for renewable electricity require a growing contribution from wind energy in Germany.

According to calculations from the German Wind Energy Association (BWE), the overall German onshore capacity could be 45,000 MW, with an additional 10,000 MW offshore by 2020. Wind energy could generate approximately 150 TWh/year, delivering 25% of German electricity consumption by 2020.

With input from the German Wind Energy Association (BWE)

India

Great wind potential

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

The total potential for wind power in India was first estimated by the Centre for Wind Energy Technology (CWET) at around 45 GW. This figure was also adopted by the government as the official estimate, following a comprehensive wind mapping exercise initiated by the MNRE, which established a country-wide network of 553 wind monitoring stations in 25 Indian States. This effort made it possible to assess the national wind potential and identify suitable areas for harnessing wind power for commercial use. However, the wind measurements were carried out at lower hub heights. At heights of 50-60 meters, the Indian Wind Turbine Manufacturers Association (IWTMA) estimates that the potential for wind development in India is around 65-70 GW.

Steady market growth for wind

Wind energy is continuing to grow steadily in India. In 2008, 1,800 MW of new wind generating capacity was installed, taking the cumulative figure up to more than 9.6 GW. This represents an annual growth of 22%.

Wind power in India has been concentrated in a few regions, especially the southern state of Tamil Nadu, which maintains its position as the state with the largest wind power installation, with 4,118 MW installed at the end of 2008, representing 44% of India's total wind capacity.

This is beginning to change as other states, including Maharashtra, Gujarat, Rajasthan and Karnataka, West Bengal, Madhya Pradesh and Andhra Pradesh start to catch up, partly driven by new policy measures, as in Maharashtra and Gujarat. As a result, wind farms can be seen under construction all across the country, from the coastal plains to the hilly hinterland and sandy deserts.

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

Kutch wind farm (Photo: Wind Power Works)

Security of supply is the main driver for wind in India

India is heavily dependent on fossil fuels for its energy needs, mainly coal, of which it has significant reserves. However, to fuel a thriving economy and a targeted GDP growth rate of 7-8% per year, the country's electricity demand is projected to more than triple between 2005 and 2030. Already today, electricity shortages are common place. To address this problem, the Indian government has envisaged a capacity addition of more than 70,000 MW by 2012.

The policy environment for wind energy in India

The Indian government's stated target is for renewable energy to contribute 10% of total power generation capacity and have a 4-5% renewables share in the electricity mix by 2012. This means that renewable energy would grow at a faster rate than traditional power generation, accounting for around 20% of the total added capacity planned in the 2008-2012 timeframe.

The Indian electricity industry was restructured by the 2003 Electricity Act, which unbundled the vertically integrated electricity supply utilities in the Indian States and set up State Regulatory Commissions (SERCs) in charge of setting electricity tariffs. The act also opened access to the Indian transmission system, allowing consumers to purchase their electricity from any producer.

The Electricity Act also required the SERCs to set Renewable Portfolio Standards for electricity production in their state, and the MNRE issued guidelines to all state governments to create an attractive environment for the export, purchase, wheeling and banking of electricity generated by wind power projects.

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008
MW	220	1,456	1,702	2,125	3,000	4,430	6,270	7,845	9,645

Ten out of the 29 Indian States have now implemented quotas for a renewable energy share of up to 10% and have introduced preferential tariffs for electricity produced from renewable sources. These states are Kerala, Rajasthan, Tamil Nadu, Karnataka, Andhra Pradesh, Maharashtra, Madhya Pradesh, West Bengal, Gujarat and Haryana. In addition, several states have implemented fiscal and financial incentives for renewable energy generation, including; energy buy back (i.e. a guarantee from an electricity company that they will buy the renewable power produced); preferential grid connection and transportation charges and electricity tax exemptions.

At the federal level, although there is no national policy for renewable energy, there are a number of measures that help drive wind energy development, including fiscal incentives such as income tax exemption for 10 years, 80% accelerated depreciation, sales tax exemption and excise duty exemption.

Feed in tariffs in India

Some states with Renewable Portfolio Standards or other policies to promote wind generation, have introduced feed-in tariffs for wind generation which are higher than that for conventional electricity. In Karnataka, for instance, the tariff for wind generation is about 3.50 rupees/kWh (5.5 Euro cent) compared to only 1.50 rupees/kWh (2 Euro cent) for coal generated power.

In June 2008, the MNRE announced a national generation-based incentive scheme for grid connected wind power projects under 49 MW, providing an incentive of 0.5 rupees per KWh (0.7 Euro cents) in addition to the existing state incentives. Investors which, because of their small size or lack of tax liability cannot draw any benefit from accelerated depreciation under the Income Tax Act can opt for this alternative incentive instead.

A national Renewable Portfolio Standard?

In 2008, the National Action Plan on Climate Change released by the Indian government included a proposal for a national renewable energy trading scheme, which would be based on a National Renewable Portfolio Standard.

In this scheme, states would be encouraged to promote the production of renewable power to exceed the national standard. They would then receive certificates for this surplus power, which would be tradable with other states which fail to meet their renewable standard obligations. Since only grid-connected electricity would be eligible for this scheme, this would particularly benefit the wind industry. It is expected that this proposal will come into force in 2009 or 2010.

CDM projects

The possibility to register projects under the Kyoto Protocol's Clean Development Mechanism (CDM) has provided a further incentive to wind energy development in India. As of 1 February 2009, 270 projects were registered with the CDM Executive Board, accounting for 5,072 MW, second only to China (see page 6 for a complete list of CDM projects by country).

The development of a domestic industry and foreign investment

India has a solid domestic manufacturing base, including global leader Suzlon, accounting for over half of the market, Vestas Wind Tech and RRB. In addition, international companies have set up production facilities in India, including Enercon, Repower, Siemens and LM Glasfiber and the new entrants like ReGen Power Tech, WinWinD, Kenersys and Global Wind Power.

Over the past few years, both the government and the wind power industry have succeeded in injecting greater stability into the Indian market. This has encouraged larger private and public sector enterprises to invest in wind. It has also stimulated a stronger domestic manufacturing sector; some companies now source more than 80% of the components for their turbines in India.

Indian company Suzlon, the world's fifth largest turbine manufacturer, is now also well established in the international wind market beyond India, operating in 20 countries around the world and supplying turbines to projects in Asia, North and South America and Europe.

With input from the Indian Wind Turbine Manufacturing Association (IWTMA) and Greenpeace India.

Italy

Italy is still a long way from meeting its renewable energy targets. Both geothermal and hydro power generation are widespread, but they have limited potential for further development. The photovoltaic market is developing fast thanks to a good feed-in tariff system and new targets. Nonetheless, wind energy and biomass are the two renewable energy sources that are technologically developed and economical enough to help Italy reach its EU targets.

Pace of wind development picking up after a slow start

The Italian wind energy sector experienced significant growth in 2008. 1,010 MW were installed in 2008, reaching 3,736 MW of cumulative installed wind power capacity and a corresponding electricity production of more than 6 TWh. This represents about 2% of the country's total power demand.

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

According to the Italian Wind Energy Association (ANEV), 16,200 MW of wind energy could be installed by 2020, producing an additional 27 TWh of electricity. This would make up approximately 50% of the 2020 objective.

The regulatory environment for renewable energy in Italy

In 2002, the Italian government abandoned the feed-in-tariff, introducing a renewable energy quota system instead. This requires power producers and importers to produce a certain percentage of electricity from renewable sources. Green certificates are used to fulfil this obligation. The required share of renewable energy is designed to gradually increase over the years; from 4.55% in 2008 to 5.3% in 2009.

A financial law introduced in 2007 requires the individual regions to produce a share of total power consumption by renewable energy. Other measures to promote renewable power production include priority access to the grid.

Several factors hamper the development of renewable energy in Italy, including uncertainty due to political changes and ambiguities in the current policy design. In addition,

Troia S. Cireo wind farm (Photo: Enertad)

administrative constraints such as complex authorization procedures and high connection costs are further obstacles. However, a number of legislative measures introduced in 2008 were designed to address some of these problems.

Towards the end of 2008 the Italian government passed an important legal measure aimed at resolving many of the principal issues related to the value of green certificates (CVs). Specifically, the ministerial measure regulates the balance between supply and demand, to address the issue of speculative fluctuations. These fluctuations affected the value of CVs last year because they varied from a maximum of 95.83 €/MWh to a minimum of 54.17 €/MWh. The new

TOTAL INSTALLED CAPACITY

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

decree stipulates that CVs which exceed the demand can be returned to the GSE and will receive the average price of CVs over the past three years.

Another recent change was the introduction of the single, all-inclusive rate for wind energy plants with a capacity of up to 200 kW, which can alternatively opt for the CV system or a feed-in-tariff of € 0.30/kWh.

Recent amendments to the 2008 Finance Act and the Executive Decree of December 2008 added welcome certainty into the system, including a fixed reference price for CVs, which is calculated as the difference between 180,00 €/CV and the market electricity price. This assures that investors receive an adequate return on investment and, more importantly, instils greater trust in the current system.

15,000 people employed in the Italian wind sector

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

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

Outlook for 2009

While the wind industry may not suffer from the current financial crisis as much as some industries, there will nonetheless be some delay in achieving the ambitious objectives that have been set by the Italian government. Overall, the Italian wind energy sector is in good health, with bright prospects for the future. If the inadequacies are addressed , resulting in a decrease in the cost and time required to implement projects, the system will benefit significantly.

In addition, steps must soon be taken to implement the regional allocation of renewable energy targets and forge the local administrations to fulfil their allocated quotas, as provided for in the current law. If these measures are taken by the middle of 2009, the prospects for growth in the sector will be met and possibly exceeded.

With input from the Italian Wind Energy Association (ANEV)

Japan

Tomamae wind farm (Photo: Japanese Wind Energy Association)

Japan's wind energy industry has surged forward in recent years, partly spurred by a government requirement for electricity companies to source an increasing percentage of their supply from renewables. Development has also been encouraged by the introduction of market incentives, both in terms of the price paid for the output from renewable plants and in the form of capital grants towards clean energy projects. Power purchase agreements for renewables also have a relatively long lifespan of 15 to 17 years, which helps to encourage investor confidence. The result has been an increase in Japan's installed capacity from 136 MW at the end of 2000 to 1,880 MW at the end of 2008. In 2008, 346 MW of new wind capacity was added in Japan.

The policy framework

In pursuit of its Kyoto Protocol objectives, Japan has a target to reduce the level of its greenhouse gas emissions by 6% (compared with 1990 levels) in the period from 2008 to 2012. The official government target for wind power in Japan by 2010 is 3,000 MW, but judging from the current pace of installations, this target seems difficult to reach.

To help achieve these goals, the Japanese government introduced a Renewable Portfolio Standard (RPS) law in April 2003 with the aim of stimulating renewable energy to provide 12.2TWh (1.35%) of total electricity supply in 2010. RPS targets will be reviewed every four years, and a new target of 16.0 TWh (1.63%) by 2014 was established in 2007. The Japanese RPS law has a number of weaknesses, including a very low target, the inclusion of electricity generated by waste incineration as "renewable" and insufficient market incentives

Apart from the RPS, the Japanese wind industry also benefits from the government's initial subsidies such as the Field Test and New Energy Business Support Programmes.

The wind market

Wind power capacity in Japan increased quickly in the past ten years, but most recently the sector has experienced a slowdown.

There are four major reasons for this slowdown, namely extreme weather, the lack of a stable legal system, grid constraints and the stagnating economy.

Firstly, severe weather conditions are constraining growth of the Japanese wind market. The country has a history of severe weather, including typhoons blowing down turbines, lightning incidents, strong gusts and high turbulence. A number of turbines were severely damaged in 2004 and in 2007. Therefore, a safety standard designed for Japanese meteorological and geographical conditions is being developed to provide technical measures against typhoons and lightning strikes and to help future wind turbine development.

Improving the integration between the International Electro Technical Commission (IEC) standards and Japanese Industrial Standards (JIS) is an important task, because the aforementioned Japanese external conditions differ from those in IEC standards. The New Energy and Industrial Technology Development Organization (NEDO) and the Japan Electrical Manufacturers' Association (JEMA) support this task under METI's initiative to develop 'J (Japanese)-class wind models' with which any manufacturer can design a turbine any place in Japan. A guideline was created under the NEDO project for J-class wind turbines, which suggests some safety measures.

Secondly, the new Japanese building code became effective in June 2007, stipulating that a wind turbine 60m or taller

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008
MW	136	302	338	580	809	1,049	1,309	1,538	1,880

Nagashima wind farm (Photo: Japanese Wind Energy Association)

will be considered a building. Under this revised code, the installation of wind turbines needs the government's authorization, and the application procedure for planning permission is very complicated, time consuming and expensive. The new building code effectively paralyzed the Japanese market for a whole year, before the first project was authorized under the new code in July 2008. However, the permission process is more standardized now and many projects have been authorized.

Thirdly, grid infrastructure continues to be a challenge for wind development in Japan. The leading regions for wind power development in Japan are Tohoku and Hokkaido in the north of the country and Kyushu in the south. The greatest electricity demand is concentrated in the center of Japan, while most potential wind power sites are located in remote areas where grid capacity is relatively small.

Limited grid access and the monopolistic hold over the power grids by regional electricity companies, who use variability issues as an excuse for not investing in more capacity, have also hampered the development of wind generation. Both the Japanese Wind Energy Association (JWEA) and the Japanese Wind Power Association (JWPA) therefore support further R&D activity in the areas of grid stability, technical safety, offshore wind and generic advanced technologies.

Finally, a shortage of available turbines in Japan has led to high prices, which is further accentuated by the depreciation of the Japanese yen against the Euro. In recent months, turbine prices have fallen due to the appreciation of the Japanese yen against the Euro in the second half of 2008. As a result, developers are attempting to resurrect projects that have been shelved previously. Nonetheless, new installations in 2009 are not expected to be high due to long lead times for the delivery of wind turbines.

The wind turbine market in Japan

Japan now has four wind turbine manufactures; Mitsubishi Heavy Industry (MHI, 2.4 MW), Fuji Heavy Industry (2 MW), Japan Steel Works (JSW) (2 MW), Komai Tekko (300 kW). However, foreign manufacturers such as Vestas, GE and Enercon dominate the Japanese market.

Nagashima Wind Hill, the third largest wind farm in Japan, has 21 MHI 2.4 MW turbines and is one of the last wind farms to use these turbines. MHI stopped selling their turbines in Japan and now concentrates on foreign markets, even though it retains a domestic market share of 19%.

Despite its significant offshore wind energy potential, Japan has so far only developed 11 MW. The government has recently investigated the feasibility of offshore projects, and offshore wind measurements will start in 2009 under the NEDO project.

With input from the Japanese Wind Power Association (JWPA)

Mexico

Mexico is one of the most promising areas for wind energy development in Latin America with a technical potential of as much as 40 GW[1]. The energy regulator CRE has stated that Oaxaca's Isthmus of Tehuantepec zone has a world-class wind resource where average wind speed often exceeds 10 m/s, and the exploitable wind power potential exceeds 6,000 MW. Other excellent sites are located in Baja California, Zacatecas, Hidalgo, Veracruz, Sinaloa and Yucatan.

Despite this tremendous potential, wind development in Mexico has been slow, mainly due to the lack of adequate financial incentives and issues with the existing regulatory framework and policies to encourage use of wind energy. There are also other market barriers that have retarded wind development, including most recently the adverse effect of the global financial crisis.

Mexico has around 50 GW of total installed electricity generation capacity, which is made up of 49% petroleum products, 21.6% hydro, 19% natural gas, 10% coal, 2.8% nuclear and 2% geothermal power. The installed and operational wind capacity was only 87 MW at the end of 2008, consisting of the state electricity company CFE's La Venta I and La Venta II projects in Oaxaca. La Venta II (83.3 MW) became operational in January 2007. In 2008, no new wind generating capacity was connected to the Mexican grid.

Limited possibilities for private sector engagement

Mexico's constitution places the sole responsibility for electricity generation in the hands of the Federal State. The Federal Commission for Electricity (CFE), the state owned enterprise responsible for two thirds of Mexico's energy generation and nearly all of its transmission, is legally obliged to provide energy at the lowest cost. This has favoured the development of conventional energy sources in the past, as well as some large hydro and geothermal projects, all exclusively by CFE.

The Mexican government is seeking to expand utilization of wind energy, due to the expected decline in Mexico's fossil fuel reserves, its exceptional and largely unexploited wind resource, and continued electricity demand growth. As a result, the government has recently adopted policies to encourage the greater development of renewable energy, within its National Development Plan, its Sectoral Energy Programme, and as part of a new Renewable Energy Law. However, constitutional and regulatory limitations exist, which hinder the development of wind energy by the private sector.

In 1992, the Mexican Power Sector law was amended to open the door for some private sector participation, creating limited possibilities for self-suppliers, cogeneration and independent power producers to generate and supply power to the national grid. This, however, must not create competition with CFE and Luz y Fuerza, the state owned distribution company for Mexico City, which means that private projects cannot sell electricity directly to end users except through autogeneration ("Autoabastacimiento" or "Self Supply") schemes.

Under the *Independent Power Producer (IPP)* scheme, private producers with plants over 30 MW must sell their power to the CFE through long-term power purchase agreements (PPA), which are awarded through competitive bidding procedures based on the lowest average generation price. Since 1992, more than more than 20% of Mexico's power generation is supplied by IPPs using conventional thermal power generation.

Under the *autogeneration scheme*, power consumers can produce electricity for their own use, which will get delivered to the CFE interconnection point and then transported to the consumer. In 2007, the first private autogeneration wind projects were erected and are now undergoing commissioning. This has laid an important foundation for a more significant private sector led development of wind energy in the future.

There is also the possibility to produce electricity for export to another country, which in practice means the US.

The Mexican Energy Reform bill

In October 2008, the Mexican Congress approved the much debated Energy Reform Bill, which includes a renewable energy law to promote and regulate the development of renewables in Mexico: Renewable Energy and Energy Transition Financing Law[2].

1 Studies by ANES, AMDEE, IEE & NREL

2 Ley para el Aprovechamiento de Energías Renovables y el Financiamiento de la Transición Energética

TOTAL INSTALLED CAPACITY

year	2005	2006	2007	2008
MW	3	87	87	87

The law aims to promote the use of renewable energy in Mexico and to take best advantage of international mechanisms such as the CDM. It provides a framework for renewable energy development, which now needs to be filled in with detail, including a concrete target and incentives.

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 and related public policies, which also involve the private sector. The national energy commission CRE was put in charge of issuing administrative norms and methodologies to enable the use of renewable energy and to adapt the electricity dispatch provisions to take into account the technical requirements of renewables.

Finally, a Fund for the Energy Transition and the Use of Energy was created, initially worth 3 billion Mexican pesos (around 150 million EUR) in 2009. This fund is designed to establish a support system to promote the use of renewable energy.

Open Season for grid infrastructure

In 2007, a "Temporada abierta" ("Open Season") was launched by the Mexican government for reservations of electricity transmission capacity required to interconnect future private autogeneration wind farms in Oaxaca. This model aims at identifying the total transmission capacity that private generators are willing to reserve so that the CFE can justify construction of new lines for renewable energy. Private sector wind autogenerators are also required to pay for a portion of the cost of the new transmission facilities that are required.

During the first temporada abierta, an agreement was signed between the CFE and four private companies, committing the CFE to build 135 km of transmission lines from the La Ventosa project site in Oaxaca to connect it to the national grid. Another agreement for a transmission line of 154 km to Cerro de Oro was also concluded. Both projects are scheduled to be completed between 2010 and 2012.

The wind energy pipeline

Approximately 143 MW of private wind autogeneration capacity were erected in Oaxaca at three wind farms during 2008, to start commercial operation during 2009.

These include:
- the first 37 MW of the 250 MW Eurus wind farm in Juchitan, Oaxaca, developed by Acciona Energia which will supply 25% of Cemex's electricity;
- the first 79.9 MW of Iberdrola's La Ventosa wind project in Juchitan, Oaxaca
- Gamesa Energia's first 26 MW unit of its Bii Nee Stipa I wind farm in Juchitan, Oaxaca

Mexican state power company CFE plans to tender 600 MW of wind projects to IPPs during 2008-2014 in 100 MW increments. These wind IPP projects will operate under power purchase agreements (PPAs) with CFE for 20 years, including a fixed capacity charge, a fixed operation and maintenance charge and a variable energy charge based on fuel prices.

During 2008, a first tender for a wind IPP project was launched for the La Venta III wind farm (101 MW). However the bid process was declared to have failed by CFE and is expected to be re-bid during 2009. CFE is also expected to tender the Oaxaca I (101 MW) wind IPP. Both projects are scheduled to be operational by the end of 2010.

Overall, it is expected that up to 650 MW of wind capacity will be installed and become operational during the next several years under both the IPP (200 MW) and autogeneration schemes (450 MW), all located in Oaxaca. An additional 3.5 GW of private wind autogeneration projects are in developers' pipelines, 1.5 GW of which already have permits from CFE.

However, the pace of Mexican wind development has been negatively impacted by the market barriers cited above as well as more recently by the global financial crisis, but the Mexican Wind Energy Association (AMDEE) remains cautiously optimistic that by 2012, over 4,000 MW of wind farms could be operational in Mexico based on currently known or announced projects.

With input from the Mexican Wind Energy Association (ADMEE)

New Zealand

A tremendous untapped resource

New Zealand has an excellent wind resource, which is largely untapped. A study completed for the Electricity Commission (New Zealand's electricity market regulator) indicated that the country's economic wind resource is sufficient to meet annual demand several times over. The study identified that areas with an annual wind speed of greater than about 8.5 metres/second have the potential to generate over 50,000 GWh per year. An even larger resource was identified in the next band of wind speed, from 7.5 m/s to 8.5m/s. New Zealand's total electricity generation in 2007 was 42,374 GWh.

While this wind energy potential is unlikely to be realised in full because of economic, environmental and community considerations, it is realistic for wind to generate 15 to 20% of electricity by 2025.

Recent market developments

New Zealand's installed wind energy capacity grew from 322 to 325 megawatts during 2008. This small growth in installed capacity, however, does not adequately reflect the wind industry's activity over the year: while only 3.5 megawatts were installed, a further 187 MW are now under construction.

Meridian Energy's Project West Wind (142 MW), near Wellington, is expected to begin generation in April 2009 and be completed by the end of 2009. The completion of the Te Rere Hau wind farm (48.5 MW) will see New Zealand's installed wind capacity pass the 500 MW milestone in early 2010.

Three projects were granted final approval in 2008 (with a combined capacity of up to 350 MW), and projects ranging from a few megawatts to several hundred megawatts are progressing through the consenting process.

However, the financial crisis did not pass New Zealand by. Developers are assessing the economics of their consented projects in light of the tightening global credit markets and the fall in value of the New Zealand dollar against the Euro. It also remains to be seen if the slowing economy will reduce demand for electricity, and how this will affect short-term demand for new generation.

White Hill wind farm (Photo: Meridian Energy)

Nonetheless, NZ's wind energy industry is set to expand over the coming years, with interest in New Zealand's world class wind resource from local and international developers, an ambitious but achievable renewable electricity target, and policy developments that should benefit the industry.

Policy developments: a new government

In 2007, the Labour-led Government announced an ambitious target for New Zealand to generate 90% of its electricity from renewable resources by 2025. While this target appears ambitious, New Zealand already generates about 65-70% of its electricity from renewable resources, with roughly 55% of total generation coming from hydro, 10% from geothermal and 2.5% from wind.

A general election in November 2008 saw the incumbent Labour Government replaced with the centre-right National Party and its coalition partners. The global economy took centre stage in the election, pushing energy issues down the agenda despite winter supply issues.

The new National-led Government supports the target, but is concerned about security of electricity supply. This is a sensitive issue in New Zealand, as fluctuations in rainfall significantly impact hydro generation. Late 2007

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008
MW	36	36	36	36	168	168	171	322	326

to mid 2008 was one of the driest periods on record in the South Island hydro lake catchments. Low hydro lake levels resulted in a power savings campaign during the winter months, and highlighted the need for greater diversity in the energy sources used for generation and investment in the transmission system.

Uncertainty surrounds climate change policy

In late 2008, the Labour-led Government passed legislation to introduce an Emissions Trading Scheme (ETS) and a restriction to the development of new base load thermal generation. Following the election, the National-led government has instigated a review of the ETS and has repealed the restriction on thermal generation. The review of the ETS is expected to be concluded, and new legislation tabled in Parliament, by September 2009.

Under current legislation the electricity sector will enter the ETS in January 2010. This entry date is likely to be delayed as a result of the review. The ETS, in its current form, would require all thermal generators to purchase carbon offsets or credits equal to their total greenhouse gas emissions, with no free allocation of credits. It is not accompanied by any mechanisms that directly encourage the uptake of renewable generation.

The review is not expected to result in any change to this approach, so no feed-in tariffs or other support mechanisms are anticipated. While the mechanisms for pricing emissions and the timing for introducing the cost are unclear, it is still expected that generators will bear the cost of their emissions, and this will make wind energy one of the lower-cost options for new electricity generation.

Consenting improvements on the cards

Obtaining consent for wind farms under the Resource Management Act (RMA) continues to be a major obstacle for developers. Once consent has been granted to a developer by the local council to build a wind farm, anyone can appeal this decision to the Environment Court, resulting in an expensive repetition of the decision-making process. In recent years, all significant wind farm projects have seen their successful consent decisions appealed to the Environment Court. The Environment Court's decisions can then only be appealed to the High Court on a point of law.

In order to simplify the consent process for 'nationally significant' projects, the government is making greater use of the RMA's 'call-in' provisions, which can reduce the consenting timeframe by calling a project directly to the Environment Court, effectively cutting out the first step of the process.

Three wind farm projects have been called in during the past year, and a decision for the first of these is expected in the coming months. The industry continues to wait with interest to see whether these 'call ins' will establish any useful precedents.

The new National-led government has initiated a process to amend the RMA, with the intention to simplify the consenting process and reduce costs and delays. Draft amendments to the Act are expected to be tabled in February 2009. The government's longer-term objective is to create an Environmental Protection Agency to deal with consent applications for significant infrastructure projects, including large wind farms.

Transmission

Like many other markets, issues around the timing and extent of new transmission investment are looming as an issue for the wind industry.

New Zealand's electricity market rules require Transpower, the owner and operator of the transmission system, to demonstrate that any new transmission investment provides a net economic benefit. This creates a vicious circle, in which no new generation will proceed without adequate transmission capacity in place, yet that capacity is unlikely to be built unless it can demonstrat that the new generation will definitely be installed.

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

Poland

Lake Ostrowo (Photo: Wind Power Works)

The fastest developing new EU member state

Poland is one of the most promising wind energy markets in Europe. Large areas of the country have favorable conditions for wind power generation, with average wind speeds between 5.5 and 7.0 m/s (at 50 meters). According to the Polish Wind Energy Association, 11-14 GW of wind energy could be installed in Poland by 2020.

In 2008, the Polish wind market continued its growth by adding 196 MW of new capacity, taking the total installations up to 472 MW, representing an annual growth of 58%. 722 GWh of wind power were produced in 2008, generating 1,107 certificates of origin (green certificates).

Ten wind farms larger than 10 MW are currently operating in Poland, and there are also single turbines or clusters of small turbines spread across the country.

Operating wind farms in Poland > 20 MW

LOCATION	CAPACITY (MW)
Jagniątkowo	30.6
Kamieńsk	30
Karścino	69
Kisielice	40.5
Łosina k/Słupska	48
Ostrowo	30.6
Puck	22
Tymień	50
Zagórze	30
Zajączkowo & Widzino	90

While onshore wind energy is progressing at a healthy rate, Poland does not have any offshore developments, and none are expected 2015, when about 500 MW are forecast to be developed. By 2020, offshore wind capacity could reach 1,500 MW.

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008
MW	4	18	59	60	65	84	153	276	472

Obstacles for wind energy development in Poland

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

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

There is also a problem related to the Polish Building Law and unclear legal definitions of which components of a wind turbine constitute a 'building'. Under the current definition, stamp duty needs to be paid not only on the foundation and the tower of a wind turbine, but also the generator, leading to much higher taxes.

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

The policy framework for wind

Poland depends on coal for 95% of its electricity production, and the country has some way to go to meet its target of producing 10.4% of its electricity from renewable energy sources by 2010 (up from 2.6% in 2005). According to the new EU Directive, Poland is legally bound to achieve a 15% share of renewables in its overall energy mix by 2020, up from 7.2% in 2005.

In 2000, the Polish government introduced a power purchase obligation for renewable energy sources, which was amended in 2003, and again in August 2008. This requires energy suppliers to provide a certain minimum share of power generated by renewable sources (from 3.1% in 2005 up to 10.4% in 2010 and 12.9% in 2017). While failure to comply with this legislation should, in theory, lead to penalties, the European Commission's 2007 report found that fines were not enforced.

In 2005, the Polish Law on Energy from 1997 was amended to introduce an obligation for all renewable energy producers, regardless of the size of the installations, to obtain a license from the Energy Regulation Authority. Following this new requirement, more than 600 producers of renewable energy applied for and received licenses for producing electricity from renewable sources.

In 2008, the Polish Economics Ministry drafted a new act amending the Energy Law, which was submitted to the Council of Ministers. Some provisions of the current draft, dated 17 February 2009, concern grid connection agreements and related charges.

The Polish government has also drafted a strategic document, which will be the starting point for a debate on the country's energy strategy. This has been sent to the energy sector for consultation, and will result in a draft document entitled *Energy policy of Poland up to 2030*. The main issues in this document include energy security, economic competitiveness and environmental protection.

Perspectives for wind energy development in Poland

According to the new EU Directive, Poland needs 15% of its final energy consumption to come from renewable energy by 2020. To date, the country has renewable energy production from biomass, biogas, wind and hydropower. Based of the number of applications received by the Energy Regulatory Office for issuing licenses for wind farms, a big increase in wind generating capacity is expected in the near future.

The Polish Wind Energy Association estimates that installed wind capacity will reach 2 GW by 2010, 5 GW by 2015 and 11-14 GW by 2020, translating into electricity production of 24-31 TWh. This would take Poland a long way towards meeting the EU target.

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

Spain

Spain is the world's third largest wind energy market, with 16,754 MW of total installed capacity. New installations in 2008 totaled 1,609 MW, in line with previous years. The developments in 2007, with over 3.5 GW of new capacity installed, must be considered an exception, as pending regulatory change brought about a higher than usual installation rate.

The Spanish market has been growing consistently and is likely to reach the government's 2010 target of 20 GW of installed wind capacity. In 2008, wind energy generated more than 31 TWh, delivering more than 11% of the country's electricity demand.

The socio-economic advantages of wind energy

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

The Spanish wind energy sector contributes more to the country's GDP than any other industry, according to a study entitled *The Macroeconomic Impact of the Wind Energy Sector in Spain*, published by the consultancy Deloitte in 2008. The Spanish wind industry exports equipment worth 2.5 billion Euros every year, invests around 200 million Euros in research and development activities and has created more than 40,000 jobs, including indirect employment and employment created by a large Spanish export industry producing components for the global wind market. Moreover, it avoided 18 million tons of CO2 emissions in 2008 and has been shown to reduce the electricity market price more than the premium it receives.

Wind energy targets

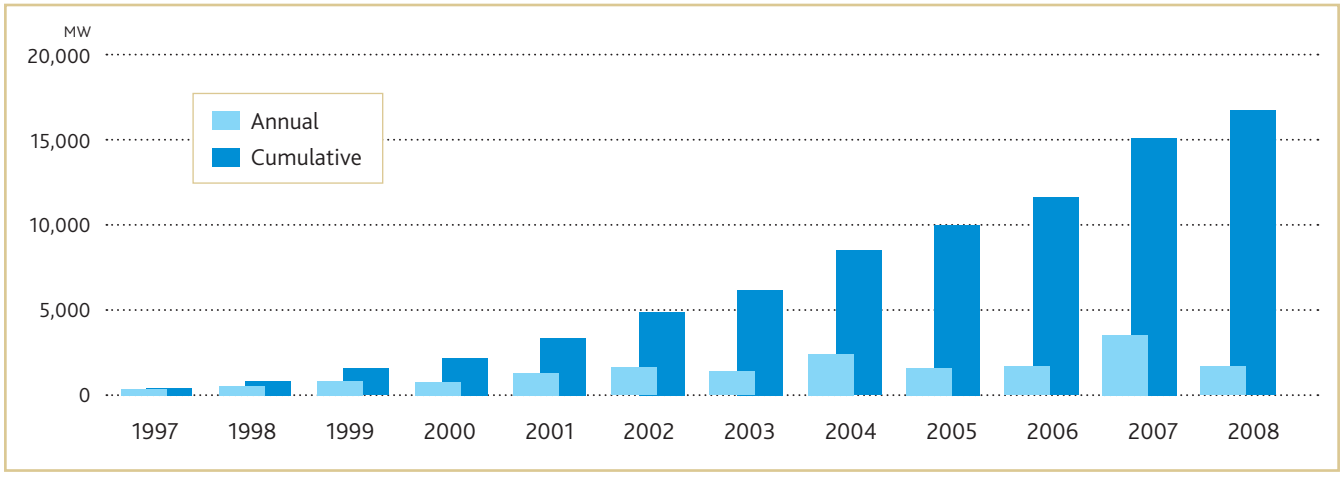
In 1999, the Spanish government set a target of achieving 12% of total energy consumption and 29% of electricity from RES by the year 2010. The EU RES Directive of 2001 stipulates that by 2010, at least 29.4% of gross electricity consumption should be met by renewable sources. In 2005, the Spanish government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

The new EU Directive for Renewable Energy has set a compulsory target of 20% of Spain's primary energy demand to be covered by renewable sources by 2020, up from 8.7% in 2005.

The Spanish feed-in tariff

The current tariff system entered into force in 1997, and was modified in 2004, 2006 and 2007, defining a feed-in mechanism for renewable power. There are different levels of tariffs depending on the technology and on the size of the installation.

ANNUAL AND CUMULATIVE WIND POWER CAPACITY IN SPAIN 1997-2008



Source: Observatorio Eolico AEE

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008
MW	2,235	3,337	4,825	6,203	8,263	10,027	11,623	15,145	16,754

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

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

Regulatory framework: New legislation entered into force in 2008

The existing Spanish fixed premium law was reformed in 2007, with a structure similar to the old system, i.e. a choice between fixed tariff and fixed premium, but with less favourable tariffs and a cap and floor mechanism for the fixed premium option.

For wind farms starting operations after 1 January 2008, the fixed tariff option is 7.32 €cents/kWh, which will be reduced to 6.12 €cents/kWh after 20 years of operation.

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

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

Outlook for 2009 and beyond

The Spanish wind power market is expected to continue its steady growth in 2009, with an estimated addition of 1,600 MW. Nonetheless, the sector will face two significant challenges; the uncertainty created by the economic crisis and the regulatory framework. The Spanish Wind Energy Association (AEE) has urged the government to come up with a clear, stable and predictable remuneration framework for the wind sector.

Maranchón wind farm (Photo: Wind Power Works)

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

With input from the Spanish Wind Energy Association (AEEolica)

Sweden

Current market situation

Sweden is the country with the highest proportion of renewable energy in the European Union, with 43.3% of total energy demand covered by renewable sources in 2007, up from 33.9% in 1990. Renewable electricity generation accounted for 18% of this figure, most of which is hydro.

Sweden is an attractive market for wind power development mainly due to very good wind resources and to the large size of the country and its relatively small population. According to the Swedish Wind Energy Association, the technical wind energy potential in Sweden is estimated to be around 540 TWh/year.

After a slow start, the Swedish support system is now starting to bear fruit, and some leading international wind power developers have entered the Swedish market.

Sweden is part of the highly integrated Scandinavian electricity system, which links it to Denmark, Norway and Finland. The country also has interconnections with the German and Polish electricity grids.

Compared to other European countries, the installed wind power capacity in Sweden is still very modest. In the last two years, though, Sweden's installed capacity doubled to reach 1,035 MW the end of 2008, with a wind energy fleet of 1,100 turbines. The amount of electricity generated from wind energy was 2 TWh in 2008, up from just 1.4 TWh in 2007. This accounted for some 1.5% of the total Swedish electricity consumption.

In spite of not having a support system for offshore wind development, Sweden is one of the leading offshore countries with an installed capacity of 133 MW.

Production targets

According to the new EU Renewables Directive, Sweden must supply 49% of its final energy consumption from renewable sources by 2020. In order to reach this goal, wind power development in Sweden must progress at a stronger rate than it has to date. This would require the removal of remaining barriers to wind development, such as the cumbersome permitting processes, the extensive appeals process and the lack of new grid construction.

Röbergsfjället wind farm (Photo: o2/Jocke Lagercrantz)

The Swedish Wind Energy Association estimates that Sweden will need to increase its wind energy production from the current 2 TWh to around 20 TWh in order to reach the 2020 target. The corresponding installed capacity will have to be about 6-9 GW, of which 2-3 GW could be offshore wind power. Annual installations will need to reach an average of 500-700 MW, a figure that, according to the association, could comfortably be achieved.

Support system

In 2003, Sweden introduced a tradable green certificate support system, which gives producers of renewable electricity (wind, small hydro, biomass based CHP) economic support for every MWh they produce.

The current support system is designed to produce 17 additional TWh of renewable electricity by 2016, made up of 7-8 TWh of wind power, the same volume of biomass based CHP and about 2TWh of small hydro. The system encourages the cheapest means of production to be built first, which creates competition between wind, biomass and small hydro.

TOTAL INSTALLED CAPACITY

year	2002	2003	2004	2005	2006	2007	2008
MW	**304**	**399**	**442**	**500**	**572**	**788**	**1,021**

The Swedish system is a market based certificate programme in which the producer of renewable energy receives one certificate for every MWh of electricity produced. New production capacity can receive certificates for up to 15 years after production starts. After this time period, they are no longer eligible for additional certificates. The quota system has recently been extended to 2030 in order to give new generation capacity coming online in 2016 the ability to earn certificates for the maximum 15 years.

Utilities are required to meet a certain percentage of renewable energy by purchasing these certificates. Thus, market prices are set by the amount of certificates available and the amount of demand for these certificates.

On 5 February 2009, the coalition government reached an internal agreement to promote renewable energy further. The target for the certificate system will be increased to 25 TWh by 2020, which will allow for some 15 TWh of onshore wind power to be built. In addition, the government will develop a separate support system for offshore wind power.

The wind industry in Sweden

Sweden has no domestic wind turbine manufacturer. However, several Swedish companies produce and export various components, such as bearings, main shafts, generators and towers, to wind turbine manufacturers in Denmark, Germany and other countries. The total value of these exports is about 500 million Euros. ABB and SKF are well known examples of Swedish subcontractors.

Foreign companies are prominent in the Swedish wind power market and include Vestas (including two factories), Enercon (including tower manufacturing), Siemens, GE Wind, Suzlon and Nordex. WinWind of Finland has also entered the Swedish market through Dynavind, manufacturing towers.

Foreign developers and consulting companies have also established offices in Sweden, including Airtricity, RES, WPD and Statkraft among others.

Wind farms in Sweden

Sweden currently has six wind farms with an installed capacity of 15 MW or more in operation, with a further ten farms under construction, and an additional 18 large wind farms with all necessary permits in place. The expected electricity production from wind power is 3 TWh at the end of 2009 and 4 TWh at the end of 2010.

The largest operating wind farm in Sweden is Lillgrund with an installed capacity of 110 MW. This offshore wind farm is owned by Vattenfall and has been operating since December 2007.

The largest onshore wind farm under construction is Havsnäs with an installed capacity of 96 MW, scheduled to be completed in 2010.

Wind farms in Sweden (over 15 MW)

IN OPERATION

WIND FARM	OWNER	TWH/YEAR	MW
Bondön	Global Green Energy	0.08	35
Bliekevare	o2 Vindkompaniet	0.10	36
Saxberget	Stena Renewable Energy	0.11	34
Lillgrund	Vattenfall	0.33	110
Hedbodberget	Vindkompaniet	0.05	18
Säliträdberget	Vindkompaniet	0.05	16

UNDER CONSTRUCTION

WIND FARM	OWNER	TWH/YEAR	COMPLETION PLANNED
Uljabuouda	Skellefteå Kraft	0.085	2009
Laholm	Arise Windpower	0.072	2009
Dragaliden	Svevind	0.07	2008
Bliekevare	Vindkomapniet	0.1	2009
Gabrielsberget	Svevind	0.3	2009
Havsnäs	RES Skandinavien	0.23	2010
Storrun	DONG Energy/ Borevind	0.08	2009
Hedbodberget	Vindkompaniet	0.05	2009
Säliträdberget	Vindkompaniet	0.05	2009
Gässlingegrund	Vindpark Vänern	0.075	2008/09
Hud/Kil	Rabbalshede Kraft	0.058	2009/10
Brattön	Rabbalshede Kraft	0.06	2010-12
Hörnefors	Umeå Energi	0.56	2009

With input from the Swedish Wind Energy Association

Turkey

Turkey's economy, which is growing at around 8% per year, is hungry for energy. At the moment, with around 42 GW of total installed power generation capacity, the country gets one third of its electricity from hydroelectric generation, one third from natural gas and one quarter from coal. The rest is made up of liquefied petroleum gas, wind energy and other sources. Power demand has been growing by about 9% each year, and power shortages are already widespread.

Turkey has very limited oil and gas reserves and is therefore looking at renewable energy 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 recent ratification of the Kyoto Protocol as an Annex I country, policy makers increasingly recognize the potential role of wind power as part of the country's future energy mix.

A Wind Atlas of Turkey 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

Recent years have seen the start of a wind energy boom in Turkey. Following a call for tender at the end of 2007, a record number of 751 projects were received by EMRA in one day, totaling 78 GW. Since then, EMRA has issued about 5,000 MW worth of licenses for wind energy generation.

In 2008, 286 MW of new wind energy capacity were added in Turkey, bringing the total up to 433 MW. A further 402 MW are under construction and 668 MW have secured supply contracts for wind turbines. The remaining projects are still securing turbines and awaiting planning permission.

However, experts caution that Turkey's transmission infrastructure needs substantial upgrades in order to allow such large scale developments to be connected to the power grid.

(Photo: Turkish Wind Energy Association)

Bandirma Bares wind farm (Photo: Turkish Wind Energy Association)

OPERATIONAL – 433.35 MW

LOCATION	COMM. DATE	MW	TURBINE MANUFACTURER
İzmir-Çeşme	1998	1.50	Enercon
İzmir-Çeşme	1998	7.20	Vestas
Çanakkale-Bozcaada	2000	10.20	Enercon
İstanbul-Hadımköy	2003	1.20	Enercon
Balıkesir-Bandırma	2006	30.00	GE Energy
İstanbul-Silivri	2006	0.85	Vestas
İzmir-Çeşme	2007	39.20	Enercon
Manisa-Akhisar	2007	10.80	Vestas
Çanakkale-İntepe	2007	30.40	Enercon
Çanakkale-Gelibolu	2007	14.90	Enercon
Hatay-Samandağ	2008	30.00	Vestas
Manisa-Sayalar	2008	30.60	Enercon
İzmir-Aliağa	2008	42.50	Nordex
İstanbul-Gaziosmanpaşa	2008	24.00	Enercon
İstanbul-Çatalca	2008	60.00	Vestas
Balıkesir-Şamlı	2008	90	Vestas
Muğla-Datça	2008	10.00	Enercon

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008
MW	19	19	19	20	20	20	50	147	433

UNDER CONSTRUCTION – 402.4 MW

LOCATION	COMM. DATE	MW	TURBINE MANUFACTURER
Hatay-Samandağ	2009	35.10	Nordex
Hatay-Samandağ	2009	22.50	Nordex
Aydın-Didim	2009	31.50	Suzlon
İzmir-Çeşme	2009	15.00	Nordex
İzmir-Çeşme	2009	22.50	Nordex
Manisa-Soma	2009	140.80	Enercon
Osmaniye-Bahçe	2009	135.00	GE Energy

CONTRACTED PROJECTS – 558.2 MW

LOCATION	COMM. DATE	MW	TURBINE MANUFACTURER
Balıkesir-Susurluk	2009	19.00	Enercon
Balıkesir-Bandırma	2009	45.00	Vestas
Tekirdağ-Şarköy	2009	28.80	Enercon
Balıkesir-Havran	2009	16.00	Enercon
Çanakkale-Ezine	2009	20.80	Enercon
Hatay-Belen	2009	30.00	Vestas
Manisa-Kırkağaç	2009	25.60	Enercon
Edirne-Enez	2009	15.00	-
İzmir-Aliağa	2009	30.00	Enercon
İzmir-Aliağa	2009	90.00	Nordex
İzmir-Aliağa	2010	30.00	Enercon
İzmir-Foça	2010	30.00	Enercon
Balıkesir-Kepsut	2010	54.90	Enercon
Manisa-Soma-Kır.	2010	90.00	Nordex
Balıkesir-Kepsut	2010	142.50	Nordex

A blade manufacturing facility is under construction in the Izmir Free Trade Zone area. It is a joint venture between Demirer Holding and Enercon, and is expected to exports its products to Italy, Greece, the Balkans, the Middle East and other regions.

Policy environment

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

(Photo: Turkish Wind Energy Association)

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

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

With input from the Turkish Wind Energy Association

United Kingdom

Burbo Bank wind farm (Photo: Wind Power Works)

In 2008, the UK installed 3,240 MW of wind energy capacity, and there are another 8, 827 MW of projects either under construction or awaiting planning permission. After failing to pick up the pace of development in the 1990s and struggling to reach 1 GW of installed capacity, a clearly revitalized and reenergized UK wind sector has delivered over 2 GW since 2006, and continues to attract interest from developers and investors.

The UK government published a Renewable Energy Strategy in June 2008 which proposes 14 GW of onshore and 14 GW of offshore wind by 2020. This would increase the current installed capacity by eight times in 12 years, a necessary step towards meeting the UK's obligation under the EU Renewables Directive of providing 15% of final energy consumption from renewable sources by 2020.

Leader in offshore wind

The Renewable Energy Strategy, currently under consultation, will help cement the country's position as a world leader in offshore wind, a position that the UK reached in 2008 with a cumulative offshore capacity of 566 MW.

The offshore sector received another major boost earlier in the year with an announcement by the Crown Estate, the Government agency in charge of managing the sea bed and the coastal waters. It was announced that land for 25 GW of offshore development could be available in UK coastal areas, and this announcement has received a great deal of interest from developers.

Policy developments: the Energy Act

2008 was an important year for the wind sector in terms of legislation, with a number of bills making their way through the UK Parliament.

Building on its Energy Review from 2007, in January 2008 the UK government introduced legislation amending its energy policy. The Energy Act was adopted by Parliament in 2008 and its various provisions entered into force from 26 January 2009. The main provision for renewable energy is the introduction of a feed-in tariff for projects up to 5 MW, which is aimed at encouraging smaller scale deployment. The government has announced that a feed-in tariff will be introduced by April 2010.

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008
MW	406	474	552	648	888	1,353	1,962	2,406	3,241

The Renewable Energy Strategy consultation from June 2008 will be followed by a second more detailed consultation in the summer of 2009, which will examine how the two systems can be harmonized and determine the way in which different technologies will be supported. This second consultation might also reexamine the 5 MW cap on feed –in tariffs.

The British Wind Energy Association (BWEA) has voiced concerns that the feed-in tariff could lessen support for the need to build large Renewable Energy Obligation (ROC) supported projects and has called for an effective harmonization of the feed-in tariff with the existing ROC system.

Another piece of legislation, the Planning Act, was passed in November 2008. Its main purpose is to deal with large infrastructure projects, and not renewable energy developments, so its impact on the large backlog of wind energy development applications is bound to be insufficient. However, the government has made repeated promises that the Infrastructure Planning Commission, created by the act, will be well resourced and equipped to deal with both onshore and offshore applications, which include wind projects of more than 50 MW onshore and more than 100 MW offshore.

The Marine Bill

Moving forward in 2009, the industry is keenly following the current progress of the Marine Bill, a first of its kind bill which will regulate and protect the UK sea environment. Government ministers have repeatedly emphasised the need to balance the interests of all sea users, while protecting the marine environment for future generations. As the bill made its way through Parliament, there was a positive signal for potential Round 3 developers from the government's Offshore Energy Strategic Environmental Assessment (SEA). It concluded: 'there are no overriding environmental considerations to prevent the achievement of the offshore... wind elements of the programme.'

Although not part of the Parliamentary procedure around the Marine Bill, the SEA is a necessary stage in obtaining planning permission. It gives an overall strategic view of location suitability and any environmental concerns that government agencies might have in connection with the building programme.

Offshore wind development in the UK has had three phases (rounds). Each round starts by setting aside zones for proposed wind development. Companies are then invited to bid for sites, and once awarded, lease holders can submit planning applications. Round 1 & 2 sites, awarded in 2000 and 2003, are now mostly built or under construction, with the total installed capacity expected to reach 8 GW. The round 3 development process, which was launched in June 2008, could result in construction of up to 25 GW of additional offshore wind capacity.

Public acceptance: 80% support for wind energy

Public acceptance of wind energy has been one of the main stumbling blocks hindering developments in the UK, and this was influenced by media reporting of the issue.

Recently, however, the media's tone has changed. Renewable energy in general and wind energy in particular received a great amount of media interest in 2008.The main national daily newspapers were broadly supportive of the industry's objectives, with the quality and depth of coverage noticeably picking up throughout 2007 and in 2008. The Times, the Guardian, the Financial Times and the Independent covered in detail the important developments, dedicating considerable resources to wind energy news.

Research on attitudes to wind energy conducted by the UK's Department of Business, Enterprise and Regulatory Reform published in June 2008 found that 84% of the UK public supports renewable energy and 80% supports wind energy.

With input from the British Wind Energy Association (BWEA)

United States

Horse Hollow wind farm, (Photo: Wind Power Works)

Continuing boom of US wind sector in 2008

The US wind industry continued to grow at a record-breaking rate in 2008, installing 8,358 MW, an increase in generating capacity of 50% in a single calendar year. In 2007, the industry grew by 45%, adding 5,244 MW. The industry has grown an average of 32% annually for the past five years.

The 2008 growth represented about 42% of new electricity generating capacity added in the United States during the year, establishing wind as a mainstream energy source for the country, second only to natural gas in new generating capacity, and number one ahead of new natural gas in net new generating capacity (counting retired plants), according to initial estimates.

US total wind generating capacity is now more than 25,170 MW, producing enough electricity to power the equivalent of close to 7 million households and to meet over 1% of total US electricity demand.

Outlook for 2009: Impacts of the financial crisis

Even with the outstanding results for 2008, the outlook for 2009 is for slower growth because economic conditions in the United States have reduced financing available for new projects. This in turn is dampening orders for new turbines and beginning to cause layoffs in component manufacturing.

The hope, however, is that with a supportive President and Administration, more favorable policies will be put in place for wind power. In February 2009, the US Congress passed an economic stimulus bill, which includes several provisions to spur development of wind energy in the current adverse economic climate, such as:

- a 3-year extension of the Production Tax Credit (PTC) beyond 2009;
- an option to elect a 30% Investment Tax Credit (ITC) in place of the PTC. This credit can then be converted into a grant for projects beginning construction or starting operation in 2009;
- a new $6 billion Department of Energy (DOE) renewable energy loan guarantee program;
- targeted provisions to encourage investment in new transmission to facilitate the expansion of renewable electricity generation.

Texas remains clear wind leader

Wind generating facilities are now located in 34 US states, with Texas still the number one wind producing state. Iowa passed California to take the second spot in 2008. The five leading states in terms of installed capacity are now:

- Texas: 7,116 MW
- Iowa: 2,790 MW
- California: 2,517 MW
- Minnesota: 1,752 MW
- Washington State: 1,375 MW

TOTAL INSTALLED CAPACITY

year	2000	2001	2002	2003	2004	2005	2006	2007	2008
MW	2,578	4,275	4,685	6,372	6,725	9,149	11,575	16,824	25,170

85,000 wind jobs in the US

As the US industry has grown rapidly in the past few years, it has created accelerated demand for US manufactured components, and 70 manufacturing facilities have opened, been expanded or announced since the beginning of 2007, including 55 in 2008 alone. As a result, about 50% of turbine components are made in the US today, making wind a job dynamo and a bright spot in the US economy. The US wind industry now employs more than 85,000 workers.

Policy outlook for 2009 – the Obama factor

The production tax credit, the incentive that has helped to fuel the recent growth in US wind energy, was extended at the end of 2008 for another year, and is expected to get a multi-year extension from the US Congress during 2009. But the positive impact of the tax credit has been greatly diminished because the US economic slowdown has reduced the number of investors seeking to reduce their tax liabilities. As result, the wind industry has been urging Congress to adjust or replace the production tax credit with a different incentive temporarily so that investment continues to spur growth in the industry.

Beyond short-term action in an economic stimulus bill, the election of President Barack Obama has increased the chances that the US will adopt a broad range of energy policies that are favorable toward wind and other forms of renewable energy. Obama ran for office pledging to increase the use of renewable energy, create millions of "green" jobs and take steps to build a green "transmission superhighway" that will spur the use of more renewable energy for electricity generation.

These campaign promises are expected to lead to a number of legislative proposals, including:

- a national "renewable electricity standard" that would require all electric utilities to generate a certain percentage of power from renewable sources, including wind;
- climate change legislation to curb greenhouse gas emissions through a cap and trade program;
- regulatory changes to facilitate the planning and building of a national clean energy transmission system.

The Obama Administration has stressed that its green energy policies will create new jobs as well as reduce greenhouse gas emissions and strengthen energy security. For a detailed description of the policies which the US wind energy industry hopes the new Administration will enact, see www.newwindagenda.org.

Wind power has now become an icon as well as a driver of the "new clean energy economy" in the US. Before the election, in mid-2008, the spike in oil prices brought renewed interest in renewable energy as a replacement for fossil fuels, especially after T. Boone Pickens, a veteran oil billionaire, undertook a nationwide media campaign proposing that oil imports be reduced by using natural gas for automotive transport and making up the shortfall in electricity generation with wind.

Looking ahead, in spite of the concerns about the deepening economic and financial crisis, the wind energy industry is in a strong strategic position thanks to the fundamental drivers behind its growth. In 2008, the US Department of Energy released a ground-breaking report, finding that wind power could provide 20% of US electricity by 2030 (www.20percentwind.org). With the wind energy industry's strong performance in 2008 and the support of the new Obama Administration, the industry seems set to turn that very achievable scenario into reality.

With input from the American Wind Energy Association (AWEA)

About GWEC

GWEC
GLOBAL WIND ENERGY COUNCIL

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

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

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

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

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

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

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

With a combined membership of over 1,500 organisations involved in hardware manufacture, project development, power generation, finance and consultancy, GWEC's members represent the entire wind energy community. Including:

- Over 1,500 companies, organisations and institutions in more than 60 countries
- The world's major wind turbine manufacturers
- 99% of the world's 121 GW of installed wind power capacity

Join GWEC today.

www.gwec.net

WIND POWER WORKS

Wind Power Works is a global campaign to promote wind power as a key solution to combat climate change. The campaign is led by GWEC and backed by industry and associations around the world.

See www.windpowerworks.net for more detail.

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