

A large white wind turbine is the central focus, set against a backdrop of rolling hills under a warm, orange-hued sky at sunset. The turbine's blades are spread out, and its nacelle is visible. The overall scene is serene and emphasizes renewable energy.

# GLOBAL WIND REPORT ANNUAL MARKET UPDATE 2014

**GWEC**

GLOBAL WIND ENERGY COUNCIL

# Navigating the global wind power market

The Global Wind Energy Council is the international trade association for the wind power industry – communicating the benefits of wind power to national governments, policy makers and international institutions. GWEC provides authoritative research and analysis on the wind power industry in more than 80 countries around the world.

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**Global Wind Statistics 2014** February 2015  
**Global Wind Report 2014** March 2015  
**Global Wind Energy Outlook 2014** October 2014  
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Our mission is to ensure that wind power establishes itself as the answer to today's energy challenges, providing substantial environmental and economic benefits.

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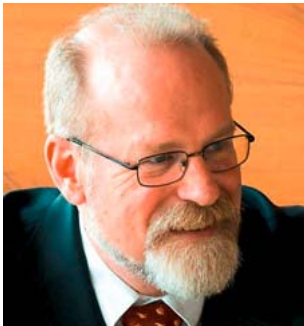
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# FOREWORD

2014 was a great year for the wind industry, setting a new record of more than 51 GW installed in a single year, bringing the global total close to 370 GW. We knew there would be a substantial recovery last year, but nobody predicted that China would install 23 GW of new wind power alone (another record); and that explains most of the difference between our projection last year of 47 GW and the actual 51 GW that was installed. Elsewhere in Asia, India had an unspectacular year, but we expect great things from India in the coming 5-10 years as the new government's renewables push gets underway; and there were significant new installations in Pakistan and the Philippines, helping Asia to once again lead all regional markets and pass Europe in terms of cumulative installed capacity.



Europe also provided us with a surprise, albeit much less dramatic, in the sense that the annual market grew by about 5%, where we were looking for a small downturn. Germany also set a new record, installing nearly 5,300 MW, which is the first time any country other than China or the US has installed more than 5,000 MW in a single year. The UK, Sweden and France had good years, and as did Poland and Turkey.

The US market recovered substantially in 2014, and we expect it to recover further in 2015. The same can be said of Canada, although both markets at this point in time look like they will run up against a policy vacuum of one sort or another sometime in 2016. Mexico will take up some of the slack, as the process of embedding its energy reform process moves ahead, with ambitious targets for the rest of the decade.

The 2014 Latin American market tripled in size compared with 2013, for cumulative installed capacity growth of nearly 80%. Brazil led the market, at #4 in the world with nearly 2,500 MW installed last year, and moved into 10th place in the global cumulative rankings. Chile and Uruguay also posted strong numbers, and the region is now finally starting to tap into its huge wind power potential.

The big new story in 2014 was South Africa, where the market finally took off in 2014, installing 560 MW, with much more to come. Morocco chipped in with Africa's largest wind farm, the 300 MW Tarfaya project, and it seems as though Africa is set to boom, North, South and East, with West Africa coming along a bit later.

The two big stories in 2014 and going forward continue to be the precipitous drop in the price of oil, and growing concerns about climate change, leading up to the COP 21 summit in Paris at the end of 2015. It's often suggested that the lower oil prices will have an effect on the wind sector, but there's no evidence of that yet – by and large, we don't compete with oil, and the price of gas is no longer tied to the price of oil as closely as it once was.

It is also unfortunately the case that there is little evidence so far that the new agreement which will emerge from the Paris talks will have much of a direct, short term impact on renewables deployment. There's still time for that to change, and the recent news from the IEA about energy sector emissions plateauing in 2014 gives hope to all and sundry that we can in fact tackle the climate change problem, and wind energy will be a big part of that.

It's safe to say that the main drivers for wind energy in most of the growth markets of late have been on the one hand wind's increasingly competitiveness – the number of markets where wind competes successfully on price against heavily subsidized incumbents continues to grow; and the need to fight the choking smog that is making an increasing number of the developing world's major cities (not only in China) unlivable. Energy security, cost stability, insulation of national economies from the price shocks in the international fossil markets, job creation and local industrial development as well as environmental considerations are all still present, but price, speed of deployment and fighting local air pollution have been the main drivers in most of the major growth markets this year. As for 2015, we're projecting another 50+ GW year, and continued growth from there.

This is the tenth annual report on the status of the global wind industry by the Global Wind Energy Council. It provides a comprehensive overview of the global industry at a moment in time; an industry now present in more than 80 countries, 24 of which have more than 1,000 MW installed, and 11 with more than 5,000 MW. The information contained in the report – market data, profiles and analysis have been collected primarily through GWEC's member associations and companies around the world, as well as from governments and independent analysts. We thank all our contributors and look forward to continuing our close cooperation in the future.

March 2015



**Steve Sawyer**  
Secretary General  
GWEC



**Klaus Rave**  
Chairman  
GWEC

Our belief in renewable energy is unwavering; it is our future. That is why Vaisala has consciously made a stronger commitment to the renewable energy industry through the acquisitions of Second Wind, wind measurement experts, as well as 3TIER, a global renewable energy assessment and forecasting consultant. As a company with sustainability values at its core and nearly 80 years of experience supporting weather-impacted businesses, we saw a big opportunity to improve the profitability and viability of renewable energy by helping customers understand weather accurately, and how it impacts their investments and operations.



## FOREWORD FROM OUR SPONSOR

# MAKING THE COMMITMENT TO RENEWABLE ENERGY

**Kenneth Horhammer**  
*Director of Energy, Vaisala*

While we still have a long way to go before the amount of installed renewable generation is large enough to significantly reduce carbon emissions, there is a growing understanding that if you are in the energy industry, you had better start looking at balancing renewables and fossil fuels in your portfolio.

In growing markets, such as India, China and Latin America, the demand for power is great, yet some difficult lessons have already been discovered. Shortcuts in development or operations do not speed the ability to meet the demand, but actually slow it. These markets have an excellent opportunity to learn from some of the growing pains experienced within more mature markets like the US and Europe. Shortsighted or overaggressive public policies and also widespread project underperformance can be avoided by taking advantage of now well-tested industry best practices and more sophisticated methods for project and business development, finance, and market structuring.

Government policy and decision making play a large role in the development and implementation of renewable energy. For example, last year's election of Narendra Modi as India's Prime Minister heralds much promise for renewable energy throughout the country. This event is certainly welcome. However, it is critical that the incoming policies are designed to provide enduring support for India's energy transformation with a healthy industry and strong future in mind.

Furthermore, as wind energy continues to grow, there is some truth to the observation that the best sites, the windiest sites, are already developed. The new generation of turbines allows sites that are slightly less windy to still be feasible economically, but doing so requires even more careful investigation of the resource characteristics and energy potential.

According to EIA, the US Energy Information Administration, US wind capacity grew by 7.7% in 2014, and is forecast to increase by 16.1% in 2015 and rise another 6.5% in 2016. The on-again-off-again nature of renewables in the US market is an issue of politics and incentives. While the politicians debate over which industry to subsidize, the renewable energy business has been steadily decreasing costs and increasing efficiency; so much so that renewables in many cases can now be cost competitive with other forms of energy without any subsidies whatsoever. Combine this lower cost with requirements to remove carbon from our power system, and the future looks very bright for renewables in the US.

Wind energy capacity in Europe increased 10.5% year on year from 2013, with cumulative installations now standing at 128.8 GW in the EU. Most of the activity is concentrated in key countries, which should be the trend in 2015 as well. Overall, the EU will have to continue its drive toward sustainable and homegrown energy that will guarantee Europe's energy security and competitiveness for the long-term.

The industry is doing its part. Over the past few years, it has dramatically improved return on investment as well as the certainty of energy production and project performance. However, some questions remain. Will there be a carbon tax? Will we invest in next generation grid infrastructure? Who will tell displaced fossil plants to shut off? No matter what the policy structure looks like, the industry needs it to be long-term, consistent and forward thinking. This is critical, yet the industry must also continue advancing our techniques around siting, financing, and integration and increase the efficiency of our technologies. We must continue to make renewable energy an attractive investment and remove cost and risk from the renewable versus fossil fuel debate.



## GLOBAL STATUS OF WIND POWER IN 2014

The Zafarana windfarm, Egypt © New & Renewable Energy Authority, NREA, Egypt

2014 was a record year for the wind industry as annual installations crossed the 50 GW mark for the first time. More than 51 GW of new wind power capacity was brought on line, a sharp rise in comparison to 2013, when global installations were just over 35.6 GW. The previous record was set in 2012 when over 45 GW of new capacity was installed globally.

In 2014 total investments in the clean energy sector reached a high of USD 310bn (EUR 277bn). The global wind sector saw investments rise 11% to a record USD 99.5bn (EUR 88.9bn<sup>1</sup>) during the year. This was significant growth over 2013 investment of USD 80.3bn (EUR 71.7bn<sup>2</sup>), and USD 80.9bn (EUR 72.3bn) in 2012<sup>3</sup>.

The new global total at the end of 2014 was 369.6 GW, representing cumulative market growth of more than 16%, which is lower than the average growth rate over the last 10 years (2005-2014) of almost 23%.

At the end of 2013, the expectations for wind power market growth were uncertain, as continued economic slowdown in Europe and political uncertainty in the US made it difficult to make projections for 2014, which we called at just over 47 GW, not anticipating the dramatic growth in the Chinese market.

China, the largest overall market for wind since 2009, had another remarkable year, and retained the top spot in 2014. Installations in Asia again led global markets, with Europe reliably in the second spot, and North America a distant third.

A result of this was that in 2014, as in 2013, the majority of wind installations globally were outside the OECD once again. This was also the case in 2010 and 2011, and is likely to continue to be so for the foreseeable future.

By the end of last year the number of countries with more than 1,000 MW installed capacity was 24: including 16 in Europe<sup>4</sup>; 4 in Asia-Pacific (China, India, Japan & Australia); 3 in North America (Canada, Mexico, US) & 1 in Latin America (Brazil).

By the end of last year six countries had more than 10,000 MW of installed capacity including China (114,609 MW), the US (65,879 MW), Germany (39,165 MW), Spain (22,987 MW), India (22,465 MW) and the UK (12,440 MW).

China in 2014 crossed the 100,000 MW mark, adding another milestone to its already exceptional history of renewable energy development since 2005. Largely

**GLOBAL INSTALLED WIND POWER CAPACITY (MW) – REGIONAL DISTRIBUTION**

		End 2013	New 2014	Total (End 2014)
AFRICA & MIDDLE EAST	Morocco	487	300	787
	South Africa	10	560	570
	Egypt	550	60	610
	Tunisia	245	-	245
	Ethiopia	171	-	171
	Cape Verde	24	-	24
	Other <sup>1</sup>	115	14	129
	<b>Total</b>	<b>1,602</b>	<b>934</b>	<b>2,535</b>
ASIA	PR China	91,413	23,196	114,609
	India	20,150	2,315	22,465
	Japan	2,669	130	2,789
	Taiwan	614	18	633
	South Korea	561	47	609
	Thailand	223	-	223
	Pakistan	106	150	256
	Philippines	66	150	216
	Other <sup>2</sup>	167	-	167
	<b>Total</b>	<b>115,968</b>	<b>26,007</b>	<b>141,964</b>
EUROPE	Germany	34,250	5,279	39,165
	Spain	22,959	28	22,987
	UK	10,711	1,736	12,440
	France	8,243	1,042	9,285
	Italy	8,558	108	8,663
	Sweden	4,382	1,050	5,425
	Portugal*	4,730	184	4,914
	Denmark	4,807	105	4,883
	Poland	3,390	444	3,834
	Turkey	2,958	804	3,763
	Romania	2,600	354	2,954
	Netherlands	2,671	141	2,805
	Ireland	2,049	222	2,272
	Austria	1,684	411	2,095
	Greece	1,866	114	1,980
	Rest of Europe <sup>3</sup>	5,715	835	6,543
<b>Total Europe</b>	<b>121,573</b>	<b>12,858</b>	<b>134,007</b>	
of which EU-28 <sup>4</sup>	117,384	11,829	128,790	
LATIN AMERICA & CARIBBEAN	Brazil**	3,466	2,472	5,939
	Chile	331	506	836
	Uruguay	59	405	464
	Argentina	218	53	271
	Costa Rica	148	50	198
	Nicaragua	146	40	186
	Honduras	102	50	152
	Peru	2	146	148
	Caribbean <sup>5</sup>	250	-	250
	Others <sup>6</sup>	55	28	83
	<b>Total</b>	<b>4,777</b>	<b>3,749</b>	<b>8,526</b>
NORTH AMERICA	USA	61,110	4,854	65,879
	Canada	7,823	1,871	9,694
	Mexico	1,917	634	2,551
	<b>Total</b>	<b>70,850</b>	<b>7,359</b>	<b>78,124</b>
PACIFIC REGION	Australia	3,239	567	3,806
	New Zealand	623	-	623
	Pacific Islands	12	-	12
	<b>Total</b>	<b>3,874</b>	<b>567</b>	<b>4,441</b>
<b>World total</b>	<b>318,644</b>	<b>51,473</b>	<b>369,597</b>	

Source: GWEC

1 Algeria, Iran, Israel, Jordan, Kenya, Libya, Nigeria

2 Bangladesh, Mongolia, Sri Lanka, Vietnam

3 Bulgaria, Cyprus, Czech Republic, Estonia, Finland, Faroe Islands, FYROM, Hungary, Iceland, Latvia, Liechtenstein, Lithuania, Luxembourg, Malta, Norway, Romania, Russia, Switzerland, Slovakia, Slovenia, Ukraine

4 Austria, Belgium, Bulgaria, Cyprus, Croatia, 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 Caribbean: Aruba, Bonaire, Curacao, Cuba, Dominica, Guadalupe, Jamaica, Martinica, Granada, St. Kitts and Nevis

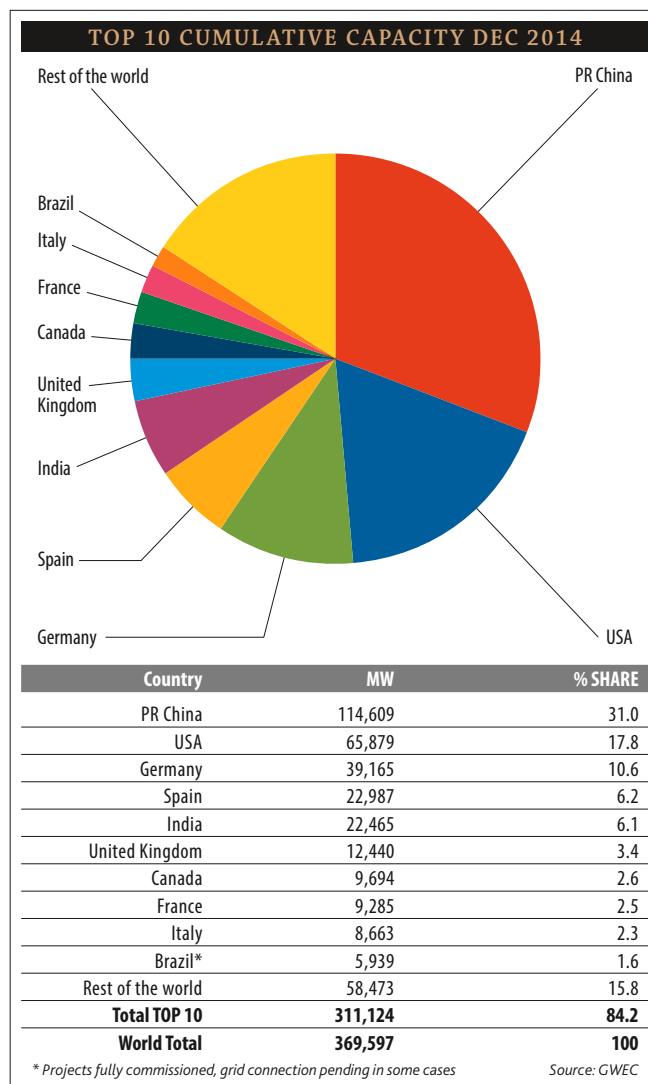
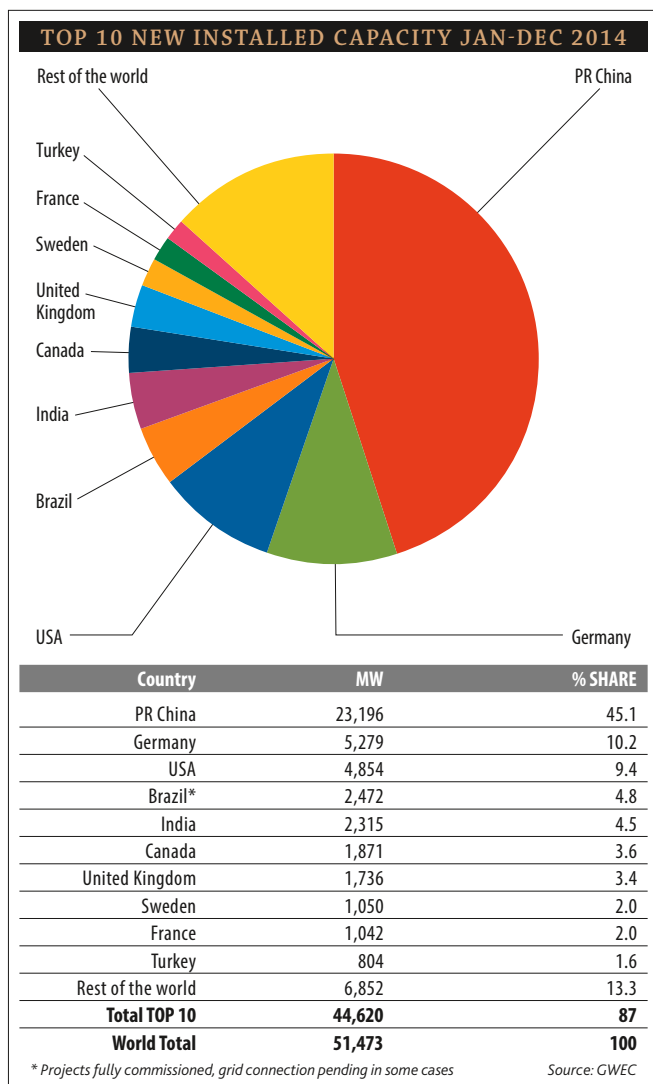
6 Bolivia, Colombia, Ecuador, Venezuela

**Note:**

Project decommissioning of approximately 523 MW and rounding affect the final sums

\* Provisional figure

\*\* Projects fully commissioned, grid connection pending in some cases



driven by China, Asia overtook Europe as the region with the most deployed wind capacity by the end of 2014.

Looking ahead, the picture is complex across various regions. 2015 is likely to be another good year: Europe's framework legislation and its 2020 targets ensure a degree of stability; the US and Canada are both anticipating strong years; China is expected to continue strong; and emerging markets in Africa and Latin America are expected to continue to grow. It is after 2015 or 2016 that policy uncertainty is likely to cause a downturn in North America, and perhaps elsewhere.

The political and regulatory support for wind across the two large Asian markets is on the rise. The slowdown in Asia in 2012-2013 was a result of a combination of factors, but these conditions were expected to be short-lived. In the next 4-5 years Asian dominance of global wind markets is expected to continue.

Brazil, Canada, Mexico and the US are expected to have a strong 2015. More than 934 MW came online in Africa this year. Global installations will be further aided by new projects coming on line in Japan, Australia, Pakistan, Kenya, and South Africa.

## ASIA: RECORD BREAKING YEAR FOR CHINA

For the seventh year in a row, Asia was the world's largest regional market for wind energy, with capacity additions totaling just over 26 GW.

In terms of annual installations **China** maintained its leadership position this year. China added just over 23 GW of new capacity in 2014, the highest annual number for any country ever. This is a significant gain over 2013 figures when China installed 16 GW of new capacity. China aims to nearly double its wind capacity to 200 GW by the end of 2020.

In 2012, wind-generated electricity in China amounted to 100.4 billion kWh, accounting for 2% of the country's total electricity output, up from 1.5% in 2011<sup>5</sup>. Wind provided 134.9 billion kWh of electricity in 2013, contributing 2.6% of the country's total electricity generation<sup>6</sup>. Total wind power generation reached 153.4 billion kWh in 2014, 2.78% of total electricity generation<sup>7</sup>.

The Chinese wind market almost doubled its capacity from 62 GW in 2011 to reach 114.6 GW by the end of





Fukushima Forward floating platform sets sail from Nagasaki port © Fukushima FORWARD Consortium

2014, cementing China's global lead in terms of cumulative installed wind power capacity.

All observers continue to be surprised by the astonishing track record for growth of the wind sector in China since 2006. The Chinese wind power market is now entering a more steady development and refinement stage. The current pace of growth in the Chinese wind power market may see a slowdown in 2016.

On-going curtailment of electricity generation is a challenge for wind power projects. However, this situation is getting better. The National Energy Administration (NEA) and State Grid are working to solve the transmission bottlenecks and other grid issues. The NEA is also actively encouraging wind farm development in lower wind zones that are closer to load centers.

**India** is the second largest wind market in Asia, presenting substantial opportunities for both international and domestic players. The Indian wind sector has struggled in the last couple of years to repeat the strong market performance of 2011 when over 3 GW was installed, and 2014 seems to signal the onset of a recovery phase.

India saw new wind energy installations reach 2,315 MW by the end of 2013, for a total of 22,465 MW. This pace of growth once again kept the Indian wind power market firmly in the top five rankings globally. The total grid

connected renewable energy installations in the country reached approximately 33,792 MW<sup>8</sup>. Wind power accounted for about 66.5% of total renewable energy capacity and about 11% of the total installed capacity of 260.8 GW at the beginning of 2015<sup>9</sup>.

The Indian government has recently committed to a target of 170 GW of renewables by 2022. The target includes achieving 100 GW of solar capacity and 60 GW of wind capacity by 2022. The government has also indicated its support for rapidly growing the power sector, renewables being a core part of this strategy. The goal is for renewables to reach a 15% share of energy mix in the next decade.

While the rest of Asia did not make much progress in 2014, there are some favourable signs on the horizon. The **Japanese** market saw new installations of 130.4 MW in 2014 to reach a cumulative capacity of 2,788.5 MW. This represents around 0.5 % of the total power supply in Japan. Japan is slowly moving towards a transformation of its energy system to allow for a more diverse energy mix including more wind power and other renewables. However, removing existing barriers will still take time. Offshore wind development, in particular floating turbines, is a promising prospect for the future.

Although **South Korea** still has "green growth" as one of its national development priorities, wind power is still





Scotland © Toby Smith

a relatively small energy generation technology, with 47.2 MW of new installations in 2014, bringing total installed capacity to just over 608 MW. The Korean government had earlier put forward a strategy for offshore wind development with a target of 2.5 GW by 2019.

**Pakistan** commissioned 149.5 MW of large-scale commercial wind farms in 2014, with total installed capacity reaching 255.5 MW by the end of the year. The **Philippines** saw 150 MW of new capacity installed in 2014, bringing its total installed capacity up to 216 MW. **Taiwan** added 18 MW of new capacity, bringing its total installed capacity to just over 632 MW. As for the rest of Asia, we expect new projects to come online in Thailand and Vietnam in 2015.

#### **NORTH AMERICA: RECORD INSTALLATIONS IN CANADA**

1,871 MW of new wind capacity came online in **Canada** in 2014, making it the sixth largest market globally. Com-

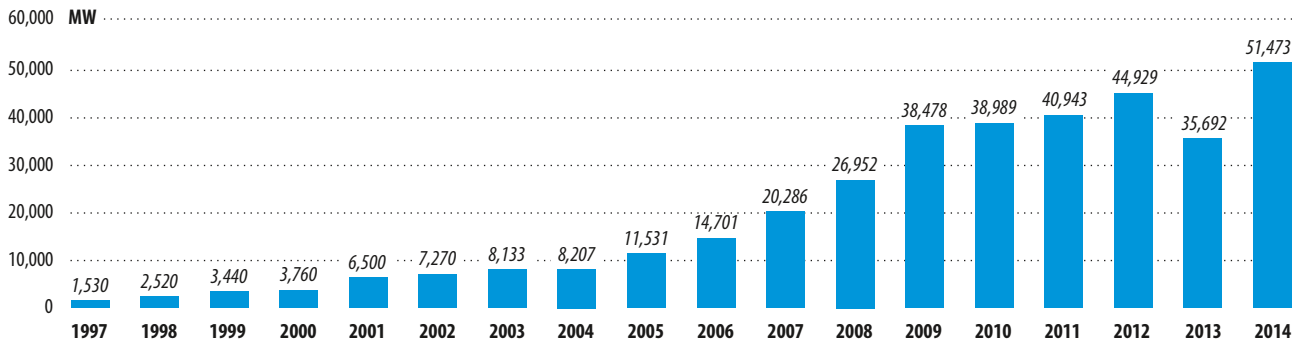
pared to 1,609 MW in 2013, Canada's wind power market saw significant growth in 2014, its best year ever. Canada finished 2014 with nearly 9,700 MW of total installed capacity, supplying approximately 4% of Canada's electricity demand.

In 2014, wind energy projects were built and commissioned in the Canadian provinces of Ontario, Quebec, Alberta, Nova Scotia and Prince Edward Island. Of the 37 new wind energy projects installed in 2014, 15 projects also include significant ownership stakes from First Nations, Municipal Corporations or local farmers.

Most of the growth was centered in the provinces of Ontario (999 MW), Quebec (460 MW) and Alberta (351 MW). The Canadian industry expects to see another record year in 2015.

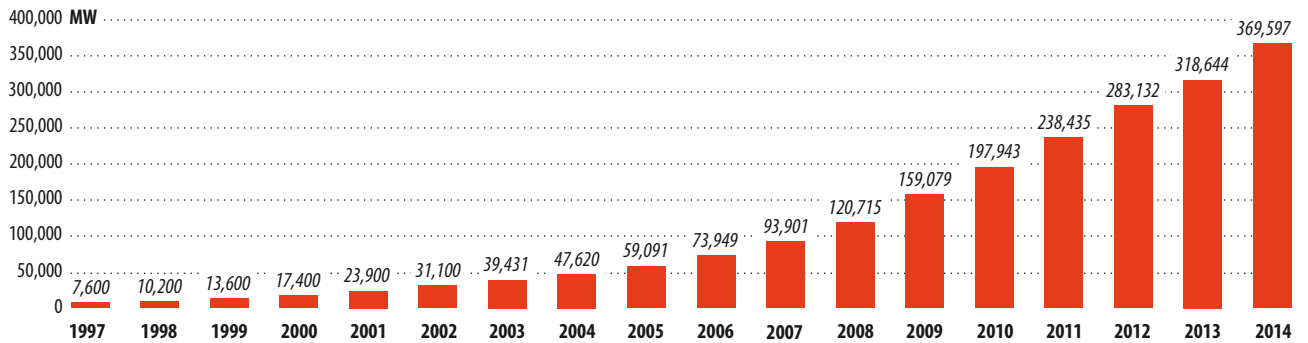
The **US** is the second largest market in terms of total installed capacity after China today. However, uncertain federal policies in the US continued to inflict a 'boom-bust' cycle on the country's wind industry. 2014 saw

### GLOBAL ANNUAL INSTALLED WIND CAPACITY 1997-2014



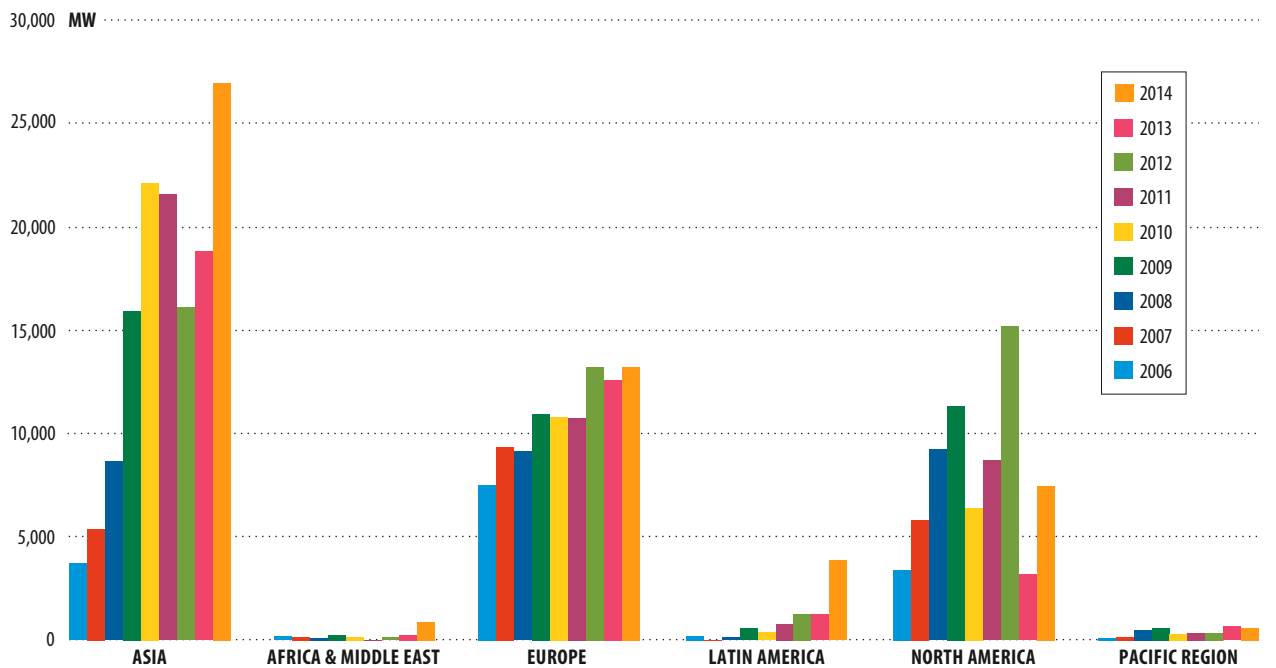
Source: GWEC

### GLOBAL CUMULATIVE INSTALLED WIND CAPACITY 1997-2014



Source: GWEC

### ANNUAL INSTALLED CAPACITY BY REGION 2006-2014



Source: GWEC

the US market rise with new installations of 4,854 MW bringing the total installed capacity to 65,879 MW. By the end of 2013, wind provided 5.23% of total installed generation capacity in the US<sup>10</sup>.

Wind energy accounted for almost 31% of all new generating capacity installed over the last 5 years (2009-2013), and provided more than 25% of the electricity in Iowa and South Dakota, and 12% or more of the generation in a total of nine states<sup>11</sup>.

In terms of annual capacity additions, Texas led the 2014 market with 1,811 MW, followed by Oklahoma (648 MW), Iowa (511 MW), Michigan (368 MW) and Nebraska (277 MW).

By the end of 2014, more than 12,700 MW of wind capacity was under construction across 98 projects in 23 states. The majority of wind construction activity (>7500 MW) was in Texas. There are 680 MW under construction in New Mexico, over 670 MW under construction in Kansas, 548 MW under construction in Iowa, and over 535 MW under construction in North Dakota<sup>12</sup>.

**Mexico** installed 633.7 MW of new capacity to reach a total of 2,551 MW by the end of 2014. Mexico's Energy Reform legislation was enacted in December 2013. Although over a year has passed, the process of embedding the reforms in legislation continues. Mexico has a target of 35% of electricity from renewable energy by 2024, and up to half of this target will need to come from wind. The market reforms for the electricity sector are expected to have a significant impact on the future of wind power in the country.

## EUROPE: STABILITY IN THE SHORT-TERM

During 2014 12,858 MW of wind power was installed across Europe, with the European Union (EU-28) member states accounting for 11,829 MW of the total. The European wind energy industry installed more new capacity than gas and coal combined in 2014. Across the EU-28 states the wind industry connected a total of 11,829 MW to the grid with coal and gas adding 3,305 MW and 2,338 MW respectively.

There are now almost 128.8 GW installed in the EU with a total cumulative capacity of 134 GW for all of Europe. Cumulative market growth in 2014 was 10.5%, although annual market growth was only 4.2% in the EU, and 5.1% in Europe as a whole. By the end of 2014 grid-connected wind power was enough to cover 10.2% of the EU's electricity consumption. Wind met 8% of EU electricity demand by end of 2013, up from 7% at the end of 2012, 6.3% at the end of 2011 and 4.8% at the end of 2009<sup>13</sup>.

The overall EU installation levels mask significant volatility across Europe. Germany and the United Kingdom accounted for 59.5% of total EU wind energy installations in 2014, installing 5,279 MW and 1,736 MW respectively. France at 1,042 MW and Sweden at 1,050 MW were the only two other markets to install over 1 GW in the year. Together these 4 countries account for over three quarters of all installations. In a number of previously

healthy markets such as Spain and Italy, installations slowed down significantly.

Over half of all new installations in 2014 were once again concentrated in just two countries (Germany and the United Kingdom). This is now a recurring trend, unlike previous years when installations were less concentrated and spread across many more healthy European markets.

Wind energy represented almost 44% of all new power capacity installed in the EU last year, and accounted for investments of between EUR 13 bn and EUR 18 bn.

Annual installations of wind power in the EU have increased over the last 14 years, from 3.2 GW in 2000, to 11.8 GW in 2014 at a compound annual growth rate (CAGR) of 9.8%. New wind capacity market shares were: Germany (44.8%), the UK (14.7%), Sweden (8.9%), France (8.8%), Poland (3.8%), Austria (3.2%), Romania (3%), Belgium (2.5%), Ireland (1.9%), and all others accounted for less than 10% in 2014.

The total installed offshore wind capacity for Europe now stands at 8,045 MW in 74 offshore wind farms in 11 European countries. Almost 1.5 GW of offshore wind was installed in 2014, 5.3% less than 2013. Offshore wind power installations represented 12.6% of the annual EU wind energy market, down from 14% in 2013.

The UK has the largest offshore wind capacity in Europe - 4,494 MW accounting for over 55% of all installations. Denmark follows with 1,271 MW or 15.8% of the market share. Germany is third with a 13% share, followed by Belgium with 713 MW for an 8.8% share, the Netherlands with 247 MW with a 3.1% share, Sweden with 212 MW and a 2.6% share, and others with less than 1% share including Finland with 26 MW, Ireland with 25 MW, Spain with 5 MW, Norway with 2 MW and Portugal with 2 MW installed capacity.

Weakened legislative frameworks, economic crises and austerity measures implemented across Europe are hitting the wind industry. The year ahead will be tough, and the long-term prospects for the wind industry are closely linked to the outcome of the debate over the EU's 2030 targets for climate and energy. In early February this year the European Commission's Energy Union proposal was made to establish post-2020 legislation for renewables. The plan is to put forward a Renewable Energy Package, possibly sometime next year<sup>14</sup>.

**Germany** had an exceptional year in 2014, both onshore and offshore. In 2014, a total of 5,279 MW was added to bring Germany's total installed capacity to over 39 GW, of which offshore wind accounted for over 1 GW, making Germany the third largest offshore market in Europe. The German wind industry expects another strong market in 2015.

The **United Kingdom** was once again the second largest market for wind in Europe, installing 1,736 MW, of which 923 MW was onshore and 813 MW was offshore. The UK is the largest offshore wind market in the world with total installations of almost 4,494 MW, accounting for over half of the global offshore market.





© Diavik Diamond Mine

Wind farms provided 9.3% of the UK's total electricity supply in 2014, up from 7.8% in 2013<sup>15</sup>. In a recent release from the UK's National Grid, January 2015 was the most productive month ever for wind energy: generation reached 4.13 TWh and provided 14% of Britain's electricity<sup>16</sup>.

Besides the two leading markets the other noteworthy European markets last year include Sweden, France, Turkey, Poland, and Austria. **Sweden** had an exceptional year and installed 1,050 MW in 2014 to reach a total installed capacity of 5,425 MW. At the end of 2013, wind power accounted for 7% of Sweden's total electricity consumption. **France's** wind capacity is also growing steadily and has now reached 9,285 MW. France is the fourth largest market cumulatively today. The French government has a target of 25 GW from wind power by 2020, but is unlikely to meet this target. **Poland** has had solid annual growth for the past few years despite a difficult political environment for renewables. It now has a total installed capacity of 3,834 MW, up from 3,390 MW in 2013, and is the eighth largest wind market in Europe.

**Turkey** continued to be a growth market for wind power in 2014, installing 804 MW for a total of 3,762.5 MW. Looking ahead, the future of Turkey's wind sector looks very promising; and **Austria** installed 411 MW, for cumulative capacity growth of nearly 25%.

**Denmark** installed 105 MW in 2014 for a total of 4,883 MW, but set a new world record for wind production by getting over 39% of its overall electricity from wind in 2014. In 2013 wind power accounted for over 33% of Denmark's total electricity consumption.

#### **LATIN AMERICA AND THE CARIBBEAN: BRAZIL CONTINUES TO LEAD**

Latin America and the Caribbean had a stellar year. The region saw 3,749 MW of new capacity come online, bringing total installed capacity in the region to 8.5 GW. Wind power is reaching critical mass in a number of Latin American markets, and the region has begun developing

a substantial wind power industry to complement its rich hydro and biomass (and potentially solar) resources. In the long-term, the demand for energy security and diversity of supply is expected to foster the growth of wind power in Latin America.

For the third year in a row the Latin American market installed over 1 GW of new capacity. In 2012, six markets in the region installed 1,225 MW of new wind capacity for a total installed capacity of just over 3.5 GW. In 2013, just five markets including Brazil, Chile, Argentina, Dominican Republic and Uruguay accounted for 1,219 MW of new wind power capacity for a total installed capacity of 4.7 GW. In 2014, ten markets added new capacity. This included Brazil, Chile, Uruguay, Peru, Argentina, Honduras, Costa Rica, Nicaragua, Venezuela and Ecuador.

**Brazil** led Latin America with exceptional installations of 2,472 MW; although the projects were fully commissioned not all of them could be given a grid connection before the end of the year. Brazil is one of the most promising onshore markets for wind energy, for at least the next five years.

**Chile** added an unprecedented 506 MW to reach a total of 836 MW in total installed capacity. **Uruguay** added almost 405 MW of new capacity, bringing its total installed capacity up to 464 MW. **Peru** after a long hiatus added almost 146 MW of new wind capacity to reach a total installed capacity of 148 MW. **Argentina** added 53 MW of new capacity to bring its total installed capacity up to 271 MW last year. The Caribbean reached a total installed capacity of 250 MW across various island states by the end of 2014.

## AFRICA AND THE MIDDLE EAST

Africa and the Middle East are awakening to the opportunity of their enormous wind power potential, adding nearly 1 GW (933 MW) last year, bringing cumulative capacity for the region up to 2,545 MW.

**South Africa** has taken off in 2014, installing 560 MW of new capacity, for a cumulative capacity of 570 MW. This is just the beginning of the wind market in the country.

Africa's wind resource is best around the coasts and in the eastern highlands, but until last year it was in North and East Africa that wind power has been developed at scale. This, too, is where current national policies are set to grow the sector further.

**Morocco** had an exceptional year as well, as the 300 MW Tarfaya wind farm (Africa's largest) came on line last year. This brought the total installed capacity in Morocco to over 786 MW. Last year for the first time since 2010 **Egypt** added new capacity. Egypt saw 60 MW of new installed capacity for a total of 610 MW. In east Africa, **Kenya** added 13.6 MW at the Ngong II wind farm, located 30 kilometers west of Nairobi<sup>19</sup>.

At the end of 2014, over 99% of the region's total wind installations were spread across ten countries - Egypt (610 MW), Morocco (787 MW), South Africa (570 MW),



Tunisia (245 MW), Ethiopia (171 MW), Iran (91 MW), Cape Verde (24 MW), Kenya (19 MW), Israel (6.25 MW) and Algeria (10 MW).

Africa is likely to emerge as a new hot spot for wind energy development with new projects in South Africa, Kenya, Tanzania, Morocco, Ethiopia and Mauritius coming online. 2014 was a milestone year for African market, as almost a GW of new capacity come online.

## PACIFIC

The region saw its total installed capacity cross the 4.4 GW mark last year. The **Australian** market added 567 MW in 2014 (down from 655 MW in 2013), bringing its total installed capacity up to 3,806 MW.

According to recent research conducted by the Clean Energy Council, 14.76% of Australia's electricity came from renewable sources in 2013. Wind farms have reportedly generated more than AUD 4 bn (EUR 2.6 bn) in investment in Australia since their introduction<sup>17</sup>. However, according to recent reports Investments in large-scale wind, solar and other clean energy sources dropped 88% in 2014 to AUD 240 mn<sup>18</sup> (EUR 168 mn).

Australia saw a new coalition government led by Prime Minister Tony Abbott come into power in 2013. This





Construction of a wind turbine in Ngong Hills, Kenya © Construction Review Online

government does not support renewables and are causing significant difficulties for the renewable energy industry in Australia. New Zealand and the rest of the Pacific did not add any new wind power capacity in 2014.

### 2014: AN EXCEPTIONAL YEAR

After a slowdown in 2013, the wind industry set a new record for annual installations in 2014. Globally, 51,473 MW of new wind generating capacity was added, and the record-setting figure represents a 44% increase in the annual market; a solid sign of the recovery of the industry after a rough patch in the past few years. Total cumulative installations stood at 369,597 MW at the end of 2014.

Wind is a rapidly maturing technology, with proven reliability and competitiveness. Not only the low prices but also the cost-stability of wind power makes it a very attractive option for utilities, independent power producers and companies who are looking for a hedge against the wildly fluctuating prices of fossil fuels.

The wind power industry is a key solution to climate change, air pollution, energy security, price stability and a driver of new industries and employment. Wind power is the most competitive way of adding new power generation capacity to the grid in a rapidly increasing number of

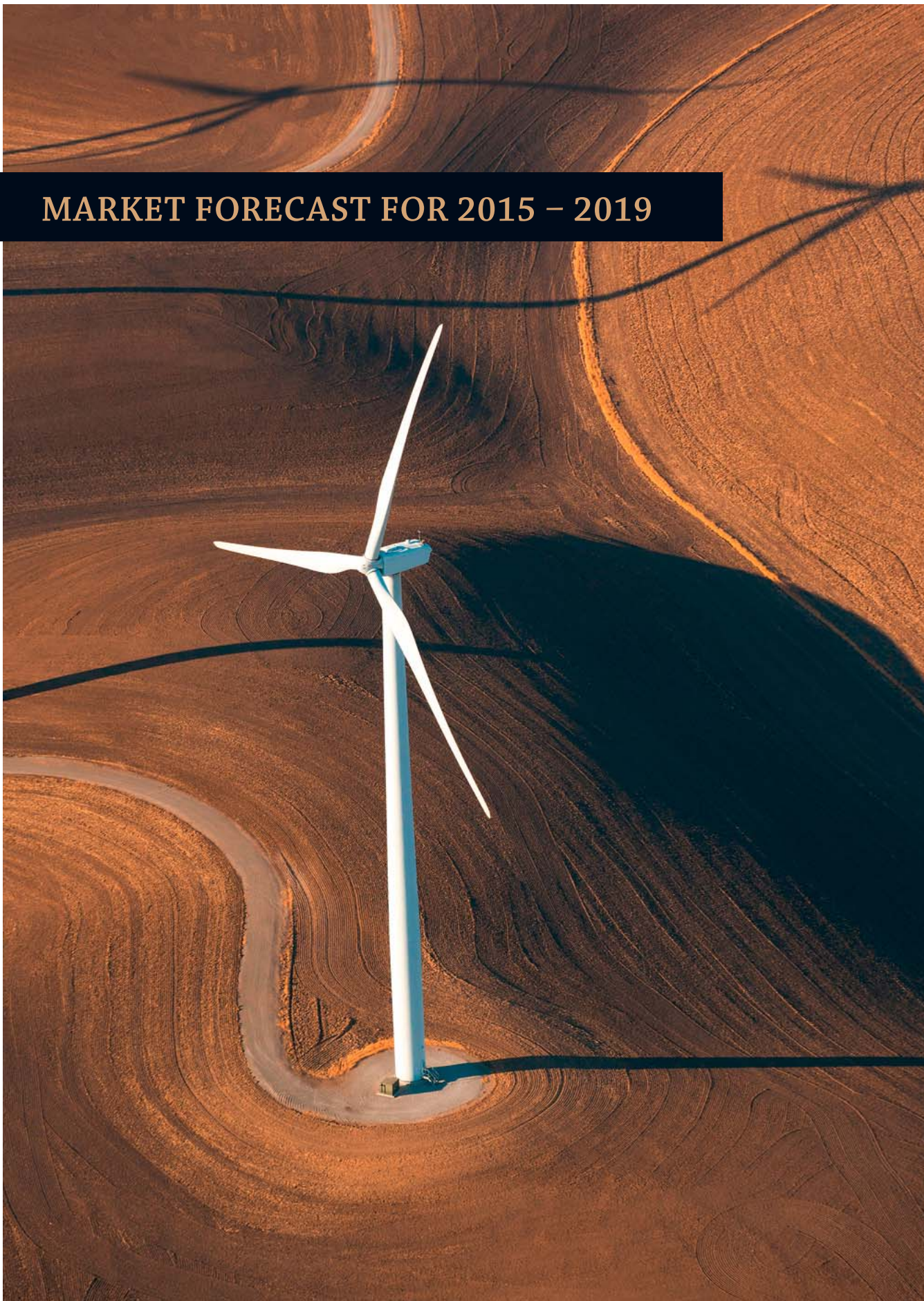
markets around the world, even when competing against heavily subsidized incumbents.

All the fundamental drivers for wind power development still hold, and there is a need around the world for new power generation, which is clean, affordable, indigenous, reliable and quick to install.

- 1 <http://about.bnef.com/press-releases/rebound-clean-energy-investment-2014-beats-expectations/>
- 2 Exchange rates used for conversion to Euro values in this section are from 03-03-15
- 3 <http://about.bnef.com/press-releases/clean-energy-investment-falls-for-second-year/>
- 4 See [http://www.ewea.org/fileadmin/files/library/publications/statistics/EWEA\\_Annual\\_Statistics\\_2013.pdf](http://www.ewea.org/fileadmin/files/library/publications/statistics/EWEA_Annual_Statistics_2013.pdf)
- 5 <http://english.peopledaily.com.cn/90778/8109836.html>
- 6 [http://www.chinadaily.com.cn/bizchina/greenchina/2014-02/26/content\\_17306185.htm](http://www.chinadaily.com.cn/bizchina/greenchina/2014-02/26/content_17306185.htm)
- 7 <http://www.reuters.com/article/2015/02/12/china-power-windpower-idUSL4N0VM3XJ20150212>
- 8 <http://www.mnre.gov.in/mission-and-vision-2/achievements/>
- 9 [http://cea.nic.in/reports/monthly/inst\\_capacity/jan15.pdf](http://cea.nic.in/reports/monthly/inst_capacity/jan15.pdf) with correction of total capacity (grid connected) of renewables as reported by the MNRE up to 31-12-14 of 33,791.74 MW
- 10 <https://www.ferc.gov/legal/staff-reports/2013/dec-energy-infrastructure.pdf>
- 11 <http://www.ferc.gov/CalendarFiles/20150213081555-Gramlich,%20AWEA.pdf>
- 12 <http://awea.files.cms-plus.com/4Q2014%20AWEA%20Market%20Report%20Public%20Version.pdf>
- 13 <http://www.ewea.org/fileadmin/files/library/publications/statistics/EWEA-Annual-Statistics-2014.pdf>
- 14 <http://www.ewea.org/press-releases/detail/2015/02/25/ewea-welcomes-energy-union-proposal-for-post-2020-renewables-directive/>
- 15 <http://www.renewableuk.com/en/news/press-releases.cfm/electricity-needs-of-more-than-a-quarter-of-uk-homes-powered-by-wind-in-2014>
- 16 <http://www.renewableuk.com/en/news/press-releases.cfm/2015-02-02-record-breaking-january-for-wind-energy>
- 17 <http://www.abc.net.au/rural/news/content/201303/s3702991.htm>
- 18 <http://www.smh.com.au/environment/climate-change/australias-largescale-renewable-investment-dives-in-2014-20150112-12mbis.html>
- 19 [http://www.iberdrola.es/press-room/press-releases/national-international/2014/detail/press-release/141111\\_NP\\_01\\_Ngong.html](http://www.iberdrola.es/press-room/press-releases/national-international/2014/detail/press-release/141111_NP_01_Ngong.html)



## MARKET FORECAST FOR 2015 – 2019



Montezuma Hills, northern California © Anthony Dunn



2015 was a great year for the wind power industry, with 44% annual market growth and record installations of more than 51 GW, recovering from the industry's biggest ever slump in 2013. The big story, of course, was China, installing an astonishing 23 GW in 2014, cornering 45% of the annual market. We continue to see new markets emerging, particularly in Africa and Latin America, but with some surprises in Asia as well. OECD markets continue to make steady progress as a whole, although the distribution of the market is not as broad as we would like to see.

In the OECD, the struggle with incumbents over market share and the shifting paradigm of future electricity markets continues, although we saw a breakthrough last year when E.ON announced it was splitting its 'old' and 'new' energy businesses, and we see others following suit. However, because of the increasing competitiveness of wind (and solar) and the growing acceptance of renewables as 'the future', it seems that the conversation has shifted more to one of how to design electricity markets that value the attributes of a transformed energy system correctly, and therefore work effectively.

Denmark has been in the lead on this, but the issue has assumed center stage in Germany, as well as in other OECD markets where wind has reached double digit penetration rates, and there is a desire to move away from the traditional feed-in tariff structure to a more market based approach. We'll no doubt have some fits and starts as different system operators try to get it right, but it seems that the question is no longer 'if', but 'when', an increasing number of major markets will embark upon reinventing themselves in the form of electricity systems dominated by wind, solar and other renewable energy sources, sooner rather than later.

Elsewhere, wind is driven by economics, energy security, price stability and (especially in China) through the need to address the choking smog that is increasingly making major urban areas in the developing world unliveable. The need for clean, sustainable indigenous power sources to fuel economic growth throughout Africa, Asia and Latin America is increasingly being met through wind power and this will continue for the foreseeable future.

So what does this all mean for markets going forward? It means a period of sustained growth, but with unspectacular numbers, at least as far as we can see now. After slipping just below our *Global Wind Energy Outlook (GWEO)*<sup>1</sup> Moderate Scenario at the end of 2013, due to 2014's spectacular growth we are back on track with the GWEO Advanced Scenario for 2014, and will no doubt be for 2015 and perhaps 2016 as well. After that, it becomes more difficult. Compared to when we did our forecast at this time last year, a number of things have changed:

- Nobody foresaw that China would install 23 GW. We thought we were on the optimistic side when we predicted 18 GW last February, but by the end of the year the word was more like 20 GW; which also turned out to be conservative. The 'extra' 5 GW in China accounts for most of the difference between our projections for the market twelve months ago (47.3 GW) and the actual

installations in 2014. Asia will continue to put distance between itself and Europe, the number two regional market, as Chinese growth continues, India experiences a resurgence, and more new Asian markets start to grow.

- We predicted more of a recovery in the US market in 2014 than actually happened; we're hoping to see much of what was expected in 2014 installed in 2015 and 2016. For Europe, we projected a slight downturn, but both the economy and the wind market recovered to see some modest growth in 2014.
- We were under on our projections for Latin America, and a bit too optimistic for Africa, but those numbers will come out in the wash over the next few years, as first Latin America and then Africa will be the new major growth markets by the end of this decade, or certainly by the beginning of next. We predicted that Brazil would move up to 4th position in terms of the annual market, and that's precisely what it did, as well as moving into 10th spot in the cumulative rankings, which we also called last year.
- We were cautiously optimistic about the beginnings of development in the two 'sleeping giants': Russia and Saudi Arabia. However, they've both gone back to sleep, at least for the moment.
- Finally, Tony Abbot's government is still waging war on renewables, and has done some severe damage to the industry in Australia. But given the dramatic progress of both wind and solar in Australia, we expect that to be shortlived, although it will no doubt depress market figures for the next few years in the Pacific region.

## REGIONAL DISTRIBUTION

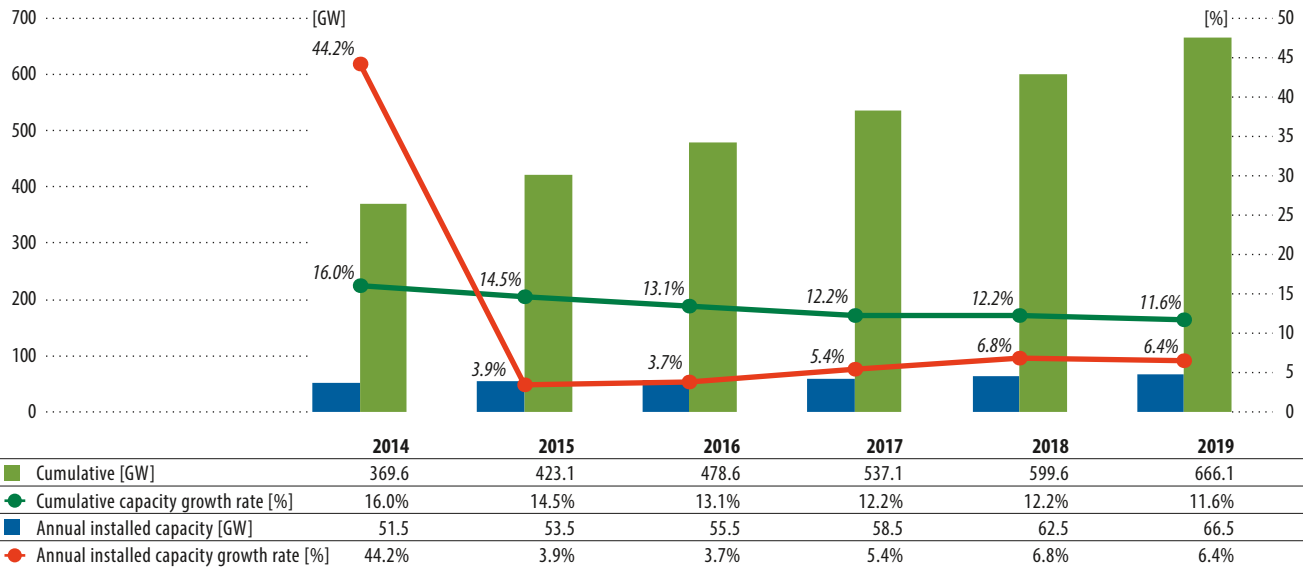
Asia will continue to dominate, and having surpassed Europe in terms of cumulative installed capacity at the end of 2014, it will continue to lead markets with 40-45% of the annual global total going forward. Of the other big markets, Europe will continue its steady march towards its 2020 targets, and North America, as always, is the most difficult to predict. After a strong 2015 and 2016 in the US and Canada it's hard to predict as to what will happen next, on the one hand due to the vagaries of the US Congress, and 'north of the border' due to a lack of policy clarity in key provincial markets after the end of next year.

Latin America's numbers will increasingly make a difference to global totals, with Brazil leading the charge, but with Chile, Uruguay, Peru, Central American markets and others providing a boost. For Africa, it's going to be a contest between Egypt and South Africa for dominance of that market, but there are many other countries that will contribute numbers to the totals going forward. The Pacific will have to wait for the end of the Abbot government in Australia to start growing again.

### Asia

Given the expiration of the current FIT arrangements in China at the end of 2015, we can expect similar numbers

MARKET FORECAST FOR 2014 – 2019



Source: GWEC

as in 2014. After that, while the market may contract a bit, it's not unreasonable to assume that China alone will install on the order of an additional 100 GW by the end of 2019, exceeding the country's 200 GW target for 2020 by a healthy margin, and a year ahead of time.

Due to the new government's initiatives on renewables, the Indian wind industry has a *de facto* target of 5 GW per annum for the rest of the decade and into the next. We don't expect it to reach that level in 2015, but it will move in that direction and get close by the end of the five year period. Elsewhere in Asia, we're seeing the basis for strong growth in Pakistan and the Philippines, and Taiwan and Thailand continue to surprise. Japan will start to grow again in 2015, but the slow pace of electricity market reform and the hesitation to unbundle the existing utilities means that it will be slow to realise its potential; and the slow pace of onshore development in Korea means that we won't see much from that market until the offshore market starts to get built out towards the end of the decade. Overall, however, we're expecting an additional 140 GW to be installed in the region between now and the end of 2019, a doubling of the existing installed capacity.

**Europe**

Germany's spectacular performance is likely to be matched in 2015, or nearly so; and will remain strong throughout the period due to the offshore segment developing in earnest and significant repowering onshore. The UK's market could stall, but it is hoped that a positive outcome of the next election will see some stability and positive support for the sector going forward. Sweden and France performed well in 2014, and we would expect that to continue. Both Turkey and Poland continue to bring strong numbers to the table, and Turkey in particular is to become a major market.

The offshore segment seems to be in a much healthier place than it was at this time last year, with more realistic targets and a stronger financial base, as well as a greater diversity of suppliers of the next generation of >5 MW machines which will be rolled out in earnest over the next few years. On the whole, we expect Europe to continue its march towards its 2020 targets, installing about 70 GW over the next five years.

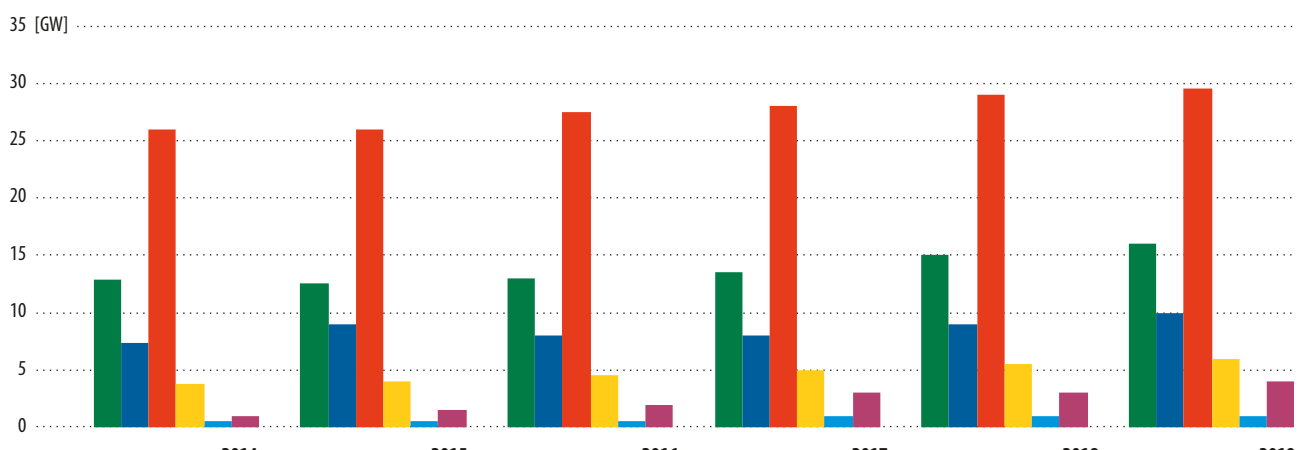
**North America**

The US is always the hardest market to call, and as the dominant market in this region, projections for North America are difficult. With a strong pipeline of projects under construction under the existing incentive arrangements, 2015 and 2016 are likely to be good years. But what happens after that? Despite the fact that close to 80% of existing wind power installations are in Republican congressional districts, it remains the case that energy (and climate) are ideologically charged political issues in Washington, and it's difficult to see how the current Administration and Congress can work together to come up with much in the short term to fill the looming policy gap.

North of the border in Canada, there is a similar lack of policy clarity after 2016, but the more diverse nature of the market there, dependent on provincial government policies rather than what emanates from Ottawa, means that we could still see support for the sector after 2016, but it's far from certain.

Mexico's existing legislation sets another *de facto* target of at least 2 GW/annum going forward, but sorting out the details of the energy reform means that Mexico will have to play 'catch-up' to reach these goals, with large market figures projected for 2017 and 2018. Overall, we expect to see about 44 GW installed in the region as a whole in the next five years.

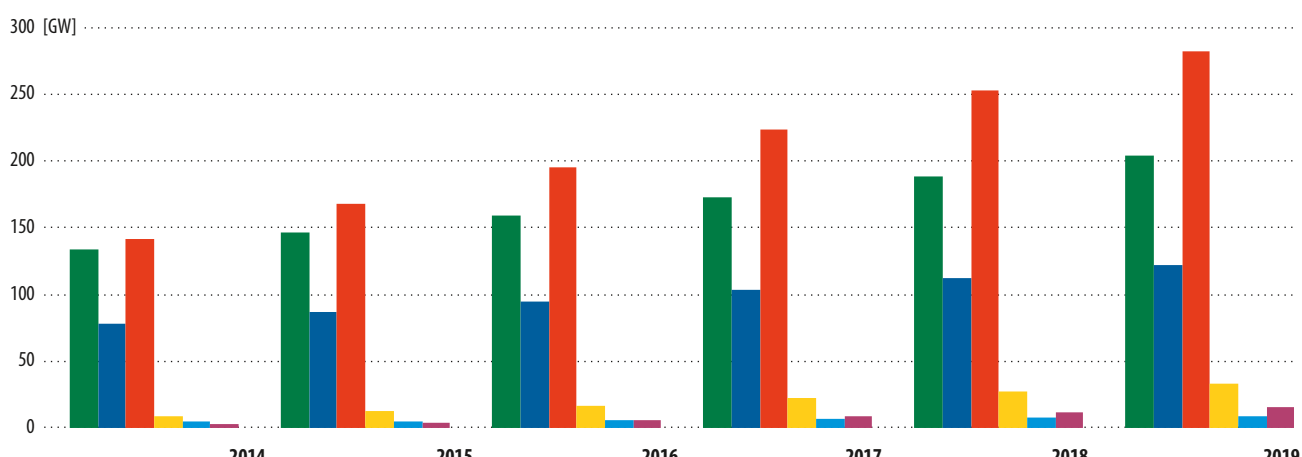
### ANNUAL MARKET FORECAST BY REGION 2014-2019



	2014	2015	2016	2017	2018	2019
Europe	12.9	12.5	13.0	13.5	15.0	16.0
North America	7.4	9.0	8.0	8.0	9.0	10.0
Asia	26.0	26.0	27.5	28.0	29.0	29.5
Latin America	3.7	4.0	4.5	5.0	5.5	6.0
Pacific	0.6	0.5	0.5	1.0	1.0	1.0
Middle East and Africa	0.9	1.5	2.0	3.0	3.0	4.0

Source: GWEC

### CUMULATIVE MARKET FORECAST BY REGION 2014-2019



	2014	2015	2016	2017	2018	2019
Europe	134.0	146.5	159.5	173.0	188.0	204.0
North America	78.1	87.1	95.1	103.1	112.1	122.1
Asia	142.0	168.0	195.5	223.5	252.5	282.0
Latin America	8.5	12.5	17.0	22.0	27.5	33.5
Pacific	4.4	4.9	5.4	6.4	7.4	8.4
Middle East and Africa	2.5	4.0	6.0	9.0	12.0	16.0

Source: GWEC

#### Latin America

On the basis of existing contracts, the Brazilian wind sector is expected to install another 12-13 GW over the next 5 years, and with four auctions planned during 2015, that number could rise substantially. Wind will likely surpass gas in terms of installed capacity by the end of 2017, and assume its place as the 'No. 2' power source in the country. This is all the more important given the recent droughts and associated unreliability

of the hydropower which is and will continue to be the backbone of the country's electricity system. Notwithstanding the current economic slump and political unrest, the Brazilian wind market looks solid for the foreseeable future.

Elsewhere in the region, Chile's wind market finally took off in 2014, and although it is unlikely to rival Brazil, will evolve into a modest but steady market. Uruguay continues to surprise, and it looks as though the Peruvian



Tarfaya wind farm, Morocco © GWEC

market is starting to move also. Panama will soon add to the small but cumulatively significant numbers put up in Central America, and there is some potential in Colombia which may start to emerge at the end of the period. Argentina remains the largest untapped resource, but until there is a change of government, we're not going to see much from that market, even though it has some of the world's best wind resources.

Overall, we expect to see about 25 GW installed in the region over the next five years, largely led by Brazil, but with other markets making significant contributions to the total as time goes by.

### **Africa and the Middle East**

The African market reached nearly 1,000 MW of annual installed capacity for the first time in 2014, and we expect that it will pass the 1 GW with room to spare in 2015, and not look back. Driven initially primarily by South Africa and Egypt, we see Morocco, Ethiopia, Kenya, Tanzania and Ghana as emerging markets to pay attention to. In the Middle East, there are new projects coming soon in Jordan, and if the current negotiations succeed, we could see the emergence of the next big market in Iran towards the end of the decade.

South Africa's emergence in 2014 is the 'take-off' after an extremely long countdown. Despite the political instability in the country, the electricity situation is dire, and they need the power. Wind is today the cheapest way to add new capacity to the grid in the country, and the market could expand far beyond the existing pipeline of 3-4 GW that is in the works.

The project to tie together the existing electrical markets in Eastern and Southern Africa continues to enjoy strong

political support, and there is some construction underway. Strong interconnections will facilitate east African states development of their enormous renewable energy sources – not only wind, but hydro, geothermal and of course solar, creating clean power for economic growth, energy security, and increased access to energy for the roughly 500 million Africans who currently do without. We project total installations of a bit more than 13 GW in the region through 2019.

### **Pacific**

Australia is the main market in this region, and was the only contributor to the region's total in 2014. While the current government is trying to kill the renewables industry, we don't think it will succeed, or at least not completely, and the climate and energy logic, as well as Australia's tremendous wind (and solar) resources mean that this is going to be a strong market again, but it's not easy to say when. As for the rest of the region, the situation has not improved in New Zealand, and although there are some projects in the pipeline in the Pacific Islands, they will take some time to mature. We expect only about 4 GW to be added in this region over the next five years.

So this is what we think the markets will do over the next five years. Asia will continue to dominate, followed by a steady Europe, and a volatile North America. Latin America surges ahead, and so does Africa, a few years behind.

It's always a challenge to look seriously into the future, and we will of course revisit the issue in twelve months' time to see how accurate we were, and to make adjustments in the face of whatever new reality faces us then.

<sup>1</sup> [http://www.gwec.net/wp-content/uploads/2014/10/GWEO2014\\_WEB.pdf](http://www.gwec.net/wp-content/uploads/2014/10/GWEO2014_WEB.pdf)



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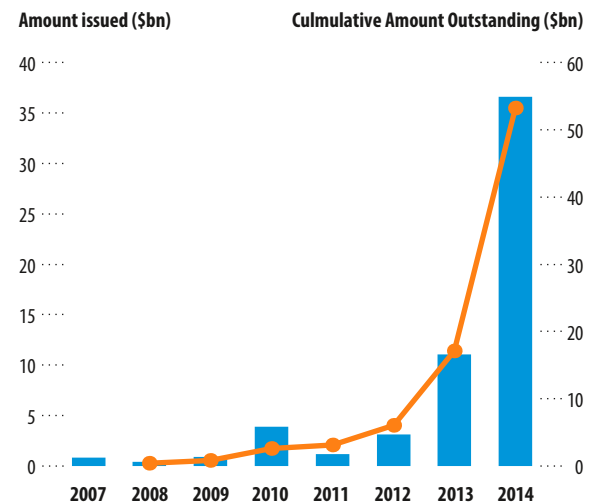
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The rapidly growing labelled green bond market offers exciting opportunities for the wind sector. In March 2015, Vestas, the large Danish wind turbine manufacturer, issued a EUR 500m green corporate bond - showing the market that the green bond market is attractive to pure-play wind companies. Banks lending to wind projects provide another example of actors in the wind sector that have tapped into the green bond market. In December 2014, the National Bank of Australia issued a labelled green bond linked to a portfolio of seventeen solar and wind farms. The bond closed in 5 hours and doubled in size due to huge investor demand. Its green credentials were certified under the Climate Bonds Standard and Certification scheme.

The bonds from Vestas and the National Bank of Australia - and many more labelled green bonds with proceeds linked to wind assets issued last year - prove that the amazing growth of the green bonds market offers a positive story for wind investments too. The opportunities are rapidly growing: 2014 was the year of the green bonds explosion, when the market tripled from USD 11 billion issuance in 2013 to almost USD 37 billion.

Global labelled green bond issuance by year



Source: The Climate Bonds Initiative (2015)

SPECIAL FOCUS

## GREEN BONDS OFFER EXCITING OPPORTUNITIES FOR THE WIND SECTOR

Sean Kidney  
CEO, Climate Bonds Initiative

So, what are green bonds? They are like normal bonds with proceeds earmarked for green investments, and that have been explicitly labelled as 'green' by their issuers. The first green bond, called a Climate Awareness Bond, was issued by the European Investment Bank in 2007, and was followed by a green bond issuance from the World Bank in 2008. During its first few years the labelled green bond market was tiny and was composed of issuance of multinational development bank bonds. In March 2013, the International Finance Corporation (IFC) issued a USD 1 billion benchmark green bond. All of the bond's proceeds were earmarked for green projects, and there was no credit risk related to the underlying projects; the IFC took the credit risk. The deal sold out in one hour and was several times oversubscribed.

That got the attention of the world's investment bankers and corporate issuers, and soon there was a lot of talk of earmarking for green projects. The first corporate green bond came to market in November 2013, and by the end of 2014 corporate issuers held 35% of the market share. Prominent issuers to date include GDF Suez, EDF, Iberdrola, Toyota and more. The Climate Bonds Initiative expects issuance of labelled green bonds to reach about USD 300 billion by 2018.

### Opportunities of the unlabelled wind bond universe to be re-labelled as green

In addition to this rapidly growing green labelled market, there is a significant market of non-labelled bonds that fund low-carbon and climate-resilient investments. The Climate Bonds Initiative publishes an annual report on this unlabelled climate-themed bond universe. In 2014 its estimate size was USD 502.6 billion – much larger than the green labelled market. At the moment, this is where we find the majority of bonds from the wind sector, as the issuers in the wind sector often are pure-play companies that do not label their bonds explicitly as green. This is the investment universe that held the bonds from wind developer Vestas until they recently decided to label their latest corporate bond issuance as green. In 2014, we identified almost USD 13.5 billion of such unlabelled wind bonds outstanding globally. All of that could benefit greatly by becoming part of the green label scheme.

Why does the label matter? The wind bonds sector by itself is too small to be a stand-alone sector of the bond market. Green bonds are a much larger and more liquid sector, providing an umbrella for wind and other clean energy investments: clean transport; climate adaptation

projects and much more. Wind energy companies issuing in the green bond market become a part of this growing and liquid green bonds asset class. The green label also gives them access to a much broader investor base – and can lower their cost of capital as a result. Many bond investors have been deterred by an illiquidity premium attached to wind investments, but because the green bond market offers a more liquid option to access wind investments, these investors can now start jumping in.

The bond market is also highly responsive to measures that reduce friction and that make it easier for engaged investors to pick A instead of B. Simplifying this discovery process will fuel green market growth: this is exactly what green bonds are doing by providing an easily identifiable label. The label is a discoverability tool for investors. Discoverability tools are important; they link relevant bond investments to the broad concerns around climate change and environmental sustainability. Discovery can be surprisingly difficult in what is a relatively new and immature market. Often, investors aren't sure what the relevant investments are, or the investments aren't presented in a way that they can connect to their overarching green prioritization – which is growing.

### **Investor appetite for financially competitive green investments is growing**

A large share of the world's investors are acutely aware of climate change and keen to put their capital to work in climate related investments – subject to risk and yield profiles that are competitive with existing investment opportunities.

Over the past year, investors from around the globe have been vocal about their interest in sustainable investments. At the UN Climate Summit in September 2014, a group of investors representing USD 24 trillion of assets under management (for comparison, US GDP is USD 17 trillion) called for swift action on climate change and said they stood ready to invest. A separate group, this time a USD 19 trillion coalition of insurance investors representing two third of the world's insurers, said they planned to scale up their climate related investments by a factor of 10 over the next five years. Later in the year, in the 'Investor Statement re. Green Bonds & Climate Bonds', funds representing USD 2.24 trillion of assets under management expressed their commitment to expand the green bonds market and called on governments to deliver projects to be financed.

Clearly, there is lots of investor demand for green investments, provided that these also meet investors' financial criteria.

### **Green bonds can tap into this investor appetite**

The biggest challenge now is to translate investor attention and public commitments into actual investment. Institutional investors need to be provided with a huge pipeline of investable deals to deliver the green infrastructure projects – including wind projects - and kick along our transition to a green economy.

 The biggest challenge now is to translate the investor attention and public commitments into actual investment. Institutional investors need to be provided with a huge pipeline of investable deals to deliver the green infrastructure projects – including wind projects – we need, and kick along our transition to a green economy. 

There is a potential for the green bonds market to reach USD 100 billion in 2015. The reason for that is that a lot of repackaging can and will take place. Apart from obvious low carbon areas such as wind, another example of assets that can and should become part of the green label are rail bonds. Transport accounts for 23% of energy sector emissions and low-carbon transport is a critical green investment. As rail bonds are brought in to the market through education and adding some reporting requirements, greater scale and liquidity will be achieved, making it easier for other sectors issuers – like wind issuers - who can then be issuing into what will be seen as a larger and more liquid market, with commensurate downward pressure on capital costs. The increasing size of the overall market makes it more attractive for specialised sectors like wind energy to tap into the green bond market.

Despite the exponential growth, if we look at absolute size rather than growth rates, the green bonds market is dwarfed by an average issuance of USD 100bn per week in investment grade bonds alone. There is a lot more room for growth. The International Energy Agency tells us that to get the world on the 2°C emissions trajectory, USD 36 trillion of investment above business as usual will be needed by 2050. Low-carbon industries must grow, on average, 25-30% per annum globally. Niche financing solutions will not be sufficient, and neither will public sector funds alone. This means that tapping the largest market of all, the USD 100 trillion bonds market, is essential. The massive growth in the green bonds market is evidence of capital beginning to move as required.

### **The success of green bonds is driven by their financial competitiveness**

What's fundamental about the success of green bonds, and the ability for the market to scale, is that they are competitive on financial returns. In other words, inves-



tors do not have to choose between financial returns and climate change impacts, thanks to full backing of the bonds from corporate and development treasuries.

If a portfolio manager is choosing between an ordinary bond and a green bond, and both have exactly the same yield and rating, with the only difference being that proceeds from the green bond go toward addressing climate change, then that green benefit becomes a bonus feature. For investors who care about climate risk but cannot address this risk due to the restrictions of their portfolio guidelines on risk-return, green bonds present an enormous opportunity. For investors who do not care about climate change, a green bond is no different from other similarly rated bonds and can still be a great investment opportunity.

So if you are an investor offered two investment products with the same interest rate, risk profile and rating but the proceeds of one, as a bonus, go to investments critical to a rapid transition to a low carbon and climate resilient economy - why wouldn't you go for the green one?

### **A wide range of issuers can tap into the market: it's about green assets, not green entities**

Another key point is that the green credentials of a bond are based on the projects or assets linked to its issuance, not the green credentials of the entity issuing the bond. This means a wide range of issuers can issue green bonds, whether they are a national government, a city or municipality, a multi-national development bank, a commercial bank or a corporation.

Exxon, for example, may not be viewed by some investors as a good investment for environmental sustainability reasons, but if Exxon issues a bond with proceeds earmarked to finance a wind farm, then that bond is a green bond and attracts new investors. In order for a bond to be green, proceeds must be earmarked toward qualifying green projects, reporting must be done on the use of the proceeds, and ideally, independent verification of the claim must be secured. This means the green bond market offers opportunities for wind projects from diversified companies, as well as pure play wind developers.

### **Strong investor demand for green bonds provides benefits to issuers**

Investors in green bonds range from pension and insurance funds to corporate treasuries and central banks. Green bond deals have generally been oversubscribed by 30%–100% more than normal bond deals. Issuers are issuing these bonds mostly for diversification reasons; a green label enables them to engage a new investor base. The German development bank KfW says one reason it last year issued two green bonds (one valued at EUR 1.5 billion, the other at USD 1.5 billion) is that the bonds have provided a deeper engagement between their investors and their green projects. Corporations are finding the same diversification and engagement benefits.



### **Next step for the green bonds market: Standards and securitisation**

At present there is no standardised approach for the issuance of a green bond; issuers self-label bonds as green and provide detail on the green eligibility criteria for use of proceeds. To maintain the confidence of investors in the market and avoid greenwash, a standardised approach to assessing the green claims of investments is needed. Investor confidence is key: without it, the green bonds market can collapse like a bad soufflé.

A set of widely-accepted standards saying which assets can and can't be included in a green bond will avoid any projects with dubious environmental credentials being financed with a green bond. *The Climate Bonds Initiative* ([www.climatebonds.net](http://www.climatebonds.net)) developed the Climate Bond Standards Board to evaluate green bonds and climate bonds. The board comprises USD 34 trillion of assets under management represented by various associations, such as the Ceres Investor Network on Climate risk and the Institutional Investors Group on Climate Change. The Board is supported by expert committees who create green definitions based on evidence, such as determining the right kind of transport criteria needed for a rapid transition to a low-carbon and climate-resilient world. The guidelines developed are a free resource for independent reviewers and others as a basis for determining eligible investments. Climate Bond Standards for wind assets are already developed, and have been used in the market – for example, by the bond from the National Bank of Australia.





Wild Horse Renewable Energy Center, Washington State © Puget Sound Energy

Another next step for the market is the securitisation of smaller green assets into green asset-backed securities. There's large potential for securitisation of wind assets – that could lead to a real explosion of this market. As many wind and other low carbon assets are smaller scale, securitisation of these assets will be crucial for them to access the bond markets: bond market investors typically demand issuance in the magnitude of hundreds of millions. There are already examples in the market illustrating that this can work well: for example, in November 2014, Northland Power in Canada, issued asset-backed securities backed by the cash flows from operating solar power plants but with proceeds of the bond partially allocated to offshore wind projects.

**Conclusion: The green bond market offers opportunities for a wide range of wind sector actors**

The green bond market, which tripled in both 2013 and 2014, allows the wind sector to tap into the growing investor appetite for financially competitive green investments, as green bonds are financially competitive with normal bonds and easily discoverable for investors.

Green bonds issued from companies like Vestas and the National Bank of Australia prove that the amazing growth of the green bond market offers a positive story for wind investments too. Pure-play wind companies like Vestas can benefit from placing a green label on their corporate bonds; USD 13.5bn of such unlabelled wind bonds

that could be re-labelled as green have been identified as outstanding in 2014. Diversified companies with wind projects being only a part of their overall business can also issue green bonds, as the 'greenness' of the bond is defined by the assets or projects that use of proceeds are allocated to, not by how green the overall company is. The green bond from the National Bank of Australia is one example of such an earmarked green bond.

Overall then, green bonds provide exciting opportunities for a wide range of actors in the wind sector, allowing them to tap into strong investor demand and the associated benefits to issuers seen so far in the market.

**Sean Kidney is the CEO of the Climate Bonds Initiative, an international NGO working to mobilize debt capital markets for climate solutions. Projects include a green bond definitions and certification scheme with USD 34 trillion of assets represented on its Board and some 50 organizations involved in its development and governance; advising the EU; and working with the Chinese Government's Development Research Centre on how to grow green bonds in China. Sean is also a director of the Network for Sustainable Financial Markets, an international group of finance sector professionals, academics and others who see the need for fundamental changes to improve financial market integrity, stability and efficiency. Sean was previously marketing advisor to a number of the largest Australian pension funds.**

## EMERGING AFRICA

**A**frica has tremendous renewable energy resources<sup>1</sup>, enough to meet all current and future energy needs. While more than 500 million<sup>2</sup> people in Africa lack access to electricity, most of them in Sub-Saharan Africa, renewable energy resources in Africa remain mostly untapped. This enormous renewable energy potential could help solve the energy access problem as well as provide these countries with affordable power for development, improve their foreign exchange balance, and protect their economies from the volatility of international fossil fuel prices.

Making reliable and affordable energy widely available is critical to the development of a region that accounts for about 13%<sup>3</sup> of the world's population, but only 4% of its energy demand. Since 2000, sub-Saharan Africa has seen rapid economic growth and energy use has risen by 45%<sup>4</sup>. Many governments are intensifying their efforts to tackle the regulatory and political barriers that are holding back investment in domestic energy supply, but inadequate energy infrastructure remains a key challenge.

Efforts to promote electrification in Africa are gaining momentum, but are outpaced by population growth. Although investment in new energy supply is on the rise, large parts of it have been committed to the development of resources for export.

The best wind technical wind energy potential in the continent can be found in Eastern Africa (170 PWh/year<sup>5</sup>), followed by Northern Africa (130 PWh/year), Southern Africa (110 PWh/year), Western Africa (40 PWh/year) and Central Africa (10 PWh/year)<sup>6</sup>. It should be noted that these are technical potentials only, unconstrained by economics, geography or competing uses. However, it gives an indication of the scale of the resource. For many African countries, wind power offers an opportunity to generate electricity in an emission-free, affordable and sustainable way.

In this Chapter we focus on wind development in Eastern and Northern Africa where much of the new wind development is taking place at present. A separate chapter is dedicated to wind development in South Africa.

### EAST AFRICA

The most prominent wind resources in Eastern Africa can be found in Ethiopia, Kenya and Tanzania. This region has the potential of becoming a clean energy power hub.

#### Ethiopia

Ethiopia has two wind farms in operation: the 51 MW Adama I wind farm, which began production in 2011; and



200 MW El Zayt Wind Farm (under construction), Egypt © RCREEE

the 120 MW Ashegoda wind farm which came on line at the end of 2013. The second phase (150 MW) of the Adama project is currently under construction.

The Ethiopian government has an ambitious plan for wind energy and other renewables development. Renewables uptake would also help mitigate the effects of the seasonal availability of hydropower, which accounts for 86%<sup>7</sup> of the installed electricity capacity, and is the major reason for the frequent blackouts which plague the country.

The government of Ethiopia, in collaboration with the Chinese government, has prepared a solar and wind power master plan. According to the master plan, Ethiopia has a wind power potential of 1,350 GW.

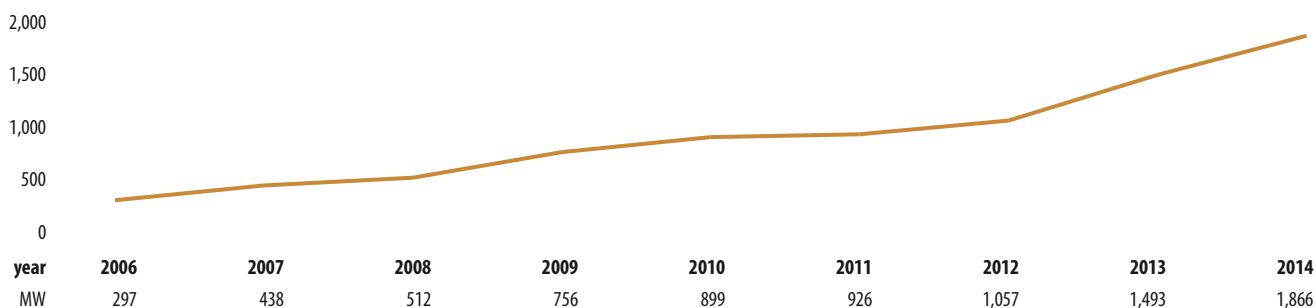
Ethiopia is looking to develop more renewable energy, and several further projects have been contracted. The government also started working on a feed-in tariff in 2009, but it is yet to be implemented.

#### Kenya

The Kenya Electricity Generating Company Limited (Kengen), a national public utility, developed the first operational wind farm in Kenya; the 5.1 MW Ngong Hills wind farm, which consists of five 850 kW turbines. After the successful operation of the pilot project, the wind farm was expanded to a second phase (Ngong II) where construction works were completed in 2014. The 13.6 MW project was developed by Iberdrola and consists of 16 Gamesa G52 turbines. The project is part of a wider initiative that includes four substations and 15 kilometres of power lines. Iberdrola is currently building a second project in Kenya, the Kinangop wind farm, which will have a capacity of 61 MW from 38 GE 1.6 MW turbines<sup>8</sup>.

Also in the pipeline is the country's first large commercial development, the 310 MW Lake Turkana wind farm, which is expected to come online in 2017, and is one of the largest wind projects in Africa. The Lake Turkana wind farm will have 365 Vestas V52-850 kW turbines, making

**TOTAL INSTALLED CAPACITY (EGYPT, MOROCCO, TUNISIA, ALGERIA, ETHIOPIA, KENYA, CAPE VERDE, NIGERIA)**



Source: GWEC

it the largest project in the company’s history<sup>9</sup> in terms of number of wind turbines ordered for a single project.

Despite the currently still low wind installation rate, Kenya boasts exceptional wind resources. According to a wind resource assessment conducted by the Ministry of Energy, over 73% of the total area of the country has annual mean wind-speeds of more than 6 m/s at a height of 100 m. The best wind resources are located in the northern and eastern parts of the country, in the Marsabit and Ngong regions, while Kenya has significant coastal (and offshore) potential as well, ideal for large-scale utility projects, with an annual mean wind speed ranging from 6-10 m/s throughout the year.

Kenya is the largest economy in East Africa, and has a reasonably stable political and economic environment for attracting investment. Kenya relies on hydropower (40% of the total installed capacity in 2013), oil and diesel (35% installed capacity, 2013), which exposes the country’s energy system to the risk of seasonal variation for hydro as well as fluctuating fossil fuel prices. The government has the ambition to develop the country’s abundant renewable energy resources and Kenya has seen increasing clean energy investment in in the past few years. At the end of 2013, clean energy, excluding large hydro, accounted for 22% of the total installed capacity in the Kenyan grid, with geothermal taking the largest share, 13% of the installations. The country’s exceptional wind and solar resources still remain largely untapped.

One of the key challenges for Kenya, as one of the fastest growing economies in the region, is to build new generation capacity to meet the nation’s soaring demand. In 2014, the government published a new target to add 20 GW of new power capacity by 2030, including 51% renewable energy. For wind power this would mean 3 GW by 2030, which is already 1 GW higher than the previous target (2 GW) set in 2013.

Kenya has a feed-in tariff system which was introduced in 2008 and covers all renewable energy technologies, including wind, solar, geothermal, hydro and biomass. In 2012, the FIT was revised with a new tariff level and a streamlined, standardised PPA. For wind power the feed-in tariff is set at USD 11 cents/kWh (EUR 9.8 cents) for 20 years. The revised policy has increased interest in wind development in the country.

**Tanzania**

To date there are not yet any grid connected wind farms in Tanzania, but the first phase of the 50 MW Singida Wind Farm is currently under construction and is expected to come online in 2016<sup>10</sup>. The second phase of the project will add a further 100 MW to the wind farm. China’s Export-Import Bank will provide a USD 136 million (EUR 121mn) soft loan to the project.

Tanzania has an estimated multi-gigawatt wind power potential, but the final wind measurements are still being conducted. The best wind resources in the country are located in the coastal areas and along the Rift Valley.

Currently Tanzania’s renewable energy development is focused on small hydropower and biomass. Tanzania has an attractive policy framework for small, grid connected and distributed renewable energy generation, which include a standardised power purchase agreement (SPPA) and associated standardised power purchase tariffs (SPPT) for projects from 100 kW to 10 MW.

However, the country needs rapid renewable energy uptake to enhance energy security and to facilitate development. Currently, large hydropower makes up over one third of the country’s installed electricity capacity. However, the hydro is seasonal with low capacity factors and is one of the main reasons for the unreliability of the electricity system. On the other hand, the national electrification rate is only 14%, and the government is under pressure to develop more renewables in the country. The government has a target of 14% of renewable energy in the power mix by 2015.

In 2014, the government started working on a new renewable energy policy including a feed-in tariff for wind power and other renewable energy sources.

**East Africa Power Pool (EAPP)**

Although the development of the electricity infrastructure is inadequate in the region, there are plans to build interconnections between different countries. The East Africa Power Pool (EAPP) was established in 2005, with participation of ten countries in the region. The objective of the EAPP is to facilitate and secure power supply to the Eastern African countries at the lowest possible cost. The EAPP also aims to optimize the exploitation of the



available energy resources in the region in order to satisfy the increasing energy demand based on the “regional” least cost options to the benefit of all the participating countries. It aims at facilitating and coordinating power exchange among member utilities with the ultimate objective of establishing regional electricity market. The establishment of the EAPP can help creating a bigger pool for using renewable energy sources with increased system flexibility and improved interconnections.

Currently, the EAPP is working on a Regional Energy Master Plan, which aims to harmonize the grid code and to coordinate the construction of new transmission lines. The first step, the interconnection between Ethiopia and Kenya, is expected to be completed in 2016. According to the plan, the participating countries will be fully interconnected by 2018 and an upgrade of the connections will be carried out by 2023.

## NORTH AFRICA

In 2014, several North African countries moved ahead with national wind deployment programs, after a few difficult years. In 2013, only Morocco and Tunisia made progress, while other countries were either immersed in the complications of the Arab Spring or were in the process of shaping and adopting new policies to develop their indigenous renewable energy resources. However, in 2014, four out of the five North African countries; Egypt, Tunisia, Algeria, and Morocco, moved ahead, bringing the total installed wind capacity to over 1.6 GW.

North Africa has rich wind resources, in particular on the Atlantic, Mediterranean and Red Sea coasts where wind speeds frequently exceed 6.9 m/s, and show potential for large-scale wind farm deployment. For example, the Gulf of Suez area in Egypt boasts annual average wind speeds of 7 to 10 m/s, reaching average annual full load hours of 3,000. Similarly, Morocco also demonstrates significant wind potential, with annual averages of 2,708 full load hours in many places.

The current share of wind energy in the electricity system in North Africa is around 2% of the region’s total installed electricity capacity. However, this situation appears to be changing fast as many of the North African governments have committed to ambitious wind energy targets for the coming two decades.

## WIND ENERGY MARKET IN 2014

For the first time since the early 2000’s, Morocco surpassed Egypt and took the top position among North African countries in terms of cumulative installed wind power capacity, with 787 MW at the end of 2014. This is mainly due to the commissioning of the new 300 MW Tarfaya wind farm. Currently, Morocco has 370 MW of new wind projects under construction and a further 1,150 MW in the pipeline.

For Egypt, installed capacity increased to 610 MW in 2014, and is expected to reach more than 800 MW in the first quarter of 2015 when the construction of the new

200 MW Gabal Elzayt wind farm is complete. Another 120 MW project was also awarded in the same area in 2014. Moreover, about 1 GW of state-owned projects are under various phases of development, while over 2.6 GW of private projects have been called for through different incentive schemes, such as competitive bidding and feed-in tariff.

Tunisia completed its 190 MW Bizerte wind farm in late 2013 and early 2014, which increased the country’s installed wind capacity to 245 MW. In Algeria, the first wind farm of 10 MW in Kabertene was commissioned in 2014 as part of the first phase of Algeria’s new wind power programme.

The new turbines in operation at the Tarfaya wind farm in Morocco were supplied by Siemens (SWT-2.3 MW), while those installed in Egypt, Tunisia and Algeria during 2014 were all supplied by Gamesa, including the G80 2 MW, Made AE-61 1.3MW, and G52 850 kW.

Installed Wind Power Capacity in North Africa (MW)

North Africa	End 2013	new 2014	Total end 2014
Morocco	487	300	787
Egypt	550	60	610
Tunisia	245	–	245
Algeria	10	–	10
<b>Total</b>	<b>1,292</b>	<b>360</b>	<b>1,652</b>

## SUPPORT FRAMEWORK FOR WIND ENERGY

Until early 2014, the support framework for wind energy deployment in North Africa relied on three main schemes: state or utility owned projects; competitive bidding processes for private investments through BOOT or BOO schemes; or self-producers. Each of the North African countries has a public authority or a company to develop their own wind farms. Such wind farms typically enjoy preferential financing through international funding agencies, which allows for very low interest rates coupled with long tenures. For example, the 190 MW Bizerte wind project in Tunisia was developed by STEG (Tunisian Electricity and Gas Company) and is a result of Spanish-Tunisian cooperation that provided a concessional credit at 1.5% for 30 years including a ten-year grace period. Similarly, the 200 MW El Zayt project in Egypt, partially commissioned in 2014, was developed by the New and Renewable Energy Authority (NREA) with financial support from the German government, the European Investment Bank and the European Commission.

In parallel, renewable self-production allows industrial users to produce their own electricity up to a certain capacity, such as the 32 MW Lafarge wind farm in Tetouan in Morocco. In Egypt, the first RE self-producer project, the 120 MW Italgem wind farm located in the Gulf El Zayt, is currently under development and is expected to supply approximately 35% of the electricity needs of a Suez cement factory.

Nevertheless, it has been clear to most of the North African countries that public investments and self-



production projects will not be sufficient to achieve their ambitious renewable energy targets and to contribute sufficiently to the growing energy demand in these countries. Accordingly, competitive bidding through auctions guaranteeing long term Power Purchase Agreements (PPA) have been launched in both Egypt and Morocco. In both cases the government has identified and allocated areas with good wind resources for private development. The developers are chosen through a tendering process and a PPA is signed with the successful bidder.

The 300 MW Tarfaya project in Morocco is owned by GDF SUEZ, together with its Moroccan partner Nareva Holding. A 20 year PPA on a Build, Own, Operate and Transfer (BOOT) basis was signed to supply electricity to the Moroccan state utility (Office National de l'Electricité et de l'Eau Potable, ONEE). In addition, Morocco set a target to develop 1,000 MW of wind power through the competitive bidding scheme and made good progress through selecting the consortium for the first 150 MW, while proposals for an 850 MW Integrated Wind Program (IWP) were published in 2014.

In Egypt, a call for evaluation and award for the first 250 MW wind farm using the public competitive bidding is expected to be carried out in 2015. This is part of the first of several projects in Egypt's plan to install 2,500 MW of wind power through the competitive bidding process.

Among the most significant developments in 2014 was the adoption of feed-in tariff (FIT) policies in Egypt and Algeria. Although Algeria announced their feed-in tariff first, Egypt has moved fast since the announcement of their FIT in September 2014. In Egypt, the government has set an interim target for the period from 2015-2017 to contract 4,300 MW of both solar and wind energy, including 2,000 MW of medium sized wind farms of up to 50 MW. For wind energy, the FIT is correlated to the number of operational full load hours. The PPA period of 20 years has been divided into two, one for the first 5 years and the second for the following 15 years. The FIT will be reviewed when the amount of new installed capacity reaches 2,000 MW, or when two years have passed. Already 28 consortia have been shortlisted within the first round under the FIT.

Moreover, tax incentives for renewable energy development are common in North Africa. For example, an exemption on customs duty is applied for RE components in Egypt, and projects in Morocco which exceed an investment of DH 200 million (EUR 48.6/USD 54.4mn) are eligible for a value added tax exemption. Furthermore, there are grants and national renewable energy funds which can finance part of a renewable energy project in Algeria, Egypt, Morocco and Tunisia. However, these funds are at different levels of operational and financial maturity. In Algeria, a 0.5% levy on oil tax revenues is feeding the Algerian National Renewable Energy Fund, which is expected to have a positive impact on future wind deployment in the country. Morocco's Energy Development Fund (FDE) has been instrumental in the promotion of renewable energy sources. The FDE has a total capital of USD 1 billion (EUR 893mn); 200 million

from the Hassan II fund, with additional contributions from Saudi Arabia and the United Arab Emirates.

## OUTLOOK FOR 2015 AND BEYOND

Several North African countries have adopted ambitious goals to increase their reliance on wind energy. At present it is estimated that the North African countries will have wind installations of 10-11 GW by 2020.

Wind energy targets in the North African wind markets

Country	Targeted installed Capacity	
Tunisia	430 MW by 2016	1,700 MW by 2030
Egypt	7,200 MW by 2020	
Morocco	2,000 MW by 2020	
Libya	600 MW by 2020	1,000 MW by 2025
Algeria	270 MW by 2020	2,000 MW by 2030

In order to reach these targets, North African countries face a number of challenges. The main barrier at the moment is linked to the lack of sufficient grid infrastructure to transfer electricity from remote areas, distant from load centers where many of the wind energy sites are located. However, this concern is currently being tackled by many governments allocating funds to grid expansion. For example, Egypt secured EGP 2 billion (EUR 233/USD 261mn) for additional transmission lines to accommodate the new renewable energy generated under the FIT scheme. Given the current low wind power penetration levels, variability is not yet a key challenge, although some countries such as Morocco have already integrated pumped hydropower storage facilities as part of their wind energy program. Egypt also announced in 2014 that they are planning a pumped hydro project. Other key challenges include cutting down the lengthy project preparation and development processes by simplifying administrative procedures and ensuring the involvement and competitiveness of local industries and services.

Overall, the North African countries have shown great commitment to wind energy as a key ingredient in the transition towards a sustainable energy system. Proactive approaches are being adopted for creating an enabling environment for large scale wind power deployment, in terms of setting the right incentives and shaping the right policy instruments.

*With input from the Regional Center for Renewable Energy and Energy Efficiency (RCREEE)*

- 18 of the 35 developing countries ranked highest in renewable energy reserves, normalised by annual domestic energy consumption, are located in Africa, <http://www.sciencedirect.com/science/article/pii/S214629614001534>
- IEA: Africa Energy Outlook: A Focus on Energy Prospects in Sub-Saharan Africa, 2014
- .9417/238 = 13.01% <http://www.tradingeconomics.com/sub-saharan-africa/population-total-wb-data.html> and extrapolating four years forward at 2.5%/yr for 2014 number.
- IEA: Africa Energy Outlook: A Focus on Energy Prospects in Sub-Saharan Africa, 2014
- 1 Petawatt-hour is equal to 1000 terawatt hours (TWh)
- Estimating the Renewable Energy Potential in Africa, IRENA, 2014 - these potentials are purely geographic potentials, with no techno-economic evaluation undertaken, and consequently, these resource potentials are subject to a significant reduction when economic parameters are applied.
- In 2013.
- <http://www.windpowermonthly.com/article/1321913/iberdrola-completes-first-kenyan-project?HAYILC=RELATED&HAYILC=INLINE>
- <http://www.vestas.com/en/media/-/media/61f484921dce40d09074fd568cb5b334.ashx>
- <http://constructionreviewonline.com/2015/03/50-mw-wind-power-project-in-tanzania-to-cost-more-than-us-132m/>

Australia's wind industry had a strong year in 2014, with the second largest annual increase in capacity to date. Three large wind farms were completed, adding 567 MW to the national grid.

Australia's Renewable Energy Target (RET) calls for at least 20% of the nation's power to come from renewable sources by the end of the decade. It remains the greatest incentive for the development of wind energy in Australia and has taken domestic wind capacity from approximately 71 MW in 2001 to 3,806 MW at the end of 2014. The policy is currently under review by the Australian Government, with an outcome expected in early 2015.

## AUSTRALIA

At the end of 2014, Australia had 1866 operating turbines across 71 wind farms. New investment in wind energy projects fell significantly in 2014 to about AUD 240 million (EUR 165/USD 187mn), from almost AUD1.5 billion (EUR 1/USD 1.2bn) in the 2013 calendar year. This fall can be largely attributed to ongoing uncertainty from the RET review.

### WIND ENERGY MARKET IN 2014

Three new projects were commissioned in 2014, adding 567 MW of new wind capacity to the Australian electricity grid. This was a 13% decrease on the 655 MW of new wind projects commissioned the year before, but still the second largest annual capacity increase Australia has seen.

#### New wind farms 2014

Owner	Location	State	Installed Capacity (MW)
Goldwind Australia	Gullen Range	New South Wales	165.5
Meridian	Mt Mercer	Victoria	131.2
Trustpower	Snowtown 2	South Australia	270

### Projects in the pipeline

Another five projects totaling 380 MW are under construction and expected to be commissioned during 2015.

Australia's wind farms are mostly distributed along its southern coastline and to the west, which are the regions



© Whitelaw, GWEC

with the most favourable wind resources. Most states have multiple wind farms, with the exception of the sparsely populated Northern Territory and Queensland, which has only one small wind farm.

South Australia remains the state with the highest wind power capacity, successfully capitalising on an excellent wind resource, a relatively small population and government policies supportive of investment. It produced more than 33% of its electricity from wind power between mid-2013 and mid-2014.

#### Installed wind capacity in Australia by state

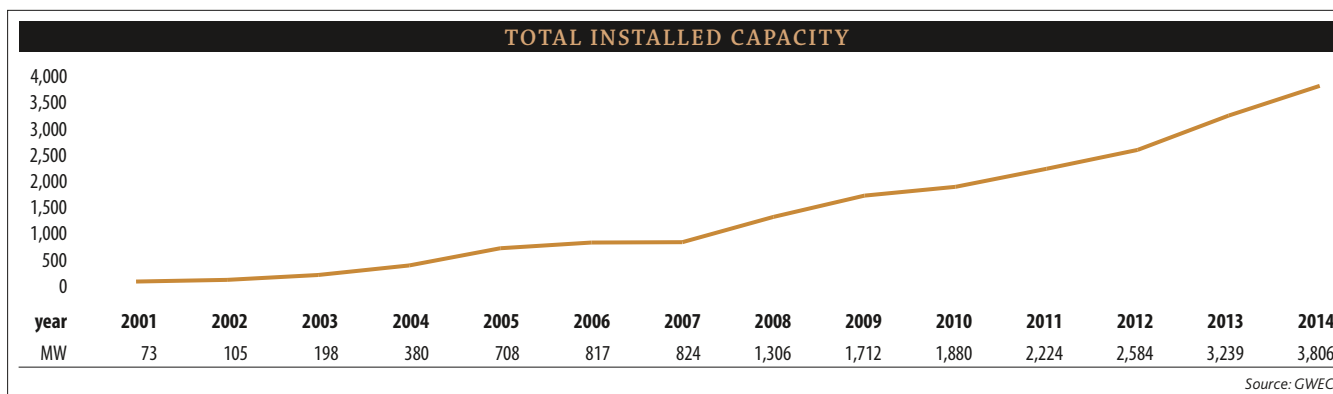
State	Installed capacity (MW)
South Australia	1,475
Victoria	1,070
Western Australia	491
Tasmania	310
New South Wales	448
Queensland	12
Total:	3,806 <sup>1</sup>

Bloomberg New Energy Finance estimated that wind power generated AUD 240 million (EUR 165/USD 187mn) of new financial investment in 2014, significantly down on 2013's total of AUD 1.5 billion (EUR 1/USD 1.2bn).

Turbine manufacturers Senvion and Vestas continue to dominate the Australian market, but new market entrants are beginning to provide an increasingly competitive environment. Siemens has supplied turbines for South Australia's Snowtown 2 wind project and Chinese company Goldwind has constructed two Australian wind

#### Wind farms under construction

Owner	Location/Name	State	Expected Commissioning Year	Installed Capacity (MW)
Banco Santander and CBD Energy	Taralga	NSW	2015	106.8
Pacific Hydro	Portland Stage 4 (Cape Nelson North and Cape Sir William Grant)	VIC	2015	47.15
Mitsui & Co Ltd	Bald Hills	VIC	2015	106.6
Electricity Generating PCL	Boco Rock	NSW	2015	113
Future Energy	Chepstowe	VIC	2015	6



farms. GE provided turbines for the new 55 MW Mumbida project in Western Australia.

### LATEST POLICY DEVELOPMENTS

The Australian government's Renewable Energy Target (RET) is a national scheme supporting investment in wind power and other types of renewable energy. The RET is designed to deliver at least 20% of Australia's electricity supply from renewable sources by 2020, or more than 41,000 GWh of renewable energy annually by that date.

This target was set in 2009. Since then, however, energy demand increase has softened due to economic restructuring and it appears that the fixed target for large-scale renewable generation may overshoot the 20 percent.

The Federal Government is reviewing the RET and has called for it to be cut back, but the opposition has so far maintained that the target provides certainty to the industry and there is no need for change.

However, the review was not resolved in 2014, with negotiations between the two major parties breaking down before the year-end. This uncertainty has brought investments in the sector to a halt.

One positive development during 2014 was the announcement by the government of the Australian Capital Territory (ACT) that there will be a reverse auction for 200 MW of wind energy. The winners of this auction are yet to be announced but the scheme may incentivise the construction of up to three new wind farms.

As wind power is one of the lowest-cost large-scale technologies, it has been the dominant form of renewable generation to receive support under the RET. The Australian Energy Technology Assessment (AETA) published by the Bureau of Resources and Energy Economics (BREE)<sup>2</sup> has shown that wind energy is fast becoming one of the lowest cost forms of electricity generation technology available in Australia.

### OUTLOOK FOR 2015 AND BEYOND

While the ongoing review of the RET is creating a high level of uncertainty, the wind industry is working hard to

demonstrate the many benefits of renewable energy to the Australian economy.

Comprehensive modelling undertaken as part of a government review<sup>3</sup> of the policy in 2014 found that any scenario in which the RET is reduced would result in higher power prices for consumers in the future. The analysis showed that those scenarios which would deliver the most renewable energy were those which would also result in the lowest power prices.

One of the reasons for this is that there is direct evidence of wind energy pushing wholesale electricity prices down. In their 2014 South Australian Electricity Market Economic Trend Report the Australian Energy Market Operator concluded that in South Australia, the state with the highest wind penetration<sup>4</sup> "wind farms have low operating costs and tend to offer energy to the market at low prices. When wind generation is available it places downward pressure on RRP (Regional Reference Prices)."

Renewable technologies also bring increased competition to the energy sector. They can operate more cheaply than traditional fossil fuels such as gas, which has risen rapidly in price this decade. The Australian Government's own Energy Technology Assessment report<sup>5</sup> shows that renewable energy is anticipated to be among the lowest-cost forms of new electricity generation available in Australia by 2020.

Subject to a positive outcome of the RET review, the existing project pipeline means there will be a lot of work to do in the next few years. The renewable energy sector has attracted more than AUD20 billion (EUR 13.8/USD 15.6bn) of new investment in Australia under the policy. A further AUD14.5 billion (EUR 10/USD 11.3bn) of investment in large-scale projects will be generated out to 2020 if the scheme is left unchanged.

*With input from the Clean Energy Council (CEC), Australia*

1 Total does not add due to rounding.  
 2 Bureau of Resources and Energy Economics: <http://www.bree.gov.au/publications/aeta.html>  
 3 RET Review, 2014, Report of the Expert Panel. Available online: <https://retreview.dpmc.gov.au/ret-review-report-0>  
 4 AEMO, 2014, South Australian Electricity Market Economic Trend Report, available online: <http://www.aemo.com.au/Electricity/Planning/South-Australian-Advisory-Functions/South-Australian-Electricity-Market-Economic-Trends-Report>  
 5 Bureau of Resources and Energy Economics: <http://www.bree.gov.au/publications/australian-energy-technology-assessments>



2014 was a record year for the Brazilian wind industry, with new installations totaling 2.5 GW, more than double the 2013 market of 958 MW. At the end of 2014, Brazil had a total of 5.9 GW of installed wind capacity, accounting for 4.3% of national electricity capacity.

The rapid growth in 2014 was due to the impressive results from the competitive energy auctions, and shows the increasing maturity of the entire supply chain in the Brazilian wind market. Wind power was sold at an average price of BRL 136/MWh (USD 48/EUR 43), and maintained the position it achieved in 2013 as the second most competitive form of energy, after large hydropower, in the auctions.



© ABEEólica

## BRAZIL

In 2014, Brazil suffered from very low rainfall resulting in water shortages in many regions, especially in the South-east. Since the electricity system is heavily reliant on hydropower, a shortage of water is a big risk to electricity supply, but this risk was reduced thanks to the growing contribution of wind and other renewable energy sources to the Brazilian energy mix.

Another achievement for the wind industry in 2014 was the expansion of transmission lines, allowing energy to be transferred from the 'ready-to-operate' wind farms in the north-eastern region of Brazil. However, 334 MW of wind power is still waiting for grid connection.

Furthermore, the government published a new provisional legal measure in 2014 for tax exemption for some wind turbine parts and components, adding to the attractiveness of wind power projects for investors.

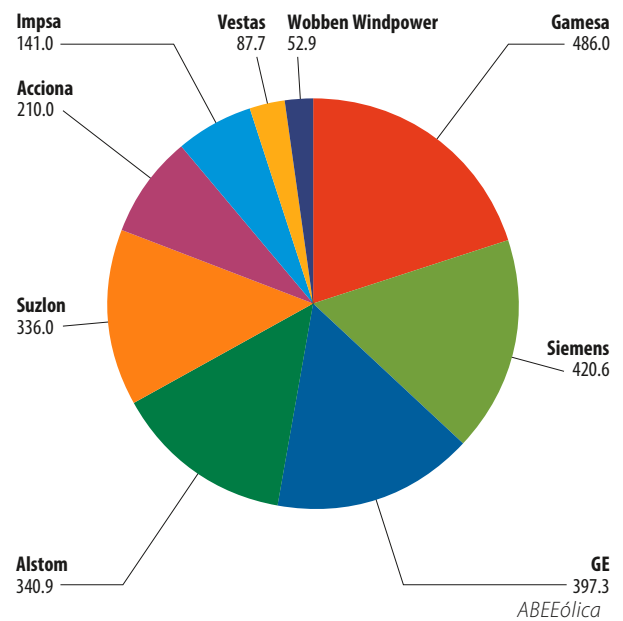
Looking at wind power potential in Brazil, a new Wind Atlas of Rio Grande do Sul was produced. More advanced technology was used for the Atlas including measurements at 150 meters height, showing much greater wind potential than was previously assessed. According to the Atlas, the State of Rio Grande do Sul has a potential of 240 GW from areas with >7m/s wind speeds at 150 meters.

The Brazilian wind industry has the objective to maintain growth of at least 2 GW per year and to keep auction prices at a level suited to the supply chain of the sector. The Brazilian government's Decennial Energy<sup>1</sup> Plan sets a goal for wind to reach nearly 12 % of national generation capacity by 2023.

### WIND ENERGY MARKET IN 2014

In 2014, Brazil built 95 new wind farms totalling 2.5 GW, of which 69 (1.8 GW) came online, and a further 23 (600 MW) were connected to the grid under "test operation phase". At the end of the year, three wind farms totalling 90 MW were still waiting to be connected.

Key industry players in the Brazilian wind market in 2014 (MW)

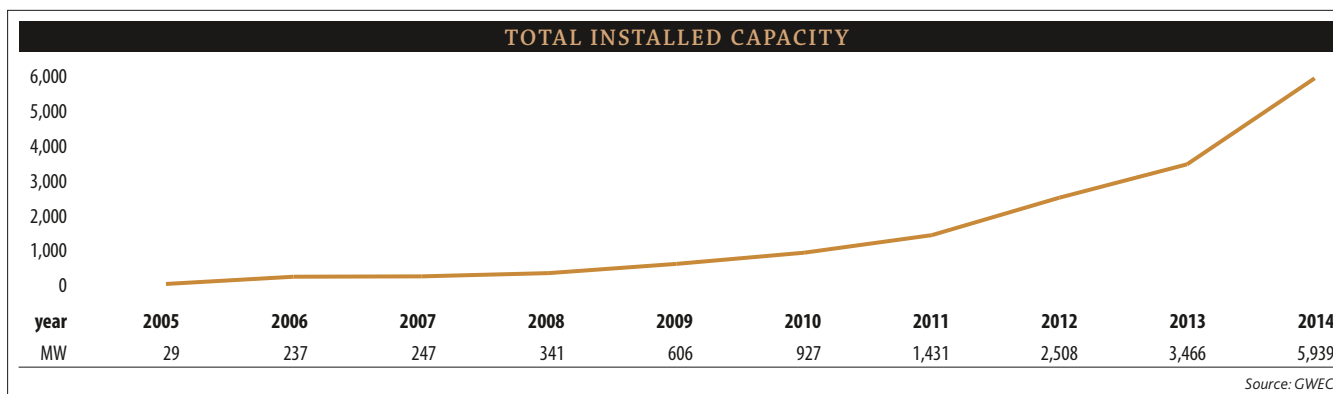


At the end of 2014, Brazil's cumulative wind capacity stood at 5.9 GW with 237 wind farms, of which 202 (5,005 MW) were fully operational and grid-connected, and a further 23 wind farms (600 MW) grid-connected under "test operation phase"; twelve wind farms totalling 334 MW are waiting to be connected.

Three major new wind farms that came online in 2014:

- **Faisa complex:** located in Ceará, with a capacity of 136.5 MW distributed over five wind farms.
- **Geribatu complex:** located in Rio Grande do Sul, with a capacity of 258 MW distributed over ten wind farms; (under test operating phase).
- **União dos Ventos complex:** located in Rio Grande do Norte, with a capacity of 169.6 MW distributed over ten wind farms.

A pioneering initiative from Honda Energy, the 27 MW Shangri-La wind farm was also completed in the course of the year, and will supply clean energy to Honda's vehicle factory.



The results of the energy auctions held in 2014, as in the previous years, were very positive for wind power. 2.25 GW of power was sold in projects, corresponding to a total investment of more than USD 4 billion (EUR 3.6bn):

Auction	Contracted capacity (MW)	Average market price
Auction for energy delivery in 2017	551.0	BRL 129.27
Reserve Power Auction	769.1	BRL 142.34
Auction for energy delivery in 2019	926.0	BRL 136.00

The three top players in the Brazilian wind market in 2014 were Gamesa, Siemens and General Electric (GE).

#### Installed capacity by State in 2014 (MW)

State	Installed capacity in 2014	Cumulative capacity at the end of 2014
Bahia	342.8	931.4
Ceará	572.2	1,233.2
Paraíba	–	69.0
Pernambuco	79.9	104.7
Piauí	70.0	88.0
Paraná	–	2.5
Rio de Janeiro	--	28.1
Rio Grande do Norte	751.6	2,092.0
Rio Grande do Sul	654.9	1,118.8
Santa Catarina	–	236.4
Sergipe	–	34.5
<b>Total</b>	<b>2,472.4</b>	<b>5,938.5</b>

## LATEST POLICY DEVELOPMENTS

Some new regulations with an impact on wind development came into force in 2014:

- **Resolution Number 462/2014:** The National Environmental Council published guidelines for the environmental licensing process for the installation of wind farms in Brazil, providing greater flexibility in the licensing process and greater legal certainty for developers.
- **New rules related to grid connection:** New rules were introduced to the regulated energy auctions introducing a compulsory guarantee on grid connection: Projects can only proceed to the next step if they have the connection to the grid guaranteed.
- **Tax exemption for some wind turbine components:** The government published a new provisional legal

measure in 2014 (Provisional Measure 656/2014 converted into Law No. 13,097) granting tax exemption for some parts and turbine components classified by the Brazilian code NCM 85.03.0090. However, some adjustments to the content of this Act are still being discussed between the industry and the government.

## Offshore wind development

With the rich onshore wind resources there are currently no plans to develop offshore wind in Brazil. However, the Brazilian government has expressed interest in conducting research on offshore wind potential and development in the country. In addition, the new Atlas of Rio Grande do Sul includes offshore measurements and demonstrates an interesting potential in this state.

## KEY BARRIERS TO WIND ENERGY DEVELOPMENT

Despite the great progress made in the sector, some barriers still remain. One of them is the long distance transport of blades and other parts needed for wind farm installations, due to the poor quality of the roads, lack of suitable vehicles and trained personnel, as well as the long time frames involved.

Moreover, it can be challenging in the future to ensure that sufficient number of energy auctions is organized in order to maintain a healthy supply chain.

## OUTLOOK FOR 2015 AND BEYOND

For 2015, the positive trend of growth for the wind industry is expected to continue. Four further energy auctions are expected to take place which will include wind power; of these, 2 are already scheduled: LFA (Alternative Sources Auction) in April 2015 and A-3 (New Energy Auction) in July 2015.

Throughout 2015, the forecast is to install 3.9 GW of wind power, including 157 new wind farms across Brazil.

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

<sup>1</sup> <http://www.epe.gov.br/PDEE/Forms/EPEEstudo.aspx>

For the second consecutive year, the Canadian wind industry enjoyed a record year for new wind energy capacity. A total of 1,871 MW was installed in five provinces in 2014. Most of this growth was centred in Ontario (999 MW), followed by Quebec (460 MW) and Alberta (351 MW). Nova Scotia installed 31 MW while Prince Edward Island added 30 MW. Canada ended the year with a total of 9,694 MW of installed wind energy capacity, supplying approximately 5% of Canada's electricity demand; enough power to meet the needs of over 3 million average Canadian households every year.

## CANADA

Ontario ended the year with 3,489 MW of wind power installations supplying over 3% of the province's electricity demand. Quebec and Alberta follow, with 2,859 MW and 1,471 MW respectively.

In 2014, over 98% of new capacity in the Canadian wind market came from five manufacturers, with Siemens and GE supplying over 50% of all wind turbines, followed by Vestas, ENERCON and Senvion. Several of these companies have now established manufacturing supply chains in Ontario and Quebec, with new facilities expected in coming years.

The 37 new wind energy projects commissioned in Canada in 2014 represent over CAD 3.5 billion (EUR 2.5/USD 2.8bn) in investments. Wind energy has now brought economic growth and diversification to more than 100 rural communities across Canada. Of the 37 new wind energy projects installed in 2014, 15 projects also include significant ownership stakes from First Nations, Municipal Corporations or local farmers.

### FEDERAL SUPPORT FRAMEWORK FOR WIND ENERGY

While Canada's federal government played a direct role in the early stages of wind energy development, there is currently no overarching federal wind energy policy. The federal government has made it clear that it believes that it is the role of the provinces to decide on their respective electricity mixes. The federal government has begun to introduce a series of sectoral greenhouse gas emission regulations which may indirectly support further wind energy development. To date only coal regulations have been implemented, and the timing of regulations for additional sectors including natural gas fired electricity and fossil fuel extraction remain unclear.

There is a need for significant new actions in order for Canada to meet its international climate change commitments and a federal election slated for 2015 could help open new markets for wind energy in Canada. Beyond leadership on the climate change front, the federal government could help kick start the next wave of wind energy development in Canada with measures

Installed capacity by province



Source: CanWEA

that facilitate transmission development, enhance grid connections between markets, incentivise investment in storage and make it easier to secure financing for projects.

Today, however, the industry focuses most of its efforts on provincial policies and programs that will advance the development of wind energy in those regions.

### WIND ENERGY MARKET IN 2014

In Quebec, the Canadian wind industry played an active role in ensuring support for further wind energy development among the province's key political parties and the result was a strong political commitment to issue and award new contracts for wind energy in 2014. Hydro-Quebec's request for proposals for the procurement of 450 MW - a call that generated a tremendous amount of interest within the industry - confirms the highly competitive nature of Quebec's wind energy industry. The three selected projects total 446.4MW at an average price of CAD 6.3 ¢/kWh (EUR 4.4 /USD 5). The utility assigned an additional CAD 1.3 ¢/kWh (EUR 0.9/USD 1) for integration costs. These projects provide better rate base value than the large hydroelectric projects currently under construction.

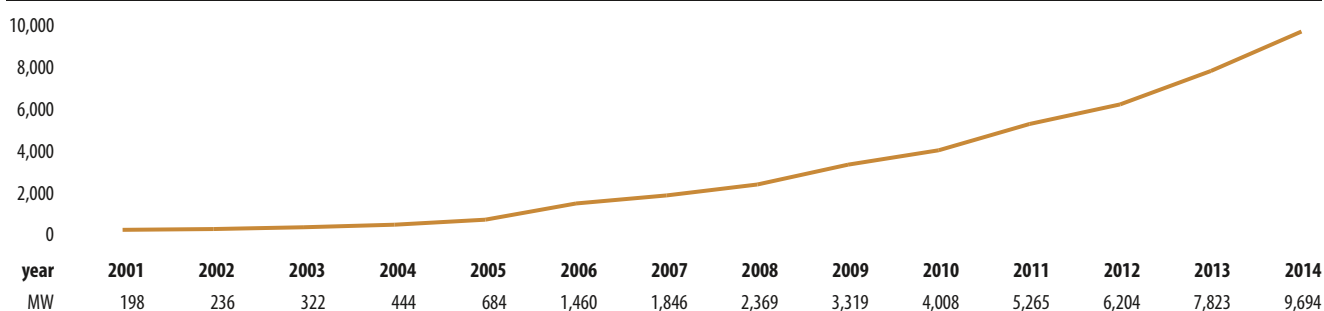
This request for proposals (RFP) was incredibly important, and not just for the new project development opportunities it opened up for developers and the new work it will provide for Quebec's wind energy supply chain. It was also essential in helping the province meet its current target of 4,000MW for wind energy, and a critical interim step towards a new long-term energy plan that will replace the current strategy when it expires in 2015.

Quebec is also home to one of the country's newest and largest wind projects, the 350 MW Rivière-du-Moulin wind farm. In Quebec, the manufacturing supply chain has grown to include more than 150 companies that together employ around 5,000 people.

In Ontario the industry is on firmer footing with the June 2014 re-election of a provincial government strongly committed to continue wind energy development, and the electricity system operator continues to work towards the release of an RFP for 300 MW of new wind



## TOTAL INSTALLED CAPACITY



Source: GWEC



© Northland and 3Ci wind energy

energy in early 2015, to be followed by another one for the same amount of capacity in 2016.

In Alberta, a highlight of 2014 was the completion of the 300 MW Blackspring Ridge wind project in May, the largest wind energy facility in western Canada. The project helped Alberta set a new wind generation record of 1,255 MW on July 25, 2014. Demand at the time was 9,109 MW, implying that wind met 13.8% of total system load. The record is a significant milestone for the province, given it was not that long ago that Alberta had a 900 MW threshold on wind capacity because of integration concerns. Now wind has peaked at nearly 40% above that original limit, giving a real live demonstration of how Alberta's electricity system operator has taken important steps to be able to reliably integrate large amounts of wind energy.

The success with integrating large amounts of wind energy in Alberta, Ontario, Nova Scotia, PEI and other provinces shows how the Canadian wind industry is meeting the challenge of being good partners on the grid.

### KEY BARRIERS TO WIND ENERGY DEVELOPMENT

Some major decisions are at stake in many Canadian provinces as federal coal regulations require existing units to retire when they reach 50 years of age, and several nuclear power plants are in need of major refurbishment. Wind energy's successful track record positions the industry well in the race to capture a growing share of

Canada's electricity supply mix going forward. Wind energy is cheaper than new nuclear or coal, cost-competitive with new hydro, and doesn't have the carbon or commodity price risks associated with natural gas. The industry employs a growing workforce looking to serving not just Canadian markets but offer their products and expertise abroad.

The industry does face some challenges however. Slow energy demand growth in most provinces means that there is limited need for new generation of any kind, and plans for new large conventional generation, like major hydroelectric projects in British Columbia and Newfoundland as well as potential nuclear refurbishment in Ontario, threaten to cut into the opportunities that do exist. Financing hurdles exist in Alberta, Canada's only merchant power market; and in every jurisdiction where projects are developed and operated, there's a continued requirement to improve performance and raise the bar with respect to community engagement and social acceptance at the local level.

### OUTLOOK FOR 2015 AND BEYOND

The Canadian wind energy industry is well positioned to build on growth achieved in 2014 as provincial governments continue to consider their new electricity supply choices for the next decade. The industry anticipates that a lot of the uncertainty that currently exists around the scope and pace of future wind energy development will be addressed in 2015. Since 2011, new wind farm construction has averaged almost 1.4 GW a year and it is expected to maintain that level of growth for at least the next couple of years as projects under construction or under contract come online.

This coming year will also see new wind energy contracts awarded in Ontario, a new Energy Strategy in Quebec, and a new climate change framework in Alberta that may open the door to accelerated wind energy development in that province. Wind's cost-competitiveness, scalability, environmental performance and economic benefits provide a strong foundation that ensures that Canada's electricity future will include a strong and growing role for wind energy generation.

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



Endesa Eco wind farm © Endesa

## CHILE

Chile has a huge untapped potential for wind power – up to 37 GW according to recent estimates by the Chilean Ministry of Energy, which far exceeds far the country's total electricity demand. Today, wind power is considered an ideal energy source to complement the country's hydropower and fossil fuel dominated electricity mix.

### WIND ENERGY MARKET IN 2014

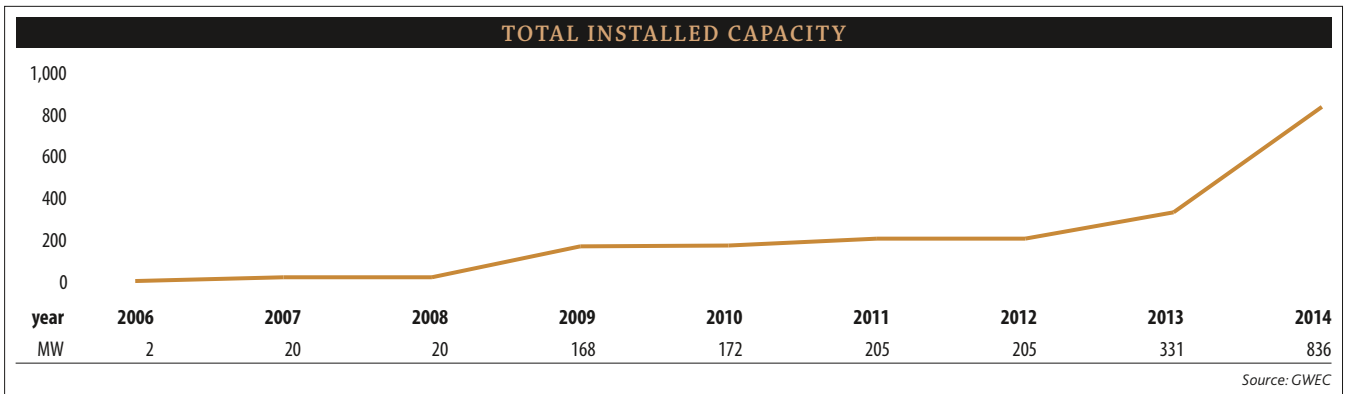
2014 was a record year for wind power development in Chile, with new installed capacity totaling 506 MW, which is almost four times the previous record (130 MW) set in 2013. Chile finished the year with a total of 836 MW, and wind energy now supplies 2.03% of the country's electricity demand. Wind accounted for 40% of total cumulative renewable energy capacity in Chile in 2014, excluding large hydro, followed by small hydropower and solar PV; and Chile accounted for just under 15% of all new installed wind power capacity in Latin America in 2014. Meanwhile, a number of large conventional power projects were rejected by Court decisions in Chile due to negative environmental impacts.

The current rapid renewable energy development in Chile is due to the government's new regulation establishing the necessary conditions for renewable energy uptake, in

particular, allowing variable energy sources to compete on a level playing field with conventional technologies, which helps to overcome regulatory and market barriers for the trading of variable electricity generation. In the latest energy auction, renewable energy sources were awarded 30% of the total contracts, clearly demonstrating their competitiveness. The average price awarded for renewable energy contracts was USD 8/MWh lower than contracts awarded for conventional plants. In the auction about 100 MW was awarded to wind power. In December 2014, Chile's Energy Commission (CNE) published new rules for electricity supply tenders, including renewables. In order to attract bids for renewable energy projects, CNE has divided the contracts to be tendered in 2016 and 2017 into three blocks (so-called "Block Hours") according to the time of the day, with one block running from 11pm to 8am, a second from 8am to 6pm, and a third at the time of peak demand between 6pm and 11pm. Currently, Chile has a pipeline of 170 MW of wind projects under construction.

### LATEST POLICY DEVELOPMENTS

Since the 2025 Energy Law was passed in Chile in 2013, the country's energy agenda has shifted. The development of renewable energy has been hindered by the lack of a specific mechanism to allow variable generation technologies, such as solar and wind, to compete with



conventional sources such as coal and hydropower. Now president Michelle Bachelet's Energy Agenda includes a large share of renewable energy; 70% of new energy capacity installed between now and 2018 shall be renewable (including hydro). The investment climate for renewable energy is becoming much clearer. In April 2015, the Chilean authorities are expected to hold a new energy auction with an estimated total annual production of about 15 GWh. The projects are expected to become operational from 2020 onwards.

#### KEY BARRIERS TO WIND DEVELOPMENT

Several key issues, which are yet to be included in the Energy Agenda of the Chilean government, need to be addressed in order to maintain the pace of wind power development in the country. The main challenges include:

- Conventional power producers must be required to adapt to the new priority dispatch rules for renewable energy, which can in some circumstances place restrictions on conventional power plants.

- Insufficient transmission and grid infrastructure combined with charges and management of the grid. According to the Energy Agenda a regulatory framework regarding these issues is likely to be passed to the Congress for consideration before the end the first half of 2015.
- The renewable energy market is limited by a *de facto* cap by the renewable energy targets, i.e. 20% RES-E by 2025.
- Lack of finance.

#### OUTLOOK FOR 2015 AND BEYOND

Chile has a strong pipeline of 5,224 MW of wind projects under various stages of development. A steady growth of 300-400 MW per year is expected once the necessary policy framework and market conditions are put in place.



Chile: Preparing a Wind Measurement © Tim-Patrick Meyer





© GWEC

China continues to be the main driver of growth in the global wind power market, setting a new record in 2014 with 23,196 MW of new installations, representing a 45% increase in the annual market. China's cumulative installations reached 114,609 MW, up 25.5% from 2013, the first country in the world to pass the 100 GW mark.

The record-setting installations are a solid sign of the recovery of the industry after a slowdown in the past few years. China consolidated its leading role, accounting for 45.2% of the annual global market, and 31% of global cumulative installations. The 23,196 MW also marked the first time a single country has installed more than 20 GW in just one year.

## WIND ENERGY MARKET IN 2014

Wind power now accounts for 2.78% of national electricity consumption with annual production reaching 153.4 TWh. The average annual full load hours reached 1893 hours, which represents a decrease of 181 hours from 2013. This is partly due to the fact that 2014 was a less windy year.

The rate of grid curtailment decreased slightly in 2014 (8% nationwide), down by about 4% from previous year, and is the lowest in the past four years since curtailment became an issue.

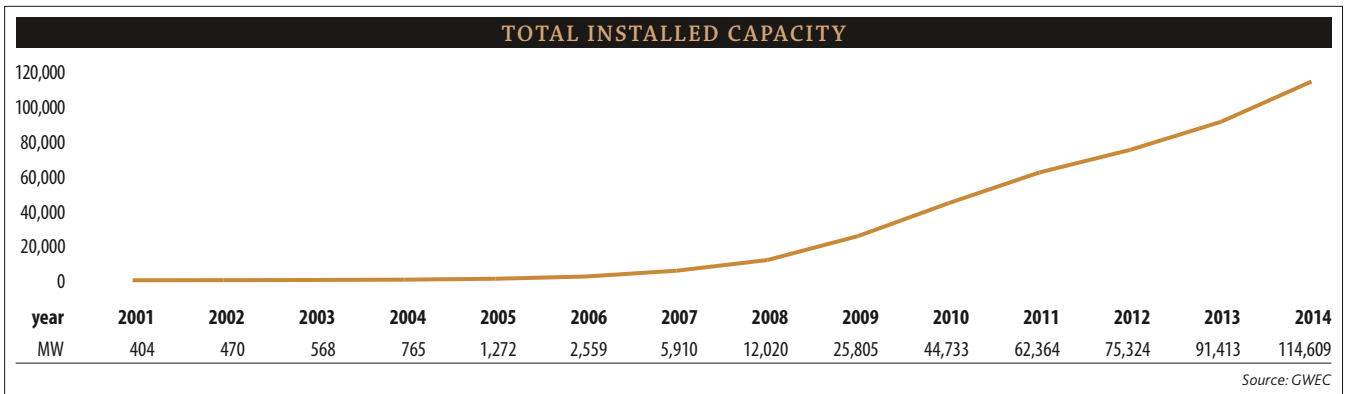
The main reason for this remarkable surge is the wind industry's recovery from the slowdown witnessed after 2011, during which time inadequate grid capacity further restricted wind power expansion. The situation has improved substantially over the past year, with several high voltage lines under construction, such as the Xinjian

Key players in Chinese wind market in 2014

	Manufacturer	MW	Market Share
1	Goldwind	4,434.00	19%
2	Guodian United	2,582.50	11%
3	Mingyang	2,058.00	9%
4	Envision	1,962.60	8%
5	XEMC	1,781.00	8%
6	Shanghai Electric	1,735.60	7%
7	Dong Fang	1,298.00	6%
8	CSIC	1,144.00	5%
9	Windey	898.00	4%
10	Sinovel	729.00	3%
11	Inner Mongolia CASC	705.00	3%
12	China Creative Wind Energy	700.50	3%
13	CSR	610.00	3%
14	Sany	495.00	2%
15	Huayi	466.00	2%
	Others	1,597.00	7%

Hami-Zhengzhou 800 kV line, and the air pollution crisis in China's cities has led to a decision to build nine new HVDC lines in the period from 2014-2017.

Secondly, the larger than expected installations were at least partly in response to the proposed reduction of the onshore FIT, especially considering the numbers in the draft that was released last summer, which proposed a dramatic cut of 7-8% in the windier areas. Fortunately, the final onshore FIT adjustment which was published at the end of last year turned out to be much less, and won't come into effect for the most part until the beginning of 2016. This much milder reduction in the FIT, and delayed implementation, will hopefully prevent the boom-bust cycles we've seen in some other large markets. It seems clear, however, that there will be a continuation of the



boom in 2015 to get as many projects as possible up and running at the current rates.

The top eight manufacturers dominated the Chinese wind market in 2014 installing over 1 GW each. The top five players jointly installed over 12 GW.

The ranking of the top five manufacturers in 2014 stayed exactly the same as last year, while their total share of the market (55%) was also nearly identical to that in 2013. The biggest reshuffle happened in the ranking after the top 6, where Dongfang almost doubled their market share, and swapped ranks 7 and 9 with Sinovel. 2014's black horse was CASC, a manufacturer based in Inner Mongolia, which jumped to 11th with 3% of the market.

Unfortunately, the existing Foreign Invested Enterprises (FIEs)'s market share shrank further, and they've disappeared from the top 15 completely. It's still tough going for FIE's in China, even though prices have bounced back. With tighter pricing due to the FIT reduction, there could be an acceleration of the shift in emphasis from cost of equipment to cost of energy, which would be a good thing not only for the FIE's but for the health of the industry as a whole.

### New onshore feed-in tariff

A number of important new policies with an impact on wind development were introduced in 2014. A new regulation amending the FIT for onshore wind, and the introduction of a FIT for offshore were the most anticipated developments of the year for the Chinese wind industry. (See information about the offshore FIT in the Global Offshore Chapter).

To the sector's relief, the reduction in the tariffs published in December 2014, was much less than anticipated by the Chinese wind industry. The wind categories remain the same, i.e., the country is divided into 4 zones, with a sliding scale of tariffs from the lowest prices for the best wind areas, to higher prices for the lower wind areas. The old prices were RMB 0.51, 0.54, 0.58 and 0.61 / kWh (EUR 0.08-0.09, USD 0.08-0.10 /kWh) and what has been adopted by the government is a reduction of RMB 0.02/kWh (EUR 0.003, USD 0.003 /kWh) for the first three categories, while leaving the last category as it was; so the price table now reads RMB 0.49, 0.52, 0.56 and 0.61 /kWh (EUR 0.07-0.09, USD 0.08-0.10 /kWh).



Xinjiang © Greenpeace China



The new tariffs will apply to the projects approved after 1st Jan 2015, or to those projects approved before 1st Jan 2015 but installed after 1st Jan 2016. The new tariff will have less adverse effects on the industry than the previous draft. However, given the fact that the Chinese manufacturers are running a very thin margin of profit due to heavy competition, the price cut will affect future investments and it is expected that the IV category of wind resources, which is the lower wind area, will see a surge of development in the next few years.

## WIND DEVELOPMENT AT REGIONAL LEVEL

Top 10 Provinces with new capacity installed in 2014

	Province	2014 New (MW)	2014 Cumulative (MW)
1	Gansu	3,630.00	10,725.95
2	Xinjiang	3,216.00	9,668.06
3	Inner Mongolia	2,081.00	22,312.31
4	Ningxia	1,693.70	6144.10
5	Shanxi	1,590.20	5,845.25
6	Hebei	1,372.50	9,872.40
7	Shandong	1,282.80	8,263.30
8	Yunnan	1,156.50	3,640.50
9	Guizhou	811.10	2001.20
10	Jiangsu	760.50	3,676.15
<b>Top 10</b>		<b>17,594.30</b>	<b>82,149.22</b>

In 2014, Gansu province led the Chinese market with a record installed capacity of 3,630 MW. This marks a welcome change in Gansu, a province with exceptional wind resources, that has suffered from grid constraints in the past few years. The record installations are due to expansion of the transmission lines and improved management by the grid companies allowing electricity generated by wind power to be transferred to neighboring provinces, as well as to the eastern provinces. Cumulative installations in Gansu reached 10.73 GW, making it the second province after Inner Mongolia to pass the 10 GW milestone.

Another province benefiting from the improved grid infrastructure was Hebei, adding 1,372 MW of new capacity to the grid, for a total of 9,872 MW. The lower wind speed area Yunnan, a province with high biodiversity, returned to the top ten list with new installations of 1,157 MW, passing 1 GW, and ranking No. 8 in 2014. Yunnan had dropped out of the top ten list in 2013 due to environmental concerns which halted all on-going projects. Measures were taken in 2014 to find a solution which combined wind development with protection of the habitat, a combined effort from both the government and project developers.

The top ten provinces accounted for 76% of the annual installations, and 72% of cumulative installations.

## LATEST POLICY DEVELOPMENTS

The Chinese government published a new decree on "Regulating the wind manufacturing market (Decree 412)" in September 2014. While introducing some new policies, the new regulation also pulls together pieces of old regulations and gives further details on their imple-



Tou Dan Nan wind farm © Greenpeace China

mentation. The focus of the new regulation is placed on quality control, introducing a compulsory certification process: all main turbine parts and components need to be certified before entering a tendering process. This addresses one of the core problems that has plagued the industry during the past years, and should have been adopted already long ago.

As a further measure to increase transparency in the market regarding wind turbine and component data, the National Energy Administration (NEA) introduced the long anticipated "performance data" requirement, which creates an evaluation system for wind turbine quality assessment including a reporting system for turbine faults and 'incidents'. This measure highlights the need for supervision by the government or a third party on quality and performance issues in the market.

Moreover, the new regulation aims to improve transparency in the tendering process; in particular, to prevent local governments from influencing local tenders. Since 2009, local governments have been implementing their own local content requirements in the provinces, where only project developers purchasing locally produced turbines would win the bids for new projects. This forced manufacturers to expand their manufacturing facilities in different provinces, exacerbating the over-capacity problem. Therefore, the regulation now forbids any local interference in the bidding process. Finally, the new regulation also tackles the issue of exiting the "warranty phase", establishing a set of rules





on “exit warranty period” tests, creating a mechanism for dispute settlement as well as a disclosure of information related to warranty and end of warranty.

### **Transmission**

To tackle the bottlenecks in the transmission system, the NEA, State Grid and Southern Grid are working on installing twelve new long distance transmission lines, nine of which are HV transmission lines. State Grid will have four HVDC and four HVAC lines, while Southern Grid will have one HVDC line. Several of the lines will connect Inner Mongolia and Hebei provinces, where vast wind development is taking place, with load centers in densely populated areas.

The Renewable Energy Portfolio Standard (RPS), which is expected to be the strongest policy measure to force grid companies to respect the Renewable Energy Law, which gives wind and other renewable electricity sources priority access to the grid, was not introduced in 2014, despite expectations that it would be. However, progress was made in the government approval process during 2014, and the RPS is likely to be finally introduced in 2015. The RPS will require provincial governments and grid companies (especially at provincial level) to fulfill the renewable portfolio standard. Currently, local governments and grid companies are negotiating the details of the RPS.

### **KEY BARRIERS TO WIND DEVELOPMENT**

The grid remains the most serious challenge facing the wind industry in China. While the government is adding new transmission lines, the major issue still lies in the management and structure of the grid system. Lack of flexibility in the system, coupled with lack of a real electricity market where electricity can be traded, are the key barriers for higher penetration of renewable energy in system. There are positive signs with increased discussion about electricity market reform, but given the current situation, this is not likely to happen in the near future.

### **OUTLOOK FOR 2015 AND BEYOND**

China, especially Beijing and its surroundings, is suffering from an increasingly severe air pollution problem, which has become a critical issue in the country during the past few years. This offers the renewables industry an opportunity to further expand and to consolidate its role as a clean energy provider.

Given the effect of the FIT adjustment, and the continuing imperative to address the air pollution crisis, the Chinese wind industry is expecting to have another good year in 2015.

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



## DENMARK



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**I**n 2014 wind energy accounted for 39.1% of Denmark's electricity needs, up from 33.2% in 2013. This shows that Denmark is well on its way towards meeting its target of 50% electricity from wind by 2020. Denmark added 105 MW of new onshore wind power to the grid in 2014, bringing cumulative wind capacity up to 4,883 MW, of which 1,271 MW is offshore. Despite the fact that no new offshore wind was installed during the year, wind energy was still the leading form of new electricity generation in 2014.

### WIND ENERGY MARKET IN 2014

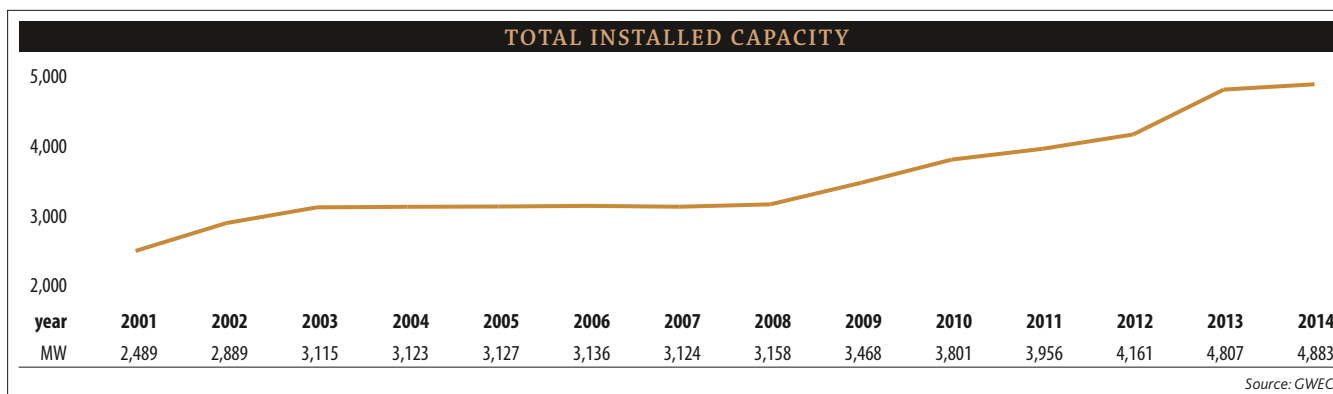
The rate of installations in Denmark decreased by 90.4% in 2014 due to the new incentive scheme which was introduced in January 2014 and set a ceiling of DKK 580/MWh (EUR 77.8/USD 86.5) for the combined DDK 250/MWh (EUR 33.5/USD 37) premium and market price; as a consequence many projects were pushed through the municipal approval procedure before the end of 2013 making 2013 an above average year and 2014 a below

average year. Additionally, public opposition had an impact on reducing the appetite to develop new onshore projects in the municipalities.

Many of the new projects in 2014 were repowering and often include decommissioning of old turbines. The 1,300 MW target for decommissioning from 2012-2020 is not a political goal but an expectation/forecast from The Danish Energy Agency done as part of the Energy Agreement. Until now the old turbines are not being decommissioned as fast as expected.

The top two players in terms of installed capacity in the Danish wind market in 2014 were: Siemens Wind Power (52%) and Vestas (48 %).

In 2014, EDF EN together with Alstom began the development of the new 6 megawatt Haliade offshore turbine at the Østerild Test Center in Denmark. Also MHI Vestas Offshore Wind is testing their 8 MW V164 offshore turbine in Østerild, and Siemens their 6 MW turbine. Envision is expected to make use of their test stand by



mid-2015. Østerild Test Center is able to facilitate testing of future generations of wind turbines up to 250 meters. All of the seven test stands available at the facility are currently rented out.

### LATEST POLICY DEVELOPMENTS

In March 2012, the Danish parliament adopted a new energy agreement for the period from 2012-2020, setting a target of 50% of Danish electricity consumption to come from wind power by 2020. This ambition to reach 50% wind by 2020 entails an onshore target of 1,800 MW of new installations, and replacing aging onshore turbines. During this period, 1,300 MW of onshore wind power are expected to be decommissioned. The government's target also includes 1,500 MW of new offshore installations by 2020, as follows:

- **Horns Reef 3 Offshore Wind Farm** with a capacity of 400 MW in the North Sea is expected to come on line on 1 January 2016 at the earliest. The winner of the tender, published by the Danish Energy Agency in December 2013, was Vattenfall, announced in March 2015.
- **Kriegers Flak Offshore Wind Farm** with a capacity of 600 MW in the Baltic Sea with a grid connection to Germany as well as Denmark is expected to get first turbines online by 1 January 2020, at the earliest.
- **An additional 400 MW** of near shore installations with 50 MW dedicated to test and demonstration projects. 350 MW of the near shore installations are distributed over six projects, which are to compete with each other in one tender with a prequalification deadline set for spring 2015. The six projects are part of a local ownership scheme, where at least 20% ownership shares are to be offered for sale to local citizens. Local citizens can thereby have a share in the revenue created by the wind farms.

In 2014, the government agreement was adjusted somewhat, cancelling 100 MW of near shore wind turbines (down from 500 MW) as well as postponing grid connection of the 600 MW Kriegers Flak wind farm until 2020. These changes are not expected to have an impact on the implementation of the 50% by 2020 target.

### SUPPORT FRAMEWORK FOR WIND ENERGY

In 2014, onshore wind power received a feed-in premium of DKK 0.25 per kWh (EUR 0.03/USD 0.04) for the first 24,000 full load hours, depending on turbine type. As of January 2014, the system was changed to include a DKK 0.58 (EUR 0.08/USD 0.09) ceiling for the sum of the market price and premium, with a 1:1 reduction in the premium when/if the market price exceeds DKK 0.33 DKK (EUR 0.04/USD 0.05) per kWh. The amount of full load hours depends on both the capacity of the generator and the swept rotor area, giving a relatively higher weight to the rotor area than the size of the generator. For a typical turbine the number of full load hours is around 24,000, corresponding to support during the first 6-8 years of production depending on the turbine as well as the wind resource at the specific location.

The offshore tariff in Denmark continues to be driven by a tendering system. The winner of a tender is the one with the lowest bid for a tariff for 50,000 full load hours.

### KEY BARRIERS TO WIND ENERGY DEVELOPMENT

In the period until 2017, reform of the incentive scheme and public opposition are expected to slow the level of onshore installations. From around 2018-2020 onwards, when the next wave of offshore wind farms will be grid connected and 50% of the Danish electricity consumption will be supplied by wind power, a very important challenge will be to establish an adequate technical and regulatory framework for the continuation of the successful integration of wind power in the energy system, including the need for additional transmission lines to neighbouring countries and increased use of wind electricity in the district heating system.

### OUTLOOK FOR 2014 AND BEYOND

No further grid connected offshore wind farms are expected to be erected before the period of 2017-2020 in Denmark; however, about 200 megawatts of onshore wind power are likely to be added to the Danish grid in 2015.

*With input from the Danish Wind Industry Association (DWIA)*



## WIND ENERGY MARKET IN 2014

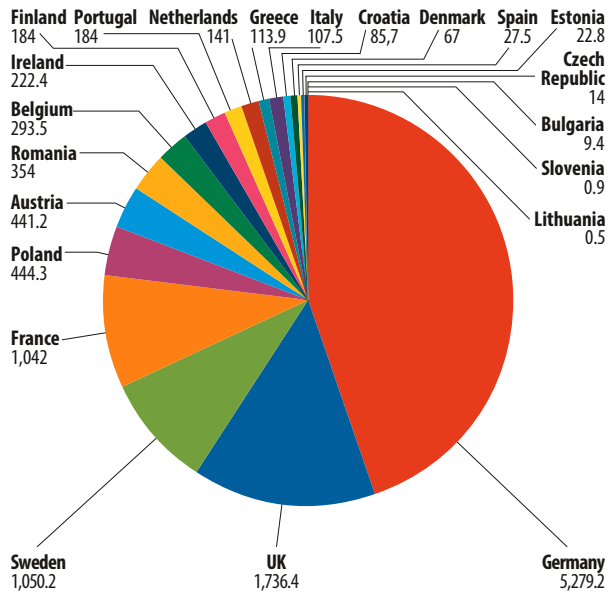
### Annual installations

During 2014, 12,858 MW of wind power was installed across Europe, of which 11,829 MW was in the European Union (EU), 3.8% more than in 2013. Of the 12,858 MW installed in 2014, 11,375 MW was onshore and 1,483 MW offshore.

More than half (59.5%) of all new installations in the EU in 2014 were in just two countries (Germany and the UK), accelerating a market concentration already seen in 2013 when the two countries accounted for 46% of total installations. Moreover, 77.2% of all new installations were concentrated in four countries (Germany, the UK, Sweden and France).

Offshore wind accounted for 12.6% of total EU wind power installations in 2014, with the UK alone accounting for more than half of installations (54.8% or 813 MW), followed by Germany (35.7% or 529 MW) and Belgium (9.5%, 141 MW).

Member State share of new installations in 2014 (MW)



Source: EWEA

## THE EUROPEAN UNION

Germany was the largest market in 2014 in terms of annual installations, with 5,279 MW of new capacity added, 10 % of which was offshore. The UK came in second with 1,736 MW, including 813 MW (46.8%) offshore, followed by Sweden with 1,050 MW and France with 1,042 MW. There is then a significant drop to Poland with 444 MW in 5th spot followed by Austria with 411 MW.

The emerging markets of Central and Eastern Europe installed 838 MW, 71% of total installations. In 2014, these countries represented a smaller share of the total EU market than in 2013 (16%) due to retroactive legislative changes in Romania and uncertainty about the impact of the Renewable Energy Sources Act on the support system and renewable energy market in Poland.

Beyond the EU, 1,029 MW were installed in other European and bordering countries, led by Turkey with 804 MW. Turkish installations were up 24.4% compared to 2013, continuing the strong growth trend of recent years.

### Cumulative installations

A total of 129 GW of wind energy capacity was installed in the European Union at the end of 2014, 9.8% more than at the end of 2013. Germany remains the EU country with the largest installed capacity, followed by Spain, the UK, France and Italy. Ten other EU countries have over 1 GW of installed capacity: Austria, Belgium, Denmark, Greece, Ireland, the Netherlands, Poland, Portugal, Romania and Sweden.

Germany (39.2 GW) and Spain (23 GW) have the largest cumulative installed wind energy capacity in Europe, together representing 48.3% of total EU capacity. The UK, France and Italy follow with, respectively, 12.4 GW (9.7% of total EU capacity), 9.3 GW (7.2%) and 8.7 GW (6.7%).

Outside the EU, Turkey now has almost 3,763 MW of installed capacity, Norway 819 MW and Ukraine 498 MW.

The wind energy capacity currently installed in the EU would in an average wind year produce 284 TWh of electricity, enough to cover 10.2% of the EU's total electricity consumption in 2014.

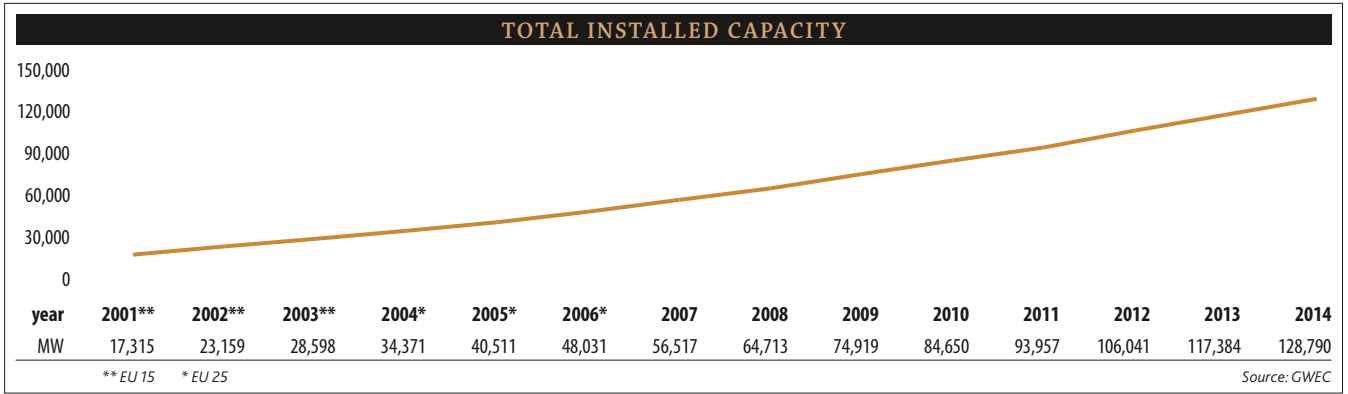
### TRENDS

In 2000, new renewable power capacity installations totalled a mere 3.6 GW. Since 2010, annual renewable capacity additions have been between 24.7 GW and 35.2 GW, up to ten times higher than in 2000.

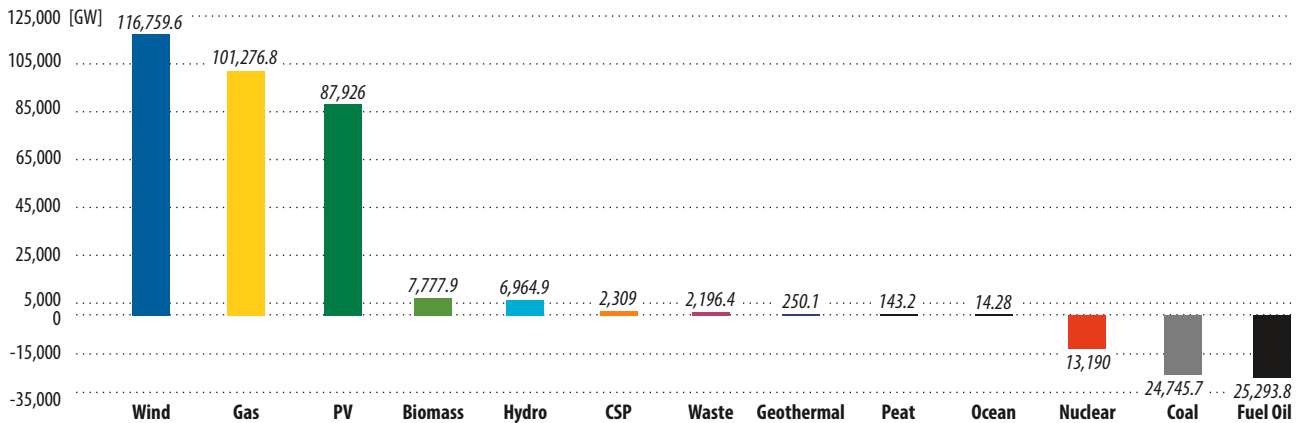
The share of renewables in total new power capacity additions has also grown. In 2000, the 3.6 GW represented 22.4% of new power capacity installations, increasing to 21.3 GW representing 79.1% in 2014.

412.7 GW of new power capacity has been installed in the EU since 2000. Of this, 29.4% has been wind power, 56.2% renewables and 91.1% renewables and gas combined.

The net growth since 2000 of wind power (116.8 GW), gas (101.3 GW) and solar PV (87.9 GW) was at the ex-



Net electricity generating installations in the EU 2000 to 2014 (GW)



pense of fuel oil (down 25.3 GW), coal (down 24.7 GW) and nuclear (down 13.2 GW). The other renewable technologies (biomass, hydro, waste, CSP, geothermal and ocean energies) have also been increasing their installed capacity over the past decade, albeit more slowly than wind and solar PV.

The EU's power sector continues to move away from fuel oil, coal, nuclear and gas while increasing its total installed generating capacity with wind and solar PV. In 2014 gas decommissioned more MW than it installed, but still has the most overall built capacity.

## OFFSHORE

Offshore wind installations in 2014 were 5.3% less than in 2013, with 1,483 MW of new capacity grid connected. Offshore wind power installations represented 12.6% of the annual EU wind energy market, down from 14% in 2013. For more details on the EU's offshore sector see the Chapter on Global Offshore.

## LATEST POLICY DEVELOPMENTS

The main legislation in the European Union supporting the deployment of wind energy remains the Renewable Energy Directive that came into force in 2009, which sets a target of 20% renewable energy in final energy

consumption at EU level, broken down into 28 national targets.

The European Heads of State have now also set a binding renewable energy EU-wide objective of at least 27% in the context of the 2030 Climate and Energy package. This figure of 27% was chosen as, according to the modelling of the European Commission, this would be the share of renewable energy required to meet the EU's 40% CO<sub>2</sub> emissions reduction target.

The Heads of State have decided to move away from binding national targets which means the EU objective will have to be delivered by a new governance system. The European Commission will make initial proposals on this subject in 2015 starting with its communication on the Energy Union. Detailed proposals on the implementation of the 2030 Climate and Energy package are also expected before the end of the year.

Eventually the European Commission is expected to come forward with a proposal of a post-2020 renewable energy directive implementing the 27% renewable energy target as well as targets for energy efficiency and GHG reduction. Taking into consideration the European decision-making process this proposal is expected in the coming 2-3 years.

*With input from the European Wind Energy Association (EWEA)*

## FRANCE



Wind turbine installed on the Eiffel Tower in Paris © Urban Green Energy

After a slow-down in 2013, France added 1,042 MW of new wind power to the grid in 2014, bringing total installed capacity up to 9.3 GW. Overall, wind power, accounted for 4% of national electricity consumption with annual production of 16.2 TWh. The record installations show the current positive political support for wind energy development in France. The government has set a target of reaching 25 GW of wind power by 2020, of which 6 GW is to be offshore.

### WIND ENERGY MARKET IN 2014

In 2014, the key players in the French wind market were Vestas, Enercon and Senvion, followed by Siemens, Gamesa, Nordex and GE. Three main turbine manufacturers dominate the onshore market in France: Enercon, Vestas and Senvion, with a total share of 66%.

Regions with most wind development in France in 2014 were Champagne-Ardenne with an installed capacity of 259.2 MW, Languedoc-Roussillon with 125.5 MW and Picardie with 115.2 MW.

### SUPPORT FRAMEWORK FOR WIND ENERGY

The level of feed-in tariff in France is EUR 8.2 cent/kWh (USD 9.2 cent) for onshore installations for the first ten years of operation, and then adjusted to between EUR 8.2 cent/kWh and EUR 2.8 cent/kWh depending on the production during the first ten years.

The feed-in-tariff for onshore wind energy was approved by the European Commission in April 2014 and thus does not need to comply with the new European guidelines to reform support mechanisms for the years to come.

For offshore wind, the tariff is set at EUR 13 cent/kWh (USD 14.5 cent) for the first ten years and then adjusted

to between EUR 3 and 13 cent/kWh for the following ten years according to the site conditions. However, there have been no takers at these prices, and since 2012 tenders have been organized for offshore wind farms, where the level of the tariff is defined by the winning bidder.

Some changes to facilitate investment and improve offshore wind farm connections to the network are expected to be made in the Energy Transition Law, which is currently under discussion in the French Parliament. It is also anticipated that the measures will include a new premium for offshore wind power.

As part of its environment law "Grenelle II", each region is required to define a regional plan for connection of renewable energies to the network. These plans have now been finalised by most regions, detailing the grid development program for each region and defining an additional fee per MW installed that will need to be paid by wind farm operators to finance it.

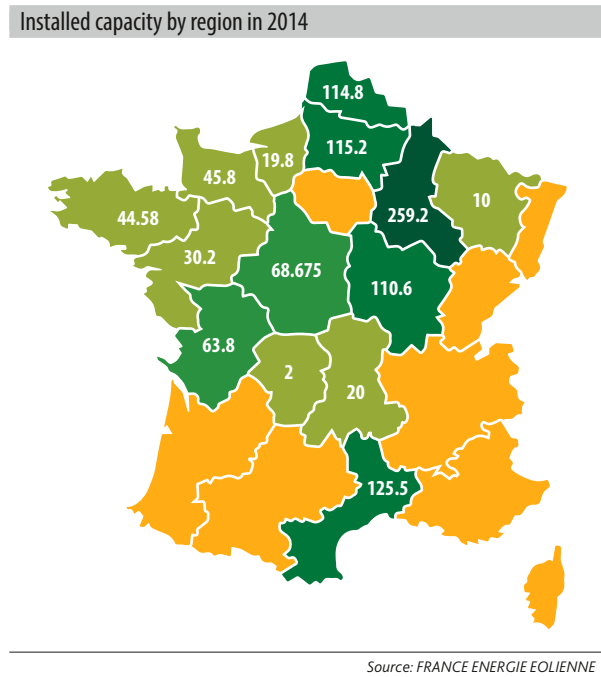
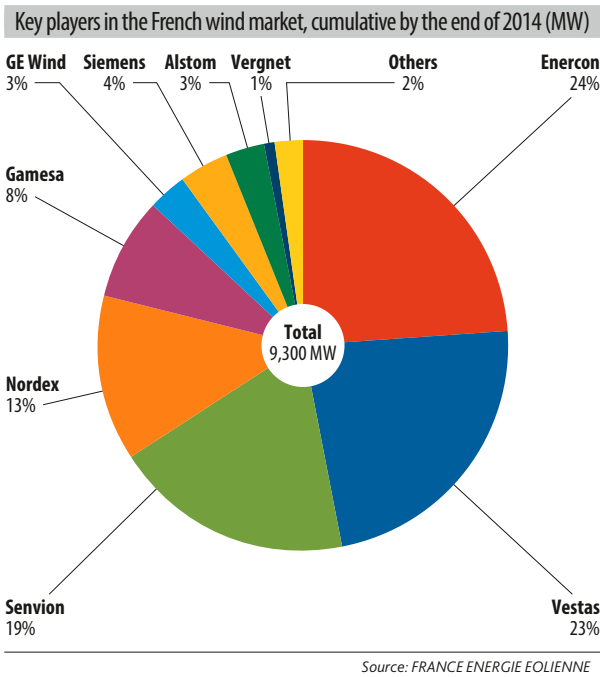
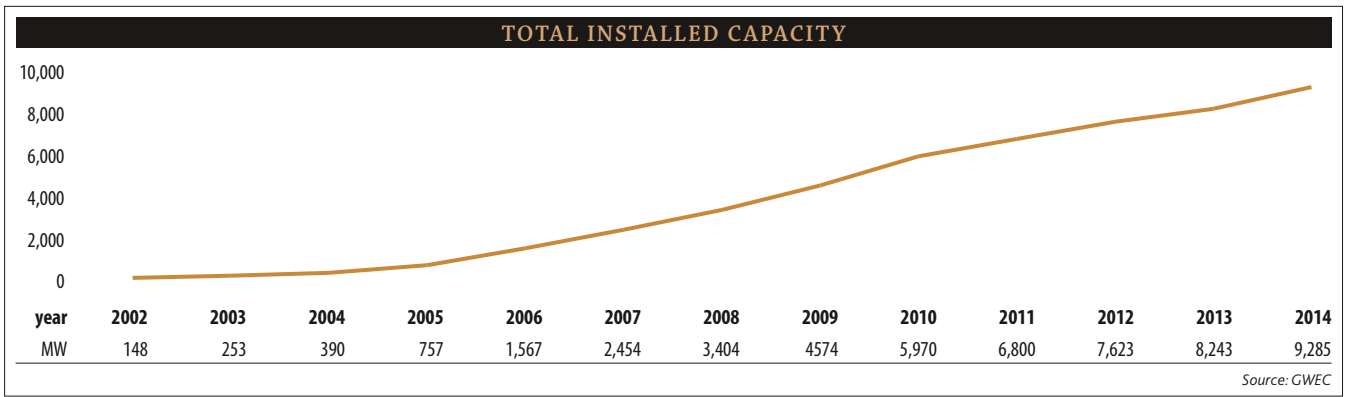
### LATEST POLICY DEVELOPMENTS

At a national level, the 2010 Grenelle II sets a target of 25 GW of wind power by 2020. The Energy Transition Law, currently under discussion in the Parliament, has a target of 32% of the country's energy to come from renewable energy sources by the end of 2015. A new energy plan including targets per sector by 2030, is expected to be prepared in the near future.

At regional level, each region must define a regional wind energy plan (SRE) which includes a target and a definition for favourable areas for wind power development. The total target set in these plans amounts to 28,377 MW.

At least two administrative permits delivered by the local Prefect need to be completed before starting a new wind project in France: a building permit and an operating per-





mit. Additionally, on a case by case basis, further permits may be required.

In 2014, seven regions started testing a simplified 'single step procedure' for permitting with an aim to speed up the lengthy administrative procedures in France. If successful, this system could be expanded to the national level by the end of 2015.

A regulation for a similar single step authorisation process for offshore wind development has been prepared and will soon be implemented.

### Offshore wind development

Six offshore wind farms totalling 3 GW are currently under construction and regional planning involving stakeholder consultation is under way for a third tender. A revision of the terms of reference for the French offshore tenders is now also under discussion, with the objective of mitigating development risks and reducing costs.

At the end of 2014, the French Prime Minister Manuel Valls announced a programme for the development of floating offshore wind turbines, with an investment of

EUR 150 million (USD 167mn). A Call for tender for the floating turbines is expected to be published in June 2015.

### KEY BARRIERS TO WIND ENERGY DEVELOPMENT

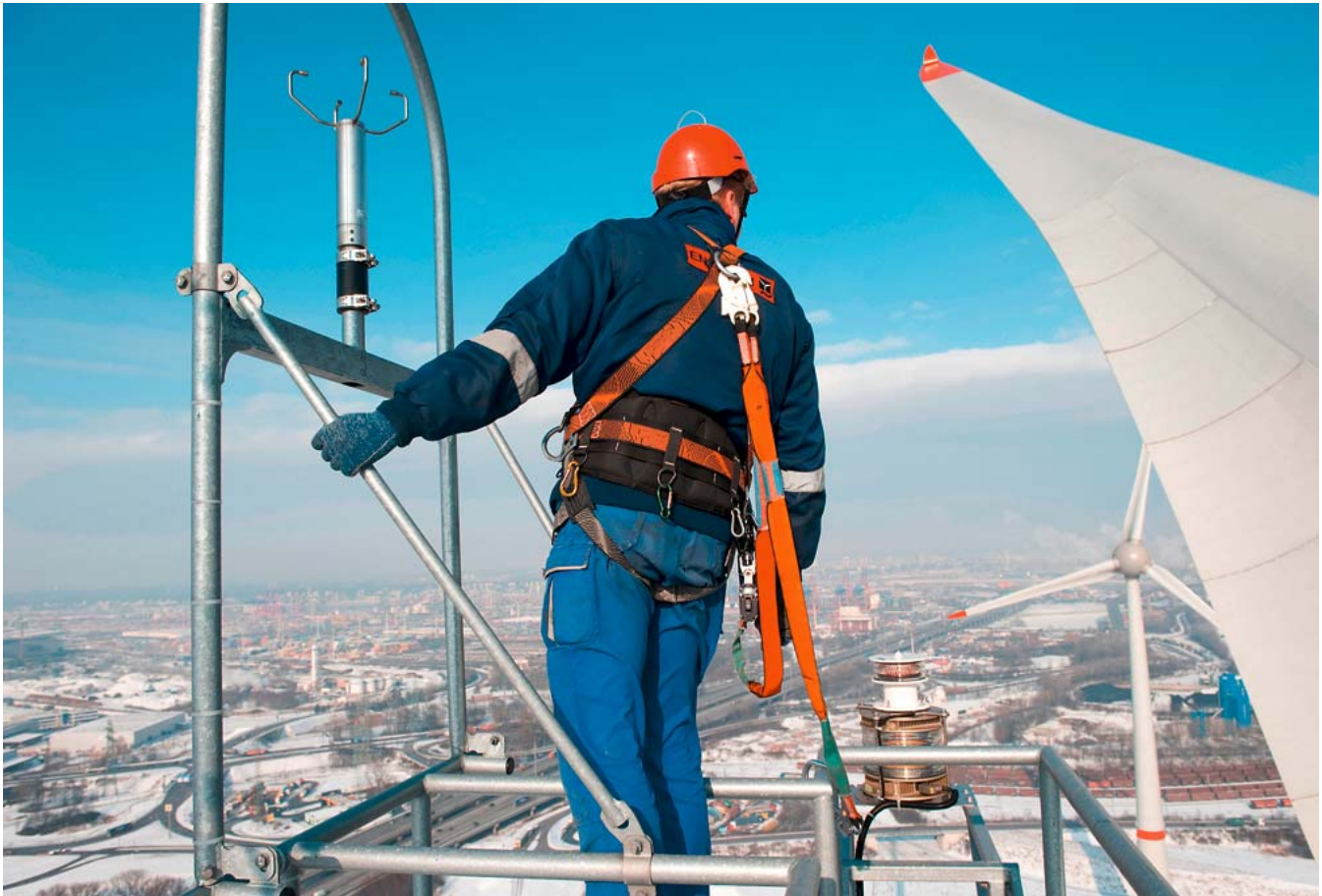
The main obstacles to wind development in France include:

1. Constraints linked to radar and aviation regulations.
2. Long administrative procedures for grid connection (average duration 31 months).
3. Litigation with long waiting times for results.

### OUTLOOK FOR 2015 AND BEYOND

The French wind industry expects solid growth to continue in 2015 and is looking to install 1.2 to 1.3 GW of onshore wind power. Additionally, France has six offshore wind projects totaling 3 GW currently under construction. A third tender for offshore wind power is also likely to be published in the course of 2015-2016.

*With input from the French Wind Energy Association (FEE)*



View on Hamburg City, service team at work © Joerg Boethling

## GERMANY

2014 marked a record year for the German wind market with new installations totalling 5,279 MW, breaking the old record by nearly 2 GW. At the end of 2014, Germany had 39,165 MW of installed wind capacity, of which 1,049 MW was offshore. In the aftermath of the Fukushima nuclear disaster in Japan in 2011, state governments from Bavaria to Mecklenburg-Western Pomerania, and from Saarland to Schleswig-Holstein, have set aside new areas for onshore wind development. The strong support for the energy transition *Energiewende* from the federal states has put Germany at the forefront of the changes to Europe's energy system, and at the same time makes a strong business case for a renewable energy future.

The number of turbines dismantled and replaced also reached an all-time high in 2014; 544 wind turbines with a combined capacity of 364 MW were dismantled, and were replaced by new turbines of more than 1,000 megawatts. Repowering has become a billion euro market. The German market for offshore wind turbines, foundations and grid technology has also grown rapidly,

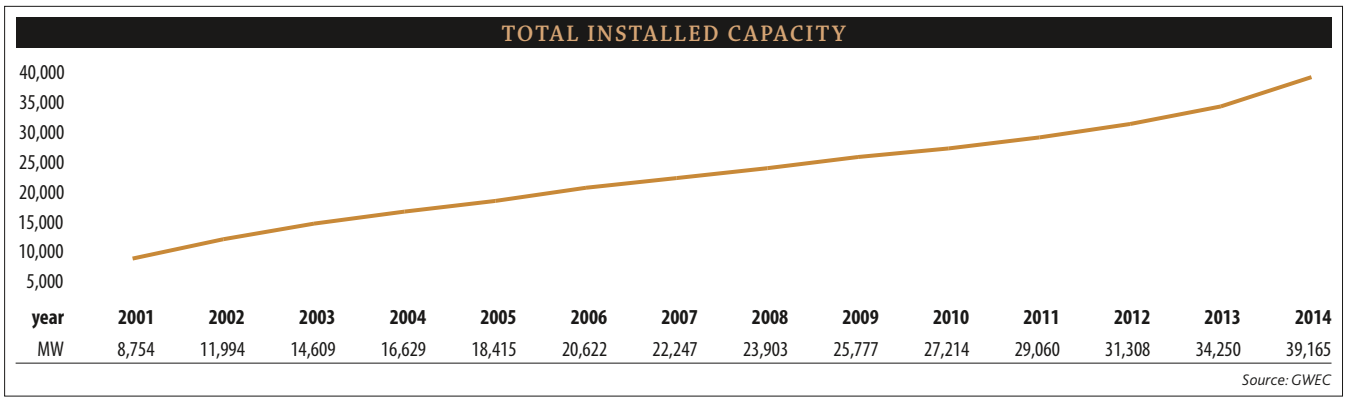
with 529 MW of new offshore wind power connected to the German grid in 2014. Overall, wind power supplied about 9 % of the country's net electricity consumption. For the first time ever on an annual basis, renewables were the largest source in the power mix in Germany, accounting for 25.8 % share of German energy usage, with wind being the largest single contributor.

Nevertheless, a reliable political framework is needed for a continued expansion in order to meet the government's targets and to maintain a strong domestic market for the export oriented German wind industry.

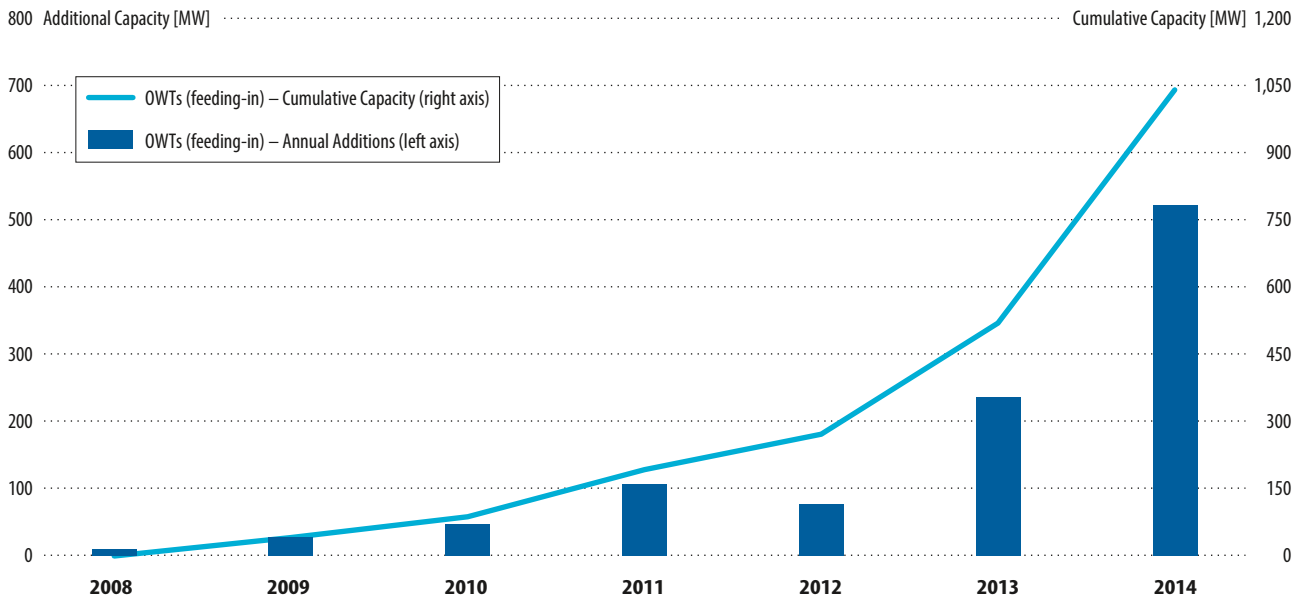
### WIND ENERGY MARKET IN 2014

#### Onshore Wind Energy

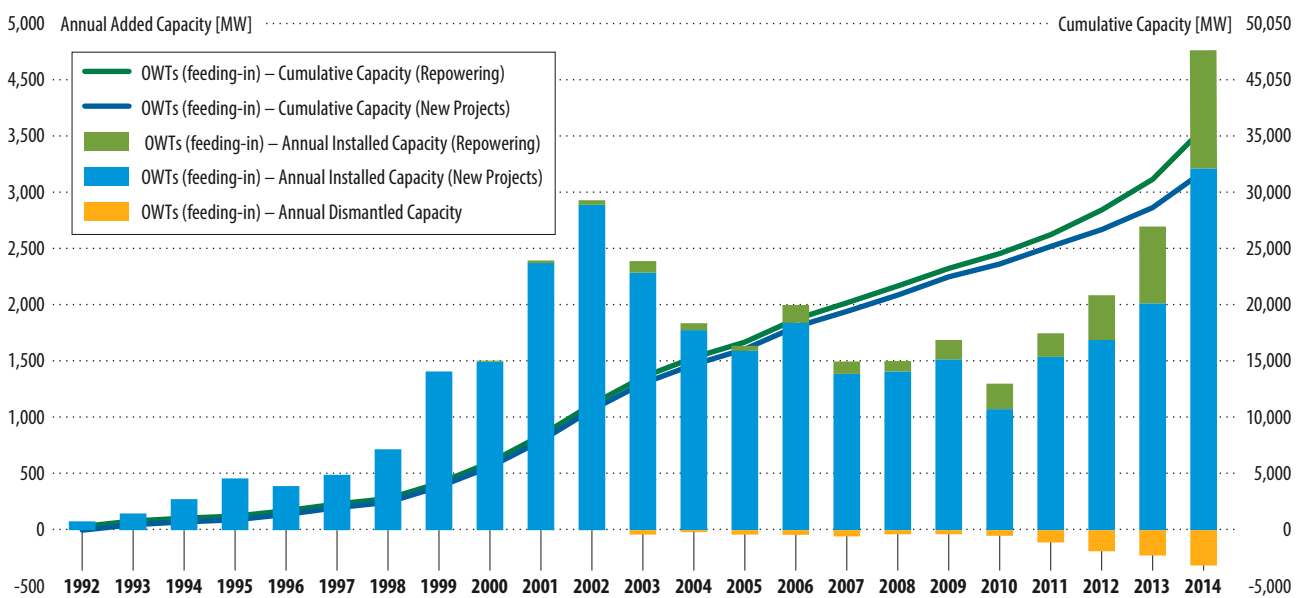
The positive development of the German wind industry after the financial and economic crisis in 2010 continues to gather steam. The German onshore wind market grew nearly 58 % in 2014: 1,766 turbines with a capacity



Development of Offshore Wind Energy in Germany (OWT feeding-in), Status: 31<sup>st</sup> December 2014



Development of the Annual Installed and Cumulative Capacity (MW) of Land-Based Wind Energy in Germany incl. Repowering and Dismantling, Status: 31<sup>st</sup> December 2014





of 4,750 MW came online, of which 1,148 MW were repowering. Overall, 544 turbines with a total capacity of 364 MW were decommissioned. Germany finished the year with 24,867 onshore turbines with a total capacity of 38,116 MW.

The average size of newly installed onshore turbines was about 2.7 MW, with an average rotor diameter of about 99 meters, four meters more than the 2013 average of 95 meters, and average hub height of about 116 meters, reflecting the technological developments in the sector in recent years.

Onshore wind power generated more than EUR 6 billion (USD 6.7bn) of new financial investment in Germany in 2014. With an annual turnover of EUR 10.6 billion (USD 11.9bn), about 119,000 people were employed by the German onshore wind industry in 2013, with strong growth in 2014.

### Offshore Wind Energy

The German offshore wind market surpassed the one gigawatt mark in 2014, more than doubling both annual market in 2013, as well as more than doubling cumulative capacity. In 2014, 142 offshore wind turbines totalling 529 MW came online bringing the total number of offshore wind turbines located in the North and Baltic Seas up to 258, and the total offshore capacity in Germany up to 1,049 MW.

Installations of a further 268 offshore wind turbines totalling 1,218 MW were completed and are scheduled to come online in 2015, and foundations for another 220 turbines were already put in place in 2014. The average size of an offshore wind turbine in Germany in 2014 had a capacity of 3.7 MW, a rotor diameter of 120 meters and a hub height of 89 meters.

The gigawatt breakthrough in installed offshore capacity corresponds to an investment volume of around EUR 4 billion (USD 4.5bn). Additionally, turbine, foundation and grid technology exports account to about one billion euros. This shows the industrial importance of offshore wind energy in Germany employing some 19,000 people with a turnover of about EUR 1.9 billion (USD 2.2bn) in 2013.

For more details on the German offshore sector see the Chapter on Global Offshore.

## LATEST POLICY DEVELOPMENTS

### Support framework for wind energy

The Renewable Energy Sources Act (EEG), which came into force in 2000 and was amended in 2012 and again in 2014, continues to provide stable support for both on and offshore wind energy in Germany.

The revision of the Renewable Energy Sources Act in July 2014 placed focus on three objectives: lower costs, a diversity of market players and meeting the renewable energy targets. The revised EEG sets new targets for



Windpark Dubener Platte © GWEC

electricity produced by renewable sources with a goal to achieve a 40 to 45% share of renewables by 2025, 55 to 60% by 2035 and a minimum of 80% by 2050.

The revised EEG also made game-changing amendments by adding technology specific targets. The new target for onshore wind is 2,500 MW per year through 2020 and a cumulative target for offshore wind was set at 6,500 MW by 2020.

Furthermore, the incentive scheme for wind power was revised in the 2014 amendment of the EEG. Onshore wind power now receives an initial tariff of EUR 8.9 cent/kWh (USD 10 cent) paid for at least five years, followed by a basic tariff of EUR 4.95 cent/kWh (USD 5.5 cent). The duration of the initial tariff depends on site conditions and varies from 5 to 20 years. From 2016 onwards, the basic tariff for onshore wind decreases quarterly by 0.4 % (degression). If the annual installed capacity exceeds or falls below the annual target of 2,500 MW, the degression rate increases or decreases accordingly. The tariff for the respective quarter is announced five months in advance, using the preceding 12 months before the publication date as a reference period for the tariff



calculation. Previous bonuses given to grid services and repowering were cancelled from 1 August 2014. The new amendment in the reference system reduces the tariff for onshore wind by roughly 20 % compared to 2013.

A so-called “acceleration model” was introduced for offshore turbines which come online before 31 December 2019. This gives developers the option for an initial tariff of 19.4 cent/kWh (USD 21.7 cent) for at least eight years, instead of EUR 15.4 cent/kWh (USD 17.2 cent) for at least 12 years depending on water depth and distance to shore. The basic tariff for offshore wind energy is EUR 3.9 cent/kWh (USD 4.4 cent).

The 2012 amendment of the EEG created conditions for direct sale of renewable electricity on the spot market with the introduction of a feed-in-premium (Marktprämie). A further amendment was made in 2014 which, as from August 2014, obliges renewable energy producers to sell directly to the market. The feed-in tariff will be implemented through a market premium. The level of the feed-in-premium per kWh is flexible and calculated as the difference between the monthly average spot market price for electricity and the fixed feed-in tariff.

The tariff will be paid for installations with a maximum capacity of 500 kW, which have started operation before 1 January 2016. Furthermore, in the absence of a direct marketer, producers can claim 80 % of the FIT from the grid operator. If market prices are negative for six consecutive hours, installations bigger than 3 MW, which have been grid-connected after 1 January 2016, can be switched off without compensation.

The biggest change, however, is the government’s plan to roll out reverse auctions starting in 2017 to deduce the ‘correct’ level of support through a market-based mechanism. The concrete design for the tendering procedure has not yet been finalised. Nevertheless, some analysis claim that introducing a functioning tendering procedure for onshore wind would be challenging in the German system and threaten meeting the government’s targets set for wind energy.

### KEY BARRIERS TO WIND ENERGY DEVELOPMENT

One of the key challenges for expanding wind energy development in Germany is system optimisation and grid expansion, in particular regarding offshore wind. Over the past years, however, administrative barriers and regulatory uncertainty have also become issues. Technical and environmental regulatory issues, such as radar, rare species and turbine distance from housing, have delayed or brought projects to a standstill. Moreover, long planning procedures (3 to 5 years) along with the unclear situation regarding the design of the future support mechanism also cause uncertainty and unpredictability in the market.

### OUTLOOK FOR 2015 AND BEYOND

The domestic market has been very stable in the past few years and is expected to continue subject to removal of key administrative barriers. These are primarily political issues, yet both national and federal state level targets for renewable electricity require a growing contribution from wind energy. In 2015, the German wind industry expects new installations of about 3,500 to 4,000 MW. While a decline in the market is expected in 2016, installations are still likely to remain at a high level. The outlook for 2017 will much depend on the timing and design of the new tendering system.

Repowering can and will play a stronger role in Germany in the future. With the potential to double the amount of onshore capacity and to triple the energy yield at repowered sites with significantly fewer turbines deployed. In 2014, repowering already increased significantly and a further 500 MW are expected to be decommissioned in 2015.

In 2015, up to 2 GW of offshore wind capacity is expected to be connected to the grid, bringing the total offshore capacity up to 3 GW, corresponding to an investment of EUR 10 billion in the German offshore wind market.

*With input from the German Wind Energy Association (BWE) and VDMA Power Systems*



## GLOBAL OFFSHORE



Offshore service © Vestas-MHI

2014 saw total cumulative installations in the offshore sector rise to 8,759 MW. The total annual installations reached 1,713 MW between January and December 2014.

At present, more than 91% (8,045MW) of all offshore wind installations can be found in European waters; mainly in the North Sea (5,094.2 MW: 63.3%), Atlantic Ocean (1,808.6 MW: 22.5%) and in the Baltic Sea (1,142.5 MW:14.2%). However, governments outside of Europe have set ambitious targets for offshore wind and development is starting to take off in China, Japan, South Korea, Taiwan and the US. The GWEC-led FOWIND consortium is developing an offshore wind roadmap for India, and other markets, such as Brazil, have raised interest in future offshore development.

While electricity from onshore wind farms is already cheaper than conventional power in an increasing number of markets, relatively high costs remains the biggest challenge for offshore wind development. However, according to a study<sup>1</sup> commissioned by EWEA in 2015, offshore wind costs could be reduced to EUR 90/MWh (USD 94) by 2030. The report says that the sector will have nearly reduced the levelised cost of energy to EUR 100 per MWh by 2020, by which time cumulative installed capacity in European waters is expected to have

tripled to 23.5 GW. Key actions to reduce costs include: deploying larger turbines to increase energy capture (a 9% saving); encouraging greater competition (7%); commissioning new projects – keeping volume up (7%) and tackling supply-chain challenges (3%).

### EUROPE

In 2014, 1,483 megawatts of new offshore wind capacity came online in Europe, a 5.34% decline over the 2013 market. The total now stands at 8,045 MW, and offshore wind power installations represented 12.6% of the annual EU wind energy market in 2014, down from 14% in 2013.

Overall, 408 new offshore wind turbines in nine wind farms and one demonstration project were fully grid-connected at the end of 2014. 54.8% of all new capacity was installed in the UK (813 MW). The second market was in Germany (529 MW or 35.7%), followed by Belgium with 141 MW (9.5%).

In total, there are now 2,488 offshore wind turbines installed and connected to the electricity grid in 74 offshore wind farms in 11 countries across Europe. Total installed capacity at the end of 2014 reached 8,045.3 MW, capable



Number of wind farms, turbines connected and MW fully connected to the grid at the end of 2014 per country in Europe

Country	Belgium	Germany	Denmark	Spain	Finland	Ireland	NL	Norway	Poland	Sweden	UK	Total
No. of farms	5	16	12	1	2	1	5	1	1	6	22	74
No. of turbines	182	258	513	1	9	7	124	1	1	91	1,301	2,488
Capacity installed (MW)	712	1,049	1,271	5	26	25	247	2	2	212	4,494	8,045

Source: EWEA

of producing 29.6 TWh in a normal wind year, enough to cover 1% of the EU's total electricity consumption.

At present, the UK has 55.9% of all installed offshore wind capacity in Europe (4,494.4 MW). Denmark follows with 1,271 MW (15.8%). With 1,048.9 MW (13% of total European installations), Germany is third, followed by Belgium (712 MW: 8.8%), the Netherlands (247 MW: 3.1%), Sweden (212 MW: 2.6%), Finland (26 MW: 0.3%), Ireland (25 MW), Spain (5 MW), Norway (2 MW) and Portugal (2 MW).

Siemens continues to be the top offshore wind turbine supplier in Europe, with 86.2% of the 2014 market (1,278 MW), followed by Vestas with 141 MW (9.5%), Areva (45 MW, 3%) and Senvion (12.3 MW, 0.8%). Samsung also connected its 7 MW demonstration turbine to the grid in Fife, UK.

In cumulative terms, Siemens is also the lead offshore wind turbine supplier in Europe, with 65.2% of total installed capacity. Vestas (20.5%) is second, followed by Senvion (6.6%), BARD (5%), Areva (0.9%), WinWind (0.7%) and GE (0.4%). Other suppliers, including Samsung, Alstom and Gamesa account for the remaining 0.8% of the market.

2014 also marked a significant year for offshore wind financing. According to EWEA, there are an increasing number of investors entering the offshore business, supplying both debt and equity finance. Out of the nine projects that reached financial closure in 2014, four of them are worth EUR1 billion or more.

At present, in Europe the average offshore wind turbine size is 3.7 MW, average water depth 22.4 meters and average distance from shore 32.9 km.

Looking ahead, there are twelve projects currently under construction, when completed will add 2.9 GW, bringing cumulative capacity in Europe to 10.9 GW in the course of 2015-2016. It is expected that Germany's annual market will surpass that of the UK in 2015 for the first time.

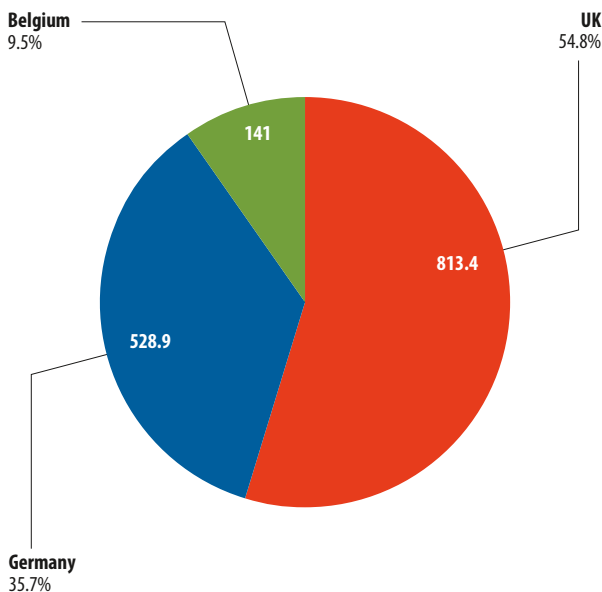
However, EWEA expects a slump in the market in 2016. No large offshore projects are expected to be commissioned in the UK in 2016, though the 50 MW Kentish Flats Extension may come on line. Outside of the UK, only Germany and the Netherlands are expected to bring capacity online in 2016 with DONG Energy's Gode Wind 1 and 2 and ENECO's Westermeerwind.

Beyond 2016, EWEA has identified 26.4 GW of consented offshore wind farms in Europe and future plans for offshore wind farms totaling more than 98 GW.

#### UK continues as the world leader

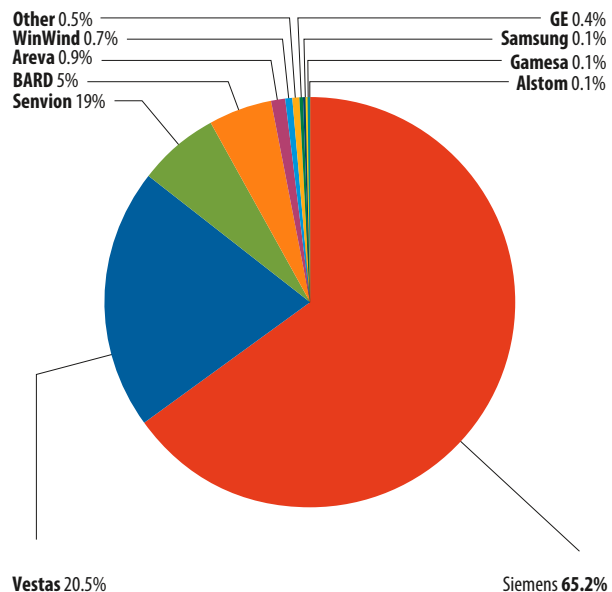
The UK continued to lead the world's offshore industry in terms of both annual and cumulative installations in 2014, with as much installed capacity as the rest of the world combined. Out of the 17 offshore wind farms where work was carried out in Europe last year, five were in the UK. At five offshore wind sites - Methil Demo (Energy Park Fife), West of Suddon Sands, Gwynt y Môr, Westernmost Rough, Humber Gateway -219 turbines were connected in 2014, for a total annual market of 813 MW.

Share of annual offshore wind capacity installations in Europe in 2014 (MW)



Source: EWEA

Wind turbine manufacturers' share at the end of 2014 (MW)



Source: EWEA



© GWEC

In April 2014, six offshore projects with a total capacity of 3.1 GW were awarded under the regime inaugurated by the Energy Act (2013). These projects are: Beatrice, Burbo Bank Extension, Dudgeon, Hornsea 1 and Walney Extension.

The challenge of a new financial regime means that less offshore wind is likely to be installed by 2020 than had previously been expected. The Contracts for Difference are underpinned by a Levy Control Framework which will limit the expansion of offshore wind, particularly if costs remain at current levels; therefore developers have a strong commitment to reduce costs.

Provided a clear long term market which allows for cost reduction is evident, prospects for offshore wind remain very strong due to the UK's excellent resources and fully established supply chain. There is no formal target for offshore wind in the UK, but the government's renewable energy roadmap envisages a minimum of 9 GW by 2020.

### Germany to shine in 2015

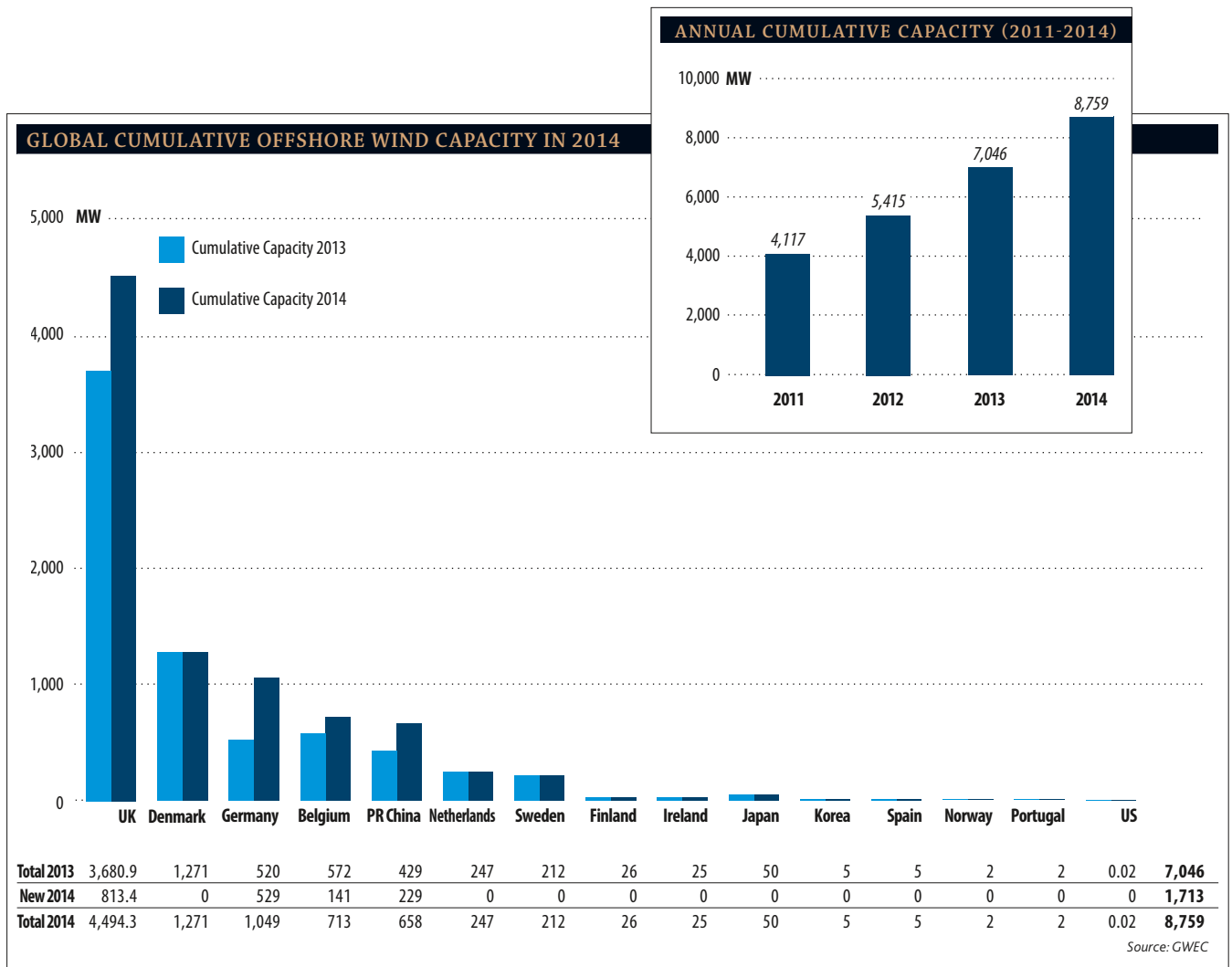
The German offshore wind market surpassed the one gigawatt mark in 2014, more than doubling both 2013's annual market and the country's cumulative offshore

capacity. In 2014, 142 offshore wind turbines totalling 529 MW came online bringing the total number of offshore wind turbines located in the North and Baltic Seas up to 258, and the total offshore capacity in Germany up to 1,049 MW.

Installations of a further 268 offshore wind turbines totalling 1,218 MW were completed and are scheduled to come online in 2015, and foundations for another 220 turbines were already put in place in 2014. The average size of an offshore wind turbine in Germany in 2014 had a capacity of 3.7 MW, a rotor diameter of 120 meters and a hub height of 89 meters.

The gigawatt breakthrough in installed offshore capacity corresponds to an investment volume of around EUR 4 billion (USD 4.5bn). Additionally, turbine, foundation and grid technology exports account for about one billion euros. This shows the industrial importance of offshore wind energy in Germany, employing some 19,000 people with a turnover of about EUR 1.9 billion (USD 2.2bn) in 2013.

In 2015, up to 2 GW of offshore wind capacity is expected to be connected to the grid, bringing total offshore capacity up to 3 GW, corresponding to an investment



of EUR 10 billion in the German offshore wind market. The largest wind farm to be fully completed during the first quarter of 2015 will be the Global Tech 1 wind farm with 400 MW. It is expected that Germany will be by far Europe's leading offshore market in 2015.

### Belgium ranks as the world's fourth biggest market

In 2014, Belgium added 141 MW of offshore capacity, installing 47 turbines which make it the world's fourth largest offshore market. Although Belgium has less than 100 km of coastline, it is a pioneer country when it comes to offshore wind development with 712 MW of total capacity. The major driver for Belgium's offshore sector is the EU's 2020 Renewables Directive.

The second phase of the NorthWind offshore wind farm came online adding 141 MW to the grid in 2014. To date, Belgium has five fully grid connected offshore wind farms spread over 182 turbines, including the 216 MW NorthWind, 325 MW Thornton Bank 1-3 and the 165 MW Belwind 1 project. Additionally, there's a 6 MW Belwind Alstom Haliade demonstrator which is installed off the coasts of Ostend harbour at the Belwind site in Belgium.

Other projects in the pipeline are: Nobel wind (165 MW), Belwind 2 (135 MW), Norther (350-450 MW), Rentel (288 MW), Seastar (246 MW), THV Mermaid (449-490 MW) and Northwester 2 (230 MW).

However, to further develop offshore wind power in the country, Elia, the Belgian TSO, needs to upgrade the transmission system to ensure that electricity produced from the North Sea can be transferred to the load centers. Elia has begun a 380kv high voltage transmission project between Zeebrugge and Zomergem, as well as the construction of two new substations. All required permissions are already in place and construction works started at the end of 2014 and are expected to be completed by 2016.

### DEVELOPMENT SLOWLY TAKING OFF IN CHINA

In 2014, China installed 229.3 MW of offshore capacity, making it the third largest annual market globally after the UK and Germany. Cumulative offshore installations total 657.88 MW.



The majority of Chinese offshore projects are installed in the shallow waters close to the shore, called inter-tidal projects, where the sites dry out (or nearly so) at low tide. Most of the projects in deeper waters, such as those granted under the first round of tenders, are either still in development or have just started construction.

In June 2014, the government made the long-awaited announcement of a feed-in tariff for offshore wind. Although the level of the tariff was lower than the industry had hoped, and may not lead to a big rush into the sector, it is likely to give the industry a bit of a boost and some of the early players with experience gained in the past few years, such as Longyuan, are likely to get more involved.

The tariff was set at RMB 0.85/kWh (EUR 0.13/USD 0.14) for near shore offshore projects and at RMB 0.75/kWh (EUR 0.12/USD 0.12) for inter-tidal projects. The current tariff is, however, only a temporary measure, covering projects that come online before 2017, after which the level will be reviewed.

A real push for the sector followed in the autumn, after the government had come to terms with the fact that their 5 GW target for offshore wind by 2015 would be difficult to achieve. In August 2014, the National Energy Agency (NEA) published a list of 44 offshore projects totaling 10.53 GW, which was topped up by 250 MW in the final project list published in December. These projects are mainly gathered from provincial planning and are expected to be developed in the next few years.

Additionally, local governments have also introduced a number of measures to attract investment into the offshore business at provincial level. For instance, the Shanghai municipal government introduced a measure to give a further boost to offshore wind by adding RMB

0.2/kWh (EUR/USD 0.03) on top of the current FIT. This additional incentive will make projects more attractive for developers and investors. Moreover, the Jiangsu government has been active in recent years in attracting OEMs to bring manufacturing facilities to their province. The Guangdong government also has an ambitious plan and has formed a consortium with Southern grid and turbine OEMs for wind development. Fujian is another provincial government putting emphasis on offshore development.

### TAIWAN AIMS FOR 600 MW BY 2020

The Taiwanese government has plans to develop 4.2 GW of wind power by 2030, of which 3 GW will be offshore. In order to reach the 600 MW target set for offshore wind by 2020, the Bureau of Energy (BOE) plans to have 4-6 pilot projects installed offshore in 2015. In October 2013, grants were allocated for two projects: the 108 MW Fuhai wind farm and the 122.4 MW Formosa wind farm.

At the end of 2014, the Formosa offshore project got a special Independent Power Producer (IPP) permit, which is a big step forward. Under the IPP permit, the first batch of TWD 1000 million (EUR 30/USD 31.5mn) of the government grant will be released for the installation of the first two offshore turbines in Taiwan. The project is aiming to install the two turbines by 2015 and a further 34 units by 2018. The project will receive a special tariff introduced by the government of TWD 5.56/kWh (EUR 0.16/USD 0.17). The Fuhai project has signed several agreements with subcontractors for wind assessment and is in the process of getting an IPP permit from the government. Both of the projects will use Siemens turbines, suitable for the typhoon and earthquake-prone Taiwanese coast.



Denmark © KeenPress and Danish Wind Industry Association

## US CONTINUES SLOWLY BUT SURELY

No offshore wind capacity is yet installed in the United States, with the exception of the University of Maine's 0.02 MW VoltturnUS floating turbine project. The underlying limiting factor for offshore wind development in the US is that the basic economic and financial conditions for offshore wind success are not yet in place. Without them, investors are not comfortable providing capital for these projects, and the sector inevitably will struggle to get off the ground.

The future of the most advanced offshore project in the US, the 468 MW Cape Wind project, was once again cast into doubt in early 2015 when the project's PPAs were cancelled. The Cape Wind project, located in Nantucket Sound south of Cape Cod, MA, has been pursued by EMI for 14 years. After years of various legal and political difficulties, the cancellation of the PPA is so far the most serious setback for the project. The cancellation of the PPA was caused by failure of EMI to meet a financial deadline at the end of 2014.

However, progress has been made on the 30 MW Block Island project, located in state waters off Rhode Island, which is poised to become America's first commercial offshore wind farm. The Block Island project will feature five Alstom Haliade 150 6 MW turbines and has secured a PPA with utility National Grid for 20 years for 100% of its output. Block Island developer Deepwater Wind plans to begin installation in the summer of 2015, with the project scheduled to be fully operational by the end of 2016.

The US Department of Interior's Bureau of Ocean Energy Management (BOEM) is in charge of the permitting process for offshore projects including planning, leasing, site assessment, construction and operations. In 2013, the BOEM started leasing tracts for offshore wind development in federal waters; there are two different tracks, the competitive auction and reward of non-competitive leases.

In August 2014, BOEM held a commercial lease sale in Maryland, where US Wind Inc. won a bid of over USD 8.7 million (EUR 8.3mn). Moreover, BOEM also leased tracks for five projects in Virginia, which will hopefully be auctioned in the next few years.

The US Department of Energy (DOE) also continues to support offshore development with their Offshore Wind Advanced Wind Technology Demonstration Projects (OWAWTD) programme. In 2014, Principle Power, Inc. won a bid of USD 46.7 million (EUR 44.8mn) for its WindFloat project, utilizing its semi-submersible floating platform, which will be located in Coos Bay, Oregon.

The US Department of Energy's new **WindVision**<sup>2</sup> report found that the United States could obtain 10% of its electricity from wind by 2020, 20% by 2030 and 35% by 2050; and 22 GW could come from offshore wind projects by 2030.

## JAPAN HAS SIX NEW PROJECTS IN THE PIPELINE

In Japan, 49.6 MW of offshore wind power capacity is currently installed: 4 MW floating; 4.4 MW on fixed foundations; and 41.2 MW of semi-offshore wind turbines. One 3 MW semi-offshore wind turbine will start operation in the first half of 2015 at Akiita port and one 7 MW floating offshore wind turbine is due to start operation in the summer of 2015 as part of the Fukushima FORWARD project. The Fukushima floating turbine will be located 20km from the coast.

A further 12 offshore wind power projects totaling 874 MW are in the planning stage, and six of those projects (504 MW) are in the EIA process and preparing for construction to begin around 2020. Offshore wind installations receive a feed-in tariff of 36 JPY/kWh (EUR 0.28/USD 0.30). The offshore FIT is 1.6 times higher than the onshore tariff (22JPY/kWh), which improves investment confidence in the sector.

The long coastline and high cost of onshore development makes offshore wind an attractive option for the Japanese wind industry. There were a few small demonstration projects installed in 2003-2004, but real offshore wind development in Japan started after 2010. In 2011-2012, small scale demonstration projects, usually one-turbine prototypes, were installed by manufacturing conglomerates who wanted to enter the offshore market. However, all of the four projects installed in 2013 were government-led investments and were mainly developed for testing different technologies. Finally, in 2014, commercial development began, bringing positive change echoing the introduction of the offshore FIT at the beginning of the year.

Offshore wind power projects in the pipeline in Japan

Project name	Location	Output (MW)	Wind turbines (MW)
Fukushima FORWARD	Fukushima	14	5 – 7
Kashima Port No.1	Ibaraki	125	5
Kashima Port No.2	Ibaraki	125	5
Yasuoka	Shimonoseki	60	4
Ishikarishinko	Hokkaido	100	2.5 – 5
Mutsuogawara	Aomori	80	2.5

Source: JWPA

The Fukushima FORWARD project is a national government led project but the four others are commercial projects. The Kashima, Ishikarishinko and Mutsuogawara projects are located in designated areas (i.e. port areas). Currently there is no law or regulation for offshore wind power development in Japan for undesignated areas. The JWPA has begun discussions with lawmakers in the Daiichi Tokyo Bar Association to address this gap in necessary regulations.

1 Offshore Wind in Europe: Walking the Tightrope to Success, Ernst & Young, 2011  
 2 [http://energy.gov/windvision?utm\\_source=wdxch&utm\\_medium=email&utm\\_campaign=windvision15](http://energy.gov/windvision?utm_source=wdxch&utm_medium=email&utm_campaign=windvision15)



Dhule wind farm © Suzlon

India was the fifth largest market globally in 2014, adding 2,315 MW of new wind power capacity to reach a total of 22.5 GW. Among renewables, wind power accounted for almost two-thirds of the installed capacity. The Indian government expects the share of renewable energy, presently at 6.9% of the total electricity production in the country, to grow to at least 15% in the next five years.

Wind energy's share in the total power mix of the country was approximately 3% for the calendar year 2014<sup>1</sup>. India's investments in the renewable sector in the year 2014 reached almost USD 7.9 billion (EUR 6.5bn). The renewable energy sector investments rose by almost 13% in 2014 over the previous year<sup>2</sup>.

#### WIND ENERGY MARKET IN 2014

The leading states in terms of installed capacity were Tamil Nadu, Maharashtra, Gujarat, Rajasthan and Karnataka. Other emerging states include Andhra Pradesh and Madhya Pradesh.

The recent announcements by the Indian Ministry of New and Renewable Energy (MNRE) indicate that India plans to achieve 60,000 MW in total wind power installations by 2022. This sets the industry an ambitious annual target of approximately 5,000 MW/year up to 2022.

The long-term outlook for wind power remains positive mainly because of regulatory support, cost competitiveness and the generation-based incentive benefit. Though the National Action Plan for Climate Change from 2008 had specified a minimum Renewables Purchase Obligation (RPO) target of 15% by FY 2020, currently a majority of the states are below the recommended RPO trajectory. During 2014 the sector continued to face challenges, as a majority of the 28 states failed to meet the long-term track for RPO norms.

#### Support framework for wind energy

By the end of 2014, 28 states and union territories had defined an RPO. However the weak enforcement of this

obligation impacted the sector negatively. Also, the renewable energy certificate (REC) framework linked to the RPO, which was introduced for inter-state purchase and sale of renewables-based power, has not been a success. This is largely due to the non-compliance and weak enforcement of the RPO by the states and market regulators.

At the state level, wind policies by various states include preferential FITs, allotment of sites and concession for wheeling charges on state owned grids and banking of excess energy for future use for wind power producers.

Wind power producers can also use the tax-based Accelerated Depreciation (AD) incentive (80% depreciation in the first year of installation) or Generation Based Incentive (GBI) of INR 0.5/kWh for at least four years and up to ten years.

Wind power producers can either opt for preferential tariffs decided by the state regulator ranging from INR 3.39-6.50/ kWh (EUR 0.04-0.08) or get tradable renewable energy certificates (minimum price: INR 1,500/MWh, EUR 19.4/MWh; maximum price: INR 3,300/MWh, EUR 42.5/MWh) along with power bought at average power purchase cost (APPC) by the utility, which ranges from INR 3.0-3.7/ kWh<sup>3</sup> (EUR 0.03-0.04).

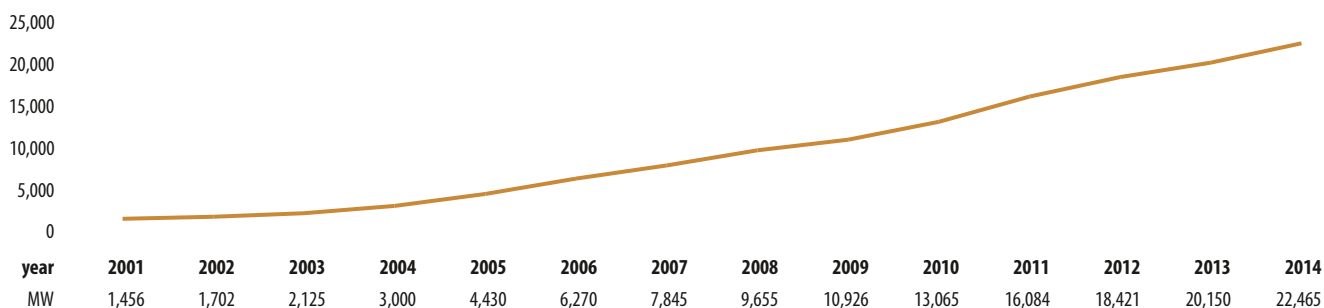
#### LATEST POLICY DEVELOPMENTS

The new government has shown significant interest in promoting wind energy. Apart from reinstatement of the accelerated depreciation benefit in 2014, various other benefits and incentives were also announced for wind energy this year including:

- Measures to promote renewables included in the Electricity Amendment Bill of 2014, include the provision for a separate National Renewable Energy Policy, measures to support development of a domestic industry, a renewable generation obligation (RGO) on coal and lignite based thermal power projects, specific exemptions to renewables from open-access surcharge, and separate penal provisions for non-compliance of RPOs.



## TOTAL INSTALLED CAPACITY



Source: GWEC

- A National Wind Mission (NWM) comprising targeted developments in onshore and offshore wind power is expected to be announced soon.
- A draft policy on offshore wind is also under consideration.
- Preferential clearance for wind projects by the Ministry of Environment and Forests, by moving them to the 'green projects' category<sup>4</sup>.
- The tax (Cess) on coal for the National Clean Energy Fund (NCEF) increased from INR 50 (EUR 0.65) to INR 100 (EUR 1.3) per tonne in the budget FY 2014/15. NCEF is used for funding research and innovative projects on clean energy technology.
- Full exemption from special additional duty and excise duty on parts and components used in manufacturing of wind turbines in the budget 2014-15.

### FUTURE PLANS FOR OFFSHORE WIND

The MNRE has initiated discussions on promoting a demonstration project in India. To support this it is set to introduce an offshore wind policy targeting 1 GW by 2020. In October the government announced plans to set up a new JV company for developing a demonstration offshore project.

Additionally, Facilitating Offshore Wind in India<sup>5</sup> (FOWIND) is the European Union supported four-year (2014-2018) project. A GWEC led consortium is implementing this project in Gujarat and Tamil Nadu. FOWIND is implemented in close consultation with the MNRE and state government agencies to establish a roadmap for offshore wind power development in India.

### KEY BARRIERS TO WIND ENERGY DEVELOPMENT

A key challenge is the high cost of finance. High interest rates (~12-14%) and limited availability of debt financing are challenges for developers as well as OEMs in the country. Most of the state level power sector utilities in India also suffer from poor financial health and are unable to comply with RPOs. Due to extremely poor financial

health, state owned utilities are unwilling to purchase higher cost wind power.

Technical challenges include grid integration issues and the development of wind turbines to cater to the lower wind speed wind regimes in large parts of India. The problems are exacerbated by a weak grid code and non-compliance by producers and grid operators.

OEMs and project developers also face supply chain and logistics related challenges. India's inverted duty structure allows for lower import duties on wind turbine components and higher duties on raw materials, thereby encouraging OEMs to import components instead of manufacturing them locally. Logistical challenges continue to be experienced during transport of bigger structures including blades, nacelles and towers.

### OUTLOOK FOR 2015 AND BEYOND

Renewables are being recognized as vital to energy security concerns, reducing fossil fuel import dependence and environmental benefits. There are tremendous expectations from renewables in the country, including wind.

The implementation of the national Green Energy Grid Corridor plans prepared by the state owned grid operator (PGCIL) was accelerated in 2014. This will ease in evacuation of large amounts of energy from wind farms. However, grid issues remain a major issue and broke state utilities frequently curtail wind power, despite the fact that wind farms are designated as 'must run' power plants.

A National Wind Energy Mission is in the works. The mission could provide a coordinated and stable policy framework to achieve highly ambitious targets for wind power. It will cover policy and regulatory aspects including incentives for onshore, offshore and small wind. Issues of repowering, tariff setting, transmission infrastructure and grid integration might also be addressed in the mission document.

*With Input from World Institute for Sustainable Energy, India*

1 National Load Dispatch Centre 2014 [www.posoco.in](http://www.posoco.in)  
 2 <http://cleantechnica.com/2015/01/27/india-clean-investment-hits-7-9-billion-expected-pass-10-billion/>  
 3 <http://www.cercind.gov.in/>  
 4 Industries/projects that are considered non polluting and require a simple No Objection Certificate (NOC) from State/Central Pollution Board  
 5 <http://www.fowind.in>



## ITALY

© GWEC

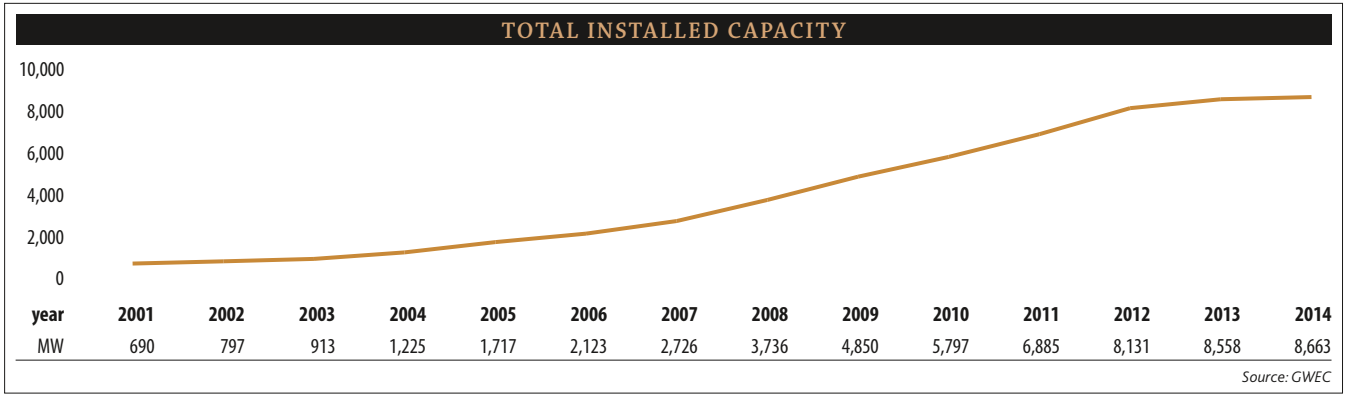
Commercial wind power development in Italy began in 1995 when the first wind farms were installed in the windiest areas of the country in the Apulia and Campania regions. The Italian wind industry and market grew steadily until 2013. After five years of solid growth of 1 GW per year, Italian wind installations fell dramatically to 437 MW in 2013 and even further to 107.5 MW in 2014. The fundamental decline came as a direct consequence of regulatory changes which reduced support for renewable energy. Although Italy's wind industry expected a slow down with the switch to an auction system for feed-in tariffs, the slowdown has been much more dramatic than anticipated.

### WIND ENERGY MARKET IN 2014

In 2014, 107.5 MW of wind power was installed across wind farms mainly in the Apulia and Basilicata regions, bringing the total capacity to 8,663 MW. In 2014 wind generated 15 TWh<sup>1</sup>, which was approximately 5% of national electricity consumption.

The dramatic fall in installations is a result of the fundamental changes introduced to the support schemes for wind and other renewable energy sources. New, complex legislation came into force in 2012, with a lack of clear and stable rules, and annual quotas for each type of generation, which has stifled the market.





The top manufacturers in 2014 in the Italian market were Vestas (with the largest share of 56%) followed by GE and Nordex. Cumulatively, Vestas leads the market with a 40% share, followed by Gamesa (20%) and Enercon (13%).

### LATEST POLICY DEVELOPMENTS

Italy has a target of at least 17% of total final consumption of energy from renewable sources by 2020, as required by the EU Renewable Energy Directive. In the National Renewable Energy Action Plan (NREAP), Italy has set a target of 26.39% for the electricity sector, corresponding to 43.8 GW of renewables based capacity and a yearly production of 98.9 TWh by renewable sources by 2020. For wind energy this corresponds to 12,680 MW (12,000 MW onshore and 680 MW offshore) of installed capacity by 2020.

In 2012, Italian government passed legislation (the RES Decree) which established a new incentive system for wind farms (onshore and offshore) as well as for all other renewable energy sources, except solar PV, which is regulated by another decree. The RES Decree became effective as from 11 July 2012, and replaced the green certificate system.

The new system sets out rules and tariffs for various plants of various sizes to access three different types of support scheme:

- a FIT for 'micro' plants up to 1 MW, which automatically receive the FIT, and there is no cap on their quantity, at least in theory;
- a feed-in-premium on top of the market price for larger plants (up to 5 MW in the case of onshore wind) which receive the incentive, with a cap of 60 MW per year;
- a reverse auction system for larger plants, with a cap of 500 MW per year for onshore wind, with an additional provision for up to 150 MW of repowering/refurbishing.

In addition to the caps set per size of plant and size of technology, there is an overall aggregate annual spending cap for the RE sector (exclusive of PV) of 5.8 billion euro; whichever cap is reached first halts the allocation process.

To qualify for the reverse auction system for the 500-650 MW/annum of onshore wind, the project must have planning and construction approval, and must post a provisional bond. Upon selection in the auction, the provisional bond turns into a permanent bond of 10% of the project value, which must be kept in place until the plant is commissioned.

The reverse auction starts with a price of 127 euro/MWh, and no bid will be accepted which is not at least 2% below the base price. Once accepted, the plants must be built within 28 months, with a possibility to extend this by up to 24 of months, although with a tariff penalty of 0.5% for each month of delay.

To add to the confusion, this is a 'transitional' system, effective through 2015, and it is not yet clear what will succeed it, and what the mechanisms, prices, or caps will be; so it is no wonder that investors are hesitant about the Italian market.

### KEY BARRIERS FOR WIND ENERGY DEVELOPMENT

The main barriers to wind energy development in Italy are:

- Massive reduction in support after the Ministerial Decree introduced in July 2012;
- Introduction of auction and registration systems which lack clear and stable framework and entail complicated and slow procedures;
- Long permitting procedures (varying from 3 to 4 years depending on the region).

### OUTLOOK FOR 2015 AND BEYOND

Italy has a target of reaching at least 17% of total final consumption of energy from renewable sources by 2020. With current support mechanisms and on-going policy uncertainty, renewable energy installations in Italy may not be able to meet the domestic 2020 target.

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

<sup>1</sup> provisional data provided by the Italian Transmission Operator, Terna



Japan's wind power market has yet to take off. The main obstacle at present is the procedural delay due to the cumbersome Environmental Impact Assessment (EIA) procedures applied to all wind farms of over 10 MW since October 2012, which takes about four years to complete. Only ten projects totaling 203 MW have completed the process, although there are 88 projects adding up to 6,226 MW still working through it.

The market is expected to grow at a faster pace in 2016, when most of the 88 projects will have completed their EIA and then can start getting built. The industry is making strenuous efforts to break through this logjam, primarily focusing on shortening the EIA procedure, but also looking at grid access and land-use related constraints.



Kaminokuni Wind Farm © JWPA/JWEA

## JAPAN

### WIND ENERGY MARKET IN 2014

At the end of 2014, 2,788.5 MW of wind capacity was operational in Japan. This accounted for 0.5% of the total power supply in 2014. 64 wind turbines for a total of 130.4 MW were installed in 2014. This capacity was 2.7 times larger than for 2013, but was still very low compared to the average over the past ten years.

No additional offshore wind turbines were installed in 2014. In Japan, 49.6 MW of offshore wind power capacity is currently installed: 4 MW floating; 4.4 MW on fixed foundations; and 41.2 MW of semi-offshore wind turbines. One 3 MW semi-offshore wind turbine will start operation in February 2015 at Akiita port and one 7 MW floating offshore wind turbine is due to start operations in the summer of 2015 as part of the Fukushima FORWARD project.

#### Japanese Wind Industry

Three Japanese wind turbine manufacturers have for several years now accounted for over 60% of the domestic market. Several new flagship wind turbines will start operation from 2013 to 2015. MHI's MWT167/7.0 7 MW turbine is to be installed at the Fukushima FORWARD floating offshore wind power demonstration project in the summer of 2015. Hitachi's HTW5.0-126 5 MW turbine is to be used for several offshore wind power projects in Japan.

#### Feed-in Tariff

The FIT for onshore wind remained steady at JPY 22/kWh (EUR 0.164/USD 0.185). Recently the Japanese Ministry

of Economy, Trade and Industry (METI) had offered JPY 36/kWh (EUR 0.27/USD 0.30) for offshore wind projects which would need to use jack-up vessels for turbine installation. This revision excluded semi-offshore wind projects constructed close to the shore.

The tariff will be re-assessed every year based on the latest market experience in Japan. Projects can qualify for the FIT only after the project is almost finished with the very costly EIA procedure. This forces Japanese developers to spend millions before knowing whether they qualify for the feed-in tariff. Only a few developers with strong balance sheets can afford such uncertainty. Therefore, the Japan Wind Power Association (JWPA) has requested the government to move the FIT qualification timelines a little earlier so as to make wind power development bankable.

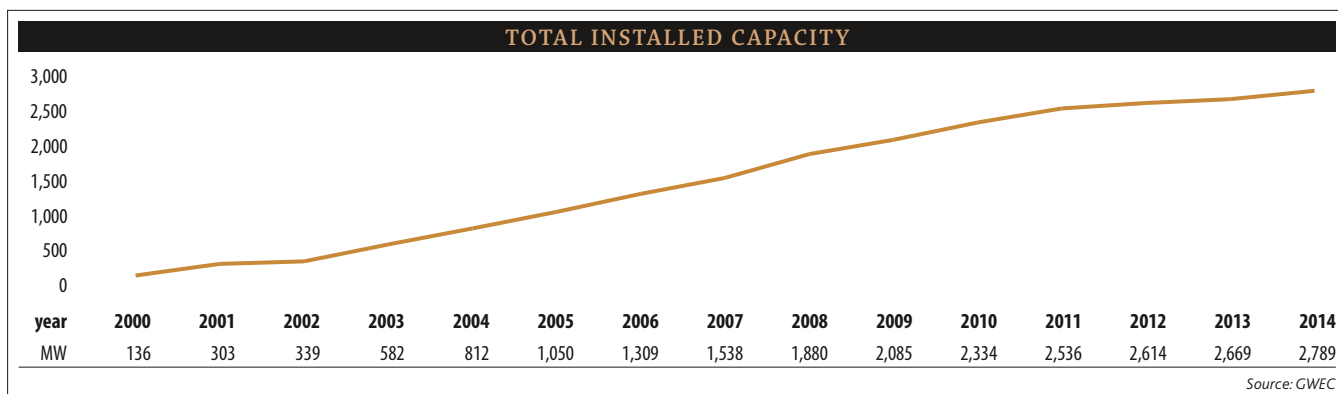
### LATEST POLICY DEVELOPMENTS

The Ministry of Environment (MOE) and the METI are working to shorten the EIA process period from 4 to 2 years. The MOE recently started to support 50% of the cost of pre-EIA investigations. This support was applied for by about 20 potential projects in the financial year (FY) of 2014.

Strict rules for land use, especially for farmland, have formed another barrier to wind development in Japan. However, The Ministry of Agriculture, Forest and Fisheries (MAFF) made a new law called the "Act for the Promotion of Renewable Energy in Rural Districts (APRERD)" which came into effect on 1 May in 2014. APRERD was designed

#### New wind turbines developed by Japanese manufacturers

Company	Wind turbine	Rated output	Expected to Start Operations	Type
MHI	MWT167/7.0	7 MW	February 2015 in the UK	Hydraulic drive
Hitachi	HTW5.0-126	5 MW	March 2015	Downwind
	HTW2.0-86	2 MW	March 2014	Downwind
JSW	J100-3.0	3 MW	Sep.2013 (2.7MW)	Gearless PMSG



to help the change of land use from the category of 'farm/agriculture' to 'wind power/industry'. This could over the long-term mean a significant increase in the potential land area available for onshore wind in Japan.

### Grid restrictions

Following METI's announcement of a reduction (from JPY 36/kWh to JPY 32/kWh – EUR 0.27/USD 0.3) in the FIT for solar in April 2014, solar power developers rushed to propose about 27 GW of new projects by the end of March 2014. The cumulative proposed PV capacity in Japan by the end of April 2014 had reached over 68 GW, the equivalent of about a quarter of Japan's total electric power plant capacity.

Thereafter Kyushu Electric Power Company announced the suspension of grid connections for all renewable energy projects, including wind power. Six other power utilities (Hokkaido, Tohoku, Hokuriku, Chugoku, Shikoku, Okinawa) followed the Kyusyu Electric Power Company's decision. The temporary suspension of grid access left many METI-approved, undeveloped solar projects in the lurch, compromising project pipelines.

This led to serious concerns being raised across Japan about the "no" declaration against renewable energy projects. METI formed a working group after long discussions with various stakeholders to explore the action by utilities.

Thereafter a new grid connection rule was introduced in October 2014. This new rule expanded the capacity of regional utilities. The new capacity cap for wind power for the seven electricity utilities was 5.73 GW in total. Currently a total of 2.1 GW is already operational in these seven regions. So 3.63 GW of additional capacity is now available for new connections. Additionally, the three central regions of Tokyo, Chubu and Kansai have significant electricity demand and are free from such restrictions.

The available capacity may be reassessed in the future, as the new grid connection rule did not address the fundamental issues with inter-regional grid connections. The Japanese government is looking at the overall reform of its electricity sector. The new Organization for Cross-regional Coordination of Transmission Operators (OCCTO) has been put in-charge and shall start its work

from April 2016. Depending on the outcome of this long-awaited reform process, renewables could find more and stable grid integration avenues.

Most of Japan's onshore wind resource is in the sparsely populated northern rural regions of Hokkaido and Tohoku. METI is beginning to build new grid lines for wind power in Hokkaido and Tohoku. METI subsidizes about 50% of the construction cost to the tune of JPY 25 billion (EUR 0.187/USD 0.209) annually. The grid development consortium for Hokkaido was granted the task to add about 3 GW in new transmission capacity last year, and two new consortiums for Tohoku (for 600MW at Akita and for 900MW at Aomori) were also announced in 2014.

The New Energy and Industrial Technology Development Organization (NEDO) has started a new national project to build-up a nation-wide wind power generation forecasting system within 5 years. The funding allocated for the first year was JPY 4 billion (EUR 31/USD 33mn). The JWPA will cooperate with NEDO on this project.

### OFFSHORE WIND POWER DEVELOPMENT

Japan had installed 49.6 MW of offshore wind power capacity by the end of February 2015, including two 2 MW floating wind turbines. The Fukushima floating turbine is located 20km from the coast. A further 12 offshore wind power projects totaling 874 MW are in the planning stage, and 6 of those projects (504 MW) are in the EIA process and preparing for construction to begin around 2020. (See more details on Japan's offshore wind development in the Global Offshore Chapter)

### OUTLOOK FOR 2015 AND BEYOND

The Japanese wind power market has significant challenges to overcome before the sector emerges strongly. However, efforts are being made to reduce the cumbersome regulatory, grid and political concerns which are slowing wind power development in Japan. Japan is expected to emerge as a strong wind power market after 2016. Japan's wind industry is making every effort to realize this future.

*With input from the Japanese Wind Power Association (JWPA) and the Japanese Wind Energy Association (JWEA)*

## WIND ENERGY MARKET IN 2014

During 2014 Mexico added 633.7 MW of new wind power to the country's electricity grid, bringing total capacity up to 2,551 MW spread over 31 wind farms and 1,200 turbines located in Oaxaca, Baja California, Chiapas, Jalisco, Tamaulipas, San Luis Potosí and Nuevo León regions. The higher pace of growth compared to 2013 was due to the installation of almost all the wind projects from the first "open season" program in Oaxaca as well as an increase of installations in other States. The Mexican wind industry expects to install 9,500 MW by 2018, representing about 8% of the country's total generation.

The key players in the Mexican wind market are still Spanish companies including Iberdrola, Gamesa and Acciona, who have announced their intention to continue wind development in the country, but new players are also entering the market, in particular from the US, including SunEdison, Invenery and Oak Creek. To date, wind power generated USD 5 billion (EUR 4,463mn) of new financial investment and an investment of USD 14 billion (EUR 12,498mn) is expected for the period from 2015-2018.

## MEXICO

### Completed wind projects in Mexico in 2014

Project	Location	Status	Year of operation	Capacity (MW)
Piedra Larga II	Oaxaca	In operation	2014	138.00
Bii Hioxo	Oaxaca	In operation	2014	227.50
El Porvenir	Tamaulipas	In operation	2014	54.00
Bii Nee Stipa II Fase IV Dos Arbolitos	Oaxaca	In operation	2014	70.00
Sureste I Fase II (Energías Renovables La Mata)	Oaxaca	In operation	2014	102.00
Dominica Fase I	San Luis Potosí	In operation	2014	100.00

## THE LATEST POLICY DEVELOPMENTS

The implementing legislation for Mexico's Energy Reform which was agreed in December 2013 is still being worked out. The reform will finally mean the opening of the market to the private sector and is expected to generate unprecedented opportunities for the renewable energy industry for years to come. However, at present the country is still in a transitional period faced with uncertainty caused by the big change, where all key public entities are being reorganized and responsibilities are being reshuffled. One of the biggest changes is the creation of the new independent system operator CENACE, which will play a leading role in ensuring fair access to the grid, as well as a functioning market. CENACE will be taking on board many of the responsibilities that previously belonged to the CFE.



© Romo Casillas

Nevertheless, the reform will need to move ahead quickly if Mexico wants to meet the very ambitious targets set for wind power at 9,500 MW by 2018 and 15,000 MW by 2022. Moreover, the Mexican Renewable Energy Law (LAERFTE) has a goal of reaching 35% (up from the current 22%) of electricity from renewable energy sources by 2024. The government has established some incentive schemes, such as the Energy Bank and fixed Transmission and Distribution (T&D) prices per MWh to help to reach the targets.

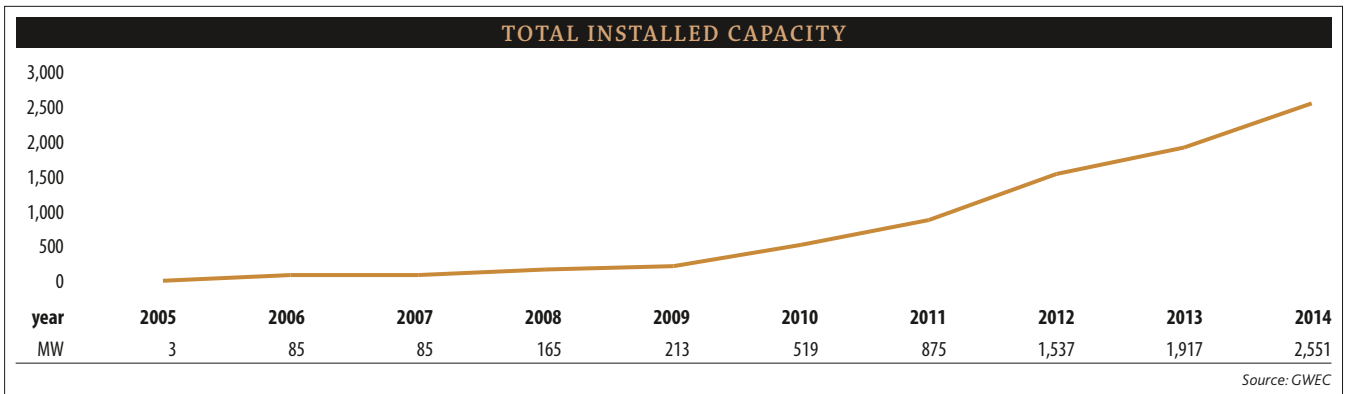
Additionally, Mexico's General Climate Change Law includes an objective to reduce CO<sub>2</sub> emissions by 30% by 2020. Renewable energy will play a vital role in achieving this goal.

## KEY BARRIERS TO WIND ENERGY DEVELOPMENT

Some of the main challenges in the next few years include:

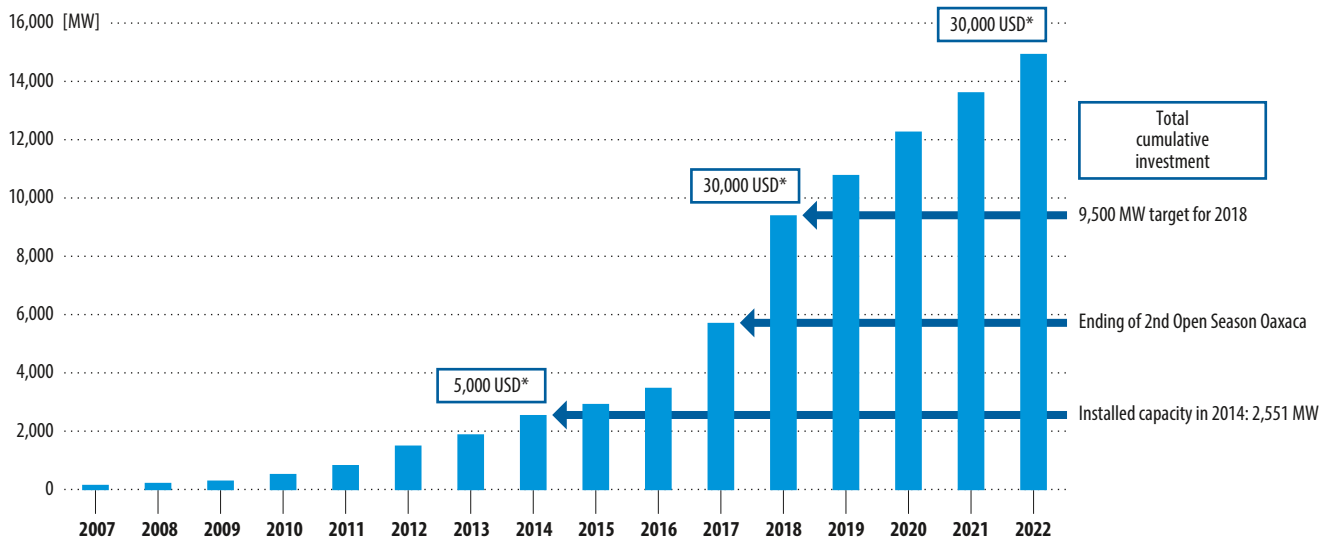
- Developing a roadmap for renewables including annual targets;
- Establishing call for auctions for renewable energy with electricity coverage contracts with basic services suppliers. The first auctions could take advantage of the high numbers of wind projects in development, in order to accelerate commissioning as much as possible;





**Expected growth of installed wind capacity**

**Evolution of installed capacity in Mexico 2007-2022**



\*Amounts expressed in millions of US Dollars

- Establishing a robust mechanism for clean energy certificates, which would entail the following :
  - Sufficient level of finance for projects;
  - Define penalties in case binding targets are not reached;
  - Consider the nature and benefits of each technology and issue certificates accordingly;
  - Create mechanisms to promote the expansion and strengthening of electricity grid in key areas with the highest renewable energy potential;
  - Implement new requirement introduced by the Energy Reform to carry out public consultations with local communities and stakeholders in order to identify and mitigate potential disputes in the areas surrounding the wind projects.

**OUTLOOK FOR 2015 AND BEYOND**

Mexico has one of world's richest wind resources mainly located in the states of Oaxaca, Tamaulipas and Baja California but new wind rich areas are emerging quickly. 2015 is expected to be the year of consolidation of the industry in the aftermath of the Energy Reform.

The Mexican government has set an ambitious target of 9.5 GW of wind power by 2018, with expected new investments of USD 14 billion for the period from 2015 to 2018. Meanwhile, the Mexican Wind Energy Association (AMDEE) has set a target of at least 12,000 megawatts of wind power by 2020, which would mean a market of more than 2 GW per year. For 2015, there are currently six projects under construction which are expected to bring about 732 MW online in the course of the year.

The CFE has also announced their intention to develop eight new wind projects with a total capacity of 2.3 GW.

A more open and transparent interconnection procedure, through the new ISO, is likely to give incentives for the development of new projects. Furthermore, the participation of the private sector in the development of T&D networks means that the areas of high wind energy potential will be able to be connected to the grid.

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



# POLAND

Rzepin Wind Farm © Vestas

**T**he pace of development of the wind energy sector in Poland has accelerated in recent years. Despite some barriers, companies investing in wind power in Poland have successfully found ways of overcoming market obstacles, and the country is attracting significant foreign investment, particularly in component manufacturing.

## WIND ENERGY MARKET IN 2014

In 2014, Poland added 444 MW to the country's electricity grid, bringing the total up to 3,834 MW, generating 7.184 TWh, 4.59% of all electricity produced in Poland. Wind energy is the largest source of electricity from renewables, accounting for just under 50% of all renewable energy capacity.

Installed capacity in top ten regions in 2014 (MW)

Region - Voivodeship	Installed capacity [MW]
Zachodniopomorskie	1072.3
Wielkopolskie	461
Pomorskie	423.8
łódzkie	350
Kujawsko-Pomorskie	320.3
Warmińsko-Mazurskie	251.6
Mazowieckie	225.7
Dolnośląskie	162.4
Opolskie	103.7
Podkarpackie	84.2

The key players in the Polish wind market are Vestas, Gamesa, Repower, GE and Enercon with a total share of about 70% of the market.

Almost 75% of the wind capacity in Poland has been developed through Independent Power Producers<sup>1</sup> (IPP's), with extensive use of the "project finance" formula. This trend is changing slightly as state owned companies are gradually developing a number of wind projects as well. Nevertheless, it is expected that IPPs will continue to have the main share of the market.

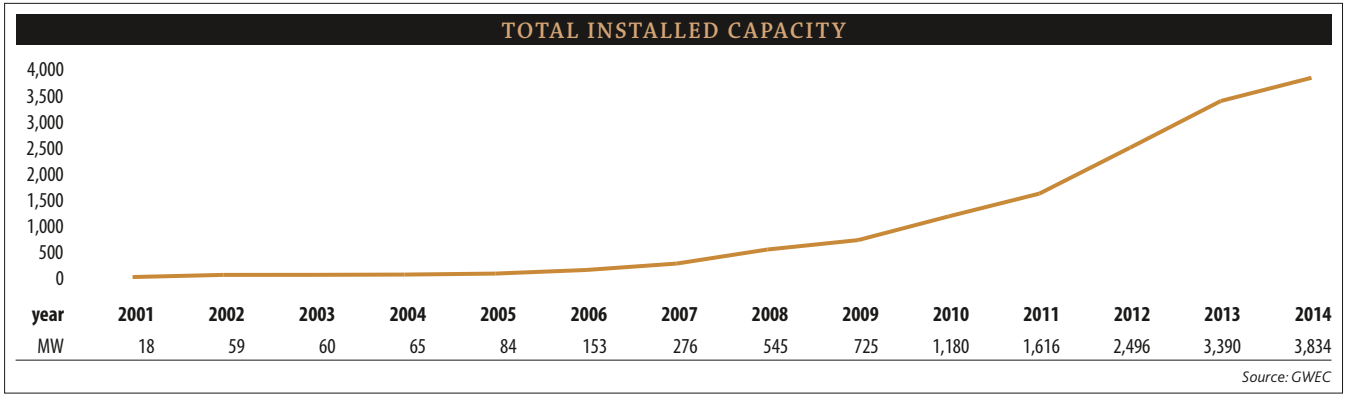
## Support framework for wind energy

In Poland the support mechanism for renewable electricity is based on tradable green certificates and on the obligation for electricity sellers to purchase electricity produced by renewable energy sources.

However, the support system is about to change in 2015. The New Renewable Energy Sources Act, which was approved by the lower chamber of the Polish Parliament on 17 January 2015, will introduce an auctioning based support mechanism.

## LATEST POLICY DEVELOPMENTS

In order to meet the EU Renewables Directive target, Poland must source 15% of its final energy demand from renewable sources by 2020. In their National Renewable Energy Action Plan (NREAP), which is based on the 'Energy Policy of Poland up to 2030' strategy, the Polish government anticipates a 15.5% share of renewables by 2020. Wind is the fastest growing renewable energy source in Poland and is expected to contribute about half of the renewable electricity required to reach the 2020 target. The NREAP target projects that wind power will reach 6,550 MW by 2020, including 500 MW offshore.



The Polish government is working on a new regulation which seeks to guarantee the full implementation of the EU Renewables Directive into Polish law. The new law (RES Act) introduces a transition from the tradable certificates system to an auction based system. Under the new system, support will be granted for each installation separately, by way of an auction conducted by the president of the Energy Regulatory Office.

The auction system will tender for a number of MWh generated. The support will be offered for 15 years to bids with the lowest price. Every year the amount of energy purchased from eligible projects will be determined, taking account of the demand for energy from renewable energy sources and the upper limit of support for the eligible projects. Only advanced projects that have passed a prequalification procedure will be allowed to participate in the auction. Investors will have to demonstrate a project's compliance with the local zoning plan and must have all the administrative approvals as required by law. Bids exceeding the so-called 'reference prices', which will be determined for individual technologies and installation capacities, will be rejected.

The new Act is expected to be approved by the Senate and signed by the Polish president in March and to come into force in April. The auction system will be effective from 1 January 2016.

### Offshore wind power

Although Poland has one of the highest offshore wind potentials in the Baltic Sea region, offshore wind development is still in the early stages.

By 16 September 2014, 37 location permits for offshore wind projects had been issued by the Minister responsible for Maritime Affairs in Poland and to date, the TSO has guaranteed grid connection for two offshore wind projects with a total capacity of 2,245.5 MW. The first of the projects, the 1045.5 MW Baltica-3 wind farm is expected to come online in 2019, and the second, with 1,200 MW, during the period from 2020-2025.

The new RES Act includes the essential policy changes needed for offshore wind development in Poland, including a new support system, provisions regarding maritime areas and maritime administration and, available grid connection for offshore wind farms.

### KEY BARRIERS TO WIND ENERGY DEVELOPMENT

Some of the key barriers to wind development in Poland include:

- Legal uncertainty caused by the prolonged approval of the RES Act, including delay of entry into force of the new support system;
- Defining zones for wind development at regional level due to conflicting stakeholder interests;
- Lack of a stable legal framework for offshore wind development remains an important investment barrier.
- Insufficient grid connection for wind farms.

### OUTLOOK FOR 2015 AND BEYOND

The Polish wind industry expects solid growth to continue in 2015. From 2016 onwards, the details of the auction system will determine the level of development for the sector in the coming years.

In the long run, wind power's role in the Polish energy sector will be defined in the revision of Poland's energy policy up to 2050 which is currently under preparation by the Ministry of Economy. The new energy policy includes a plan to decrease the share of energy produced by coal, ultimately to a level of about 57% in 2030, mainly through increasing the use of nuclear energy, shale gas and renewables.

The draft Energy Policy for 2050 projects the share of renewables at 19% by 2020, 25% by 2030 and 33% by 2050. For wind power this would mean an installed capacity of 7,050 MW by 2020 MW, 13,500 by 2030 and 21,000 MW by 2050.

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

<sup>1</sup> An independent power producer (IPP) or non-utility generator (NUG) is an entity, which is not a public utility, but which owns facilities to generate electric power for sale to utilities and end users. NUGs may be privately held facilities, corporations, cooperatives such as rural wind energy producers, and non-energy industrial concerns capable of feeding excess energy into the system.



## SOUTH AFRICA



Jeffreys Bay wind farm © MainstreamRP

After taking a decade for the first 10 MW of wind power to be installed, the South African wind industry added 560 MW to the country's electricity grid in 2014. The development of the wind industry has taken place within a relatively short period of about three years, placing South Africa amongst the leading new wind markets globally. The country's wind resource<sup>1</sup> is exceptional. The wind industry and its supply chain are becoming firmly established with several large wind farms now fully operational, and many more under construction

South Africa's long term energy blue print, the Integrated Resource Plan (IRP), gives wind power a significant allocation, about 8,400 MW of new capacity in the period up to 2030. There are expectations that this can be exceeded by a wide margin.

Currently, the South African wind industry is looking to develop about 5 GW of wind power by 2019, of which 562 MW is under construction and a further 787 MW has reached financial close. Moreover, the preferred bidders for the fourth round under the government's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) are expected to be announced shortly, which will add another 600 MW or more to the existing pipeline. This is good news in a country which has been plagued by serious power shortages for years now.

### SOUTH AFRICA'S ENERGY MIX

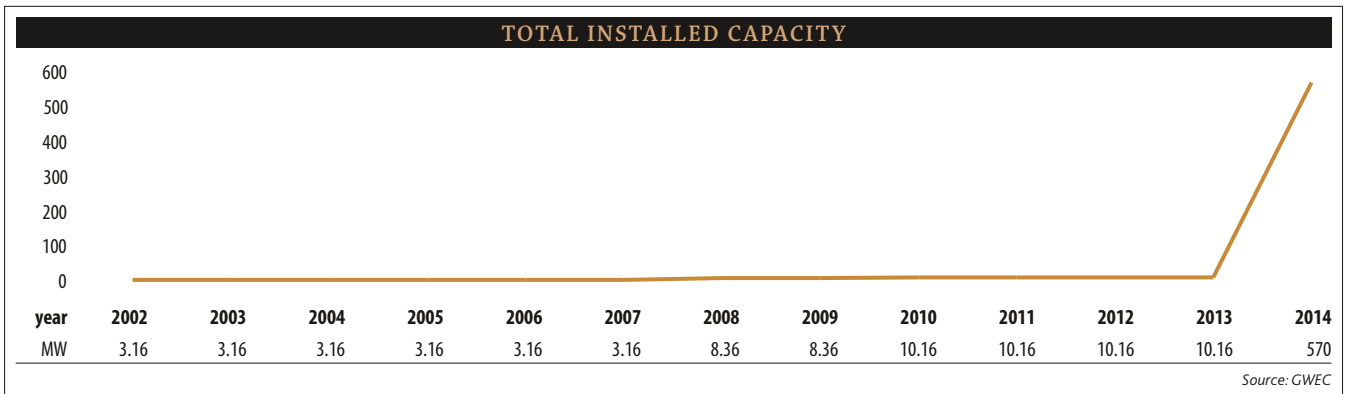
South Africa has world's seventh largest coal reserves, so it is no surprise that about 77% of South Africa's pri-

mary energy comes from coal, followed by oil and solid biomass and waste. South Africa's energy balance also includes relatively small shares of natural gas, nuclear, and hydroelectricity. South Africa's dependence on hydrocarbons, particularly coal, has made the country the 12th largest CO<sub>2</sub> emitter in the world.

The maintenance of the coal fleet has been challenging and capacity factors are down to about 70%, leading to regular electricity shortages, which could be eased by rapid deployment of renewable energy, especially wind power.

Historically, South Africa has had very low electricity prices, but in recent years they have been rising quickly and still face upward pressure, consistently narrowing the difference between the unit cost of wind power and conventional power generation. In 2013, the price for wind energy dropped well below the cost of new coal power. The average selling price of electricity is around ZAR 63 cent/kWh (EUR 4.8/USD 5.4 cent). Wind power is presently procured competitively at around ZAR 65 cent/kWh (EUR 5/USD 5.5 cent). New coal based power is likely to cost ZAR 1.05/kWh (EUR 8 /USD 9 cent) if not cross-subsidised from existing plants.

Much work has been done in synthesising the regulatory framework for renewables; and with a few exceptions it is now largely resolved. Wind projects under the REIPPPP sell electricity to the national utility on a 20 year Power Purchase Agreement backed by the national government, with dispatch priority. There is draft legislation under consideration for the creation of an Independent System



and Market Operator (ISMO), but the liberalization of the electricity market is unlikely any time soon.

South Africa's National Energy Regulator (NERSA) oversees electricity matters in the country, including issues related to pricing and the licensing of electricity generation, transmission and distribution. REIPPPP projects are procured on a competitive tender basis with 70% of the scoring going to price and 30% to socio-economic factors. Up to this point all these projects have been licensed by NERSA.

### WIND ENERGY MARKET IN 2014

With bidding for the first four rounds of South Africa's Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) submitted, and after three rounds of preferred bidders have reached financial close, the wind industry in the country has established itself as a major new infrastructure sector and is now worth of about ZAR 44 billion (EUR 3.4/USD 3.7bn).

During 2014 the first projects under the REIPPPP Programme were commissioned. Several large wind farms of up to 138 MW came online. Financial close was also reached for the preferred bidders in round 3 of the REIPPPP in February 2015. Many of the leading international turbine manufacturers were involved in partnership with local developers in the first three procurement rounds which total just below 2,000 MW. Steel and cement towers are now made locally and a local blade manufacturing facility is likely to be set up with an international partner in the next few years.

The original structure of the REIPPPP entailed five bidding rounds, with the last and final round due for submission in May 2015. However, the Integrated Resource Plan with the goal of 8,400 MW of wind power by 2030, calls for further procurement rounds and according to recent indications from the Department of Energy, an additional allocation is likely to follow.

The procurement rules include a strong government ambition to create a high level of local content, with an incentive to boost employment and to support local communities. The wind industry, jointly with other renewable energy industries in the country, is also supporting pioneering innovations in the field of sustainable

development, community development, community ownership, socio-economic development and enterprise development and have committed about ZAR 5 billion (USD 430/EUR 306mn) to these sectors over the next twenty years.

### KEY BARRIERS TO WIND ENERGY DEVELOPMENT

Some remaining obstacles to the wind industry include:

- Logistical challenges have emerged in terms of contractor resources and equipment due to the rapid growth.
- The IRP 2010 (energy master plan until 2030) is supposed to be reviewed every two years. Until the outcome of the review is settled there won't be certainty as to whether the present regime will continue in the same form.
- Government plans for grid integration issues, including the assignment of the responsibility for the costs, are not yet settled. Additionally, extended transmission and distribution works are needed, and how these are going to be paid for is not yet clear.
- The costs involved in tendering for the procurement programme are high and create a challenge for smaller players.

### OUTLOOK FOR 2015 AND BEYOND

The industry in South Africa is in a very rapid growth phase. The country's chronic energy shortages mean that the renewable energy procurement programme is likely to be expanded. South Africa is moving towards a large wind industry with a domestic installed capacity in excess of 5,000 MW within eight years. South Africa is evolving into the hub for manufacturing and development that the industry has been looking forward to for many years.

*With input from the South African Wind Energy Association (SAWEA)*

<sup>1</sup> See South Africa's wind map developed by WASA at <http://www.wasaproject.info/>.



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## SWEDEN

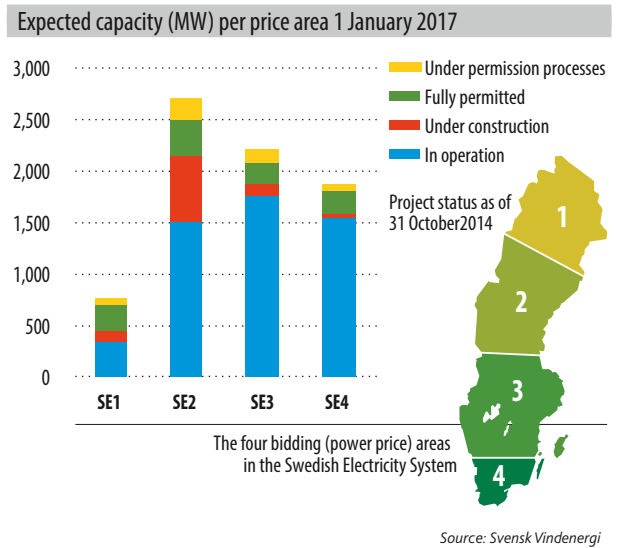
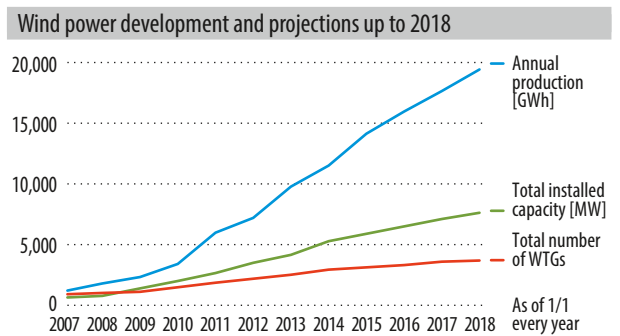
### WIND POWER MARKET IN 2014

In 2014, 1,050 MW of new onshore wind power capacity was installed in Sweden, bringing total capacity to 5,425 MW, of which 212 MW is offshore, meeting about 8% of the country's total electricity consumption. Power production from wind increased by 16% last year from 9.9 TWh in 2013 to 11.5 TWh in 2014. In the last five years Sweden has more than tripled its wind power production, from 3.5 TWh in 2010.

The three largest wind power projects that came online in 2014 were the 85 MW Mörttjärnberget wind farm, and the 78 MW Mullberget and the 72 MW Maevaara wind farms. No new offshore projects were completed in the course of the year.

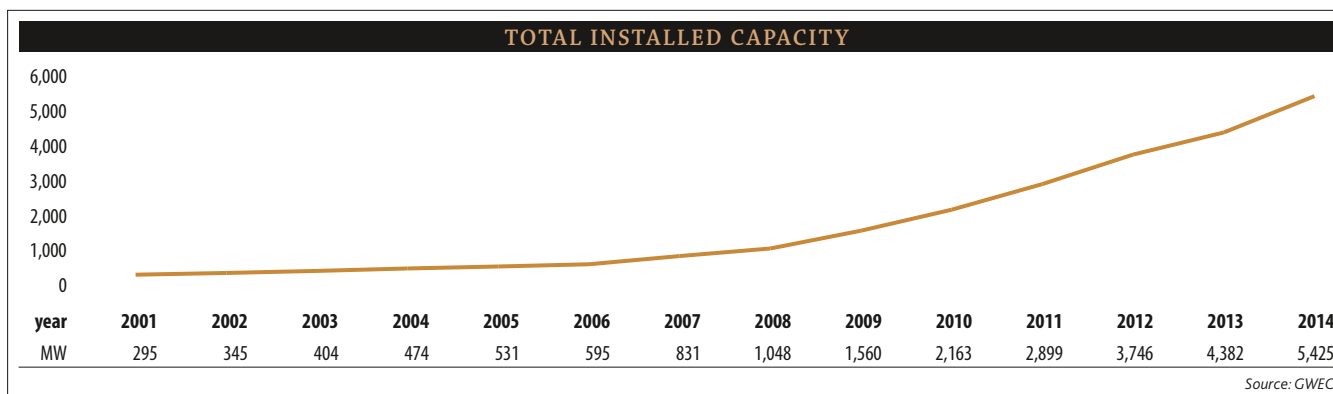
The average size of new onshore turbines installed in 2014 was 2.7 MW, with an average expected capacity factor of about 33%.

In 2011, Sweden was divided into four separate bidding areas by the Swedish Transmission System Operator (Svenska Kraftnät). This division identified the areas where the national electricity grid needs to be expanded, and provided a clear indication of areas where increased electricity production is required in order to better meet consumption, thereby reducing the need for transporting electricity over long distances.



While in northern Sweden (SE1 and SE2 bidding areas) there is a surplus of electricity production, in southern Sweden (SE4 bidding area) the circumstances are reversed. The system of different bidding areas helps to ensure that regional market conditions are reflected in the price. Due to bottlenecks in the transmission system, the bidding areas may have different prices (i.e. area prices). When there are constraints in transmission capacity between two bidding areas, the power will always be transferred from the low price area to the high price area.





Currently, most of the wind farms in Sweden are located in the SE3 bidding area, where the power consumption is also the highest. However, at present there is a concentration of wind farms under construction in the northern part of the country, where larger wind farms are feasible. In the next three years it is expected that most of the new installed wind capacity will be in the SE2 bidding area.

### SUPPORT FRAMEWORK FOR WIND ENERGY

Since January 2012, Sweden has had a joint Electricity Certificate System<sup>1</sup> with Norway with a joint target of increasing electricity production from renewable energy sources to 26.4 TWh annually by 2020. The joint market will permit trading in both Swedish and Norwegian certificates, and a generator can receive certificates for renewable electricity production in either country.

A surplus of certificates occurs if the supply of certificates exceeds demand. In general this happens if the development of renewable energy has been faster and electricity demand lower than expected at the time the quotas were set. When this happens the development of renewable energy decreases until the price of the certificate reaches again a level that makes investing in renewable energy profitable (in theory).

In the previous two years, the price of a certificate reached low levels due to a large surplus of certificates resulting from forecast errors at the time when the Swedish quotas were set. However, this has not yet slowed down investment, despite the low price of both electricity and the green certificates. One explanation might be that building wind power in Sweden has become much cheaper recently, but the entrance of larger institutional investors requiring lower returns on investment has also played a role.

In order to restore the balance in the system and to ensure that the 2020 renewables target is met, the Swedish Energy Agency proposed technical quota adjustments in 2015 with the first adjustment expected to take place in 2016.

In 2014, the average certificate price was SEK 196.3/MWh (EUR 21.2/USD 23.6) and the average power price was SEK 287.5/MWh (EUR 31/USD 34.6).

### LATEST POLICY DEVELOPMENTS

Sweden's new government has made a proposal for a new target for renewable electricity production of 30 TWh by 2020, which is expected to be sent to the Swedish parliament for approval in March 2015.

The government has also taken measures to enhance offshore wind development, which is too costly to be built within the green certificate system. The Swedish Energy Agency is currently exploring alternative support mechanisms to support offshore wind power outside the green certificate system.

### KEY BARRIERS FOR WIND ENERGY DEVELOPMENT

The high penetration of wind power in the northern part of Sweden will further increase the load on already congested transmission corridors, particularly between price areas 2 and 3. The Swedish TSO has, however, already decided to start reinforcing these sections.

In the long run further integration with the European continental grid will also be necessary in order to avoid "locking in" scenarios for Nordic wind power. However, in the short and medium term, Sweden's substantial hydro-power capacity is well suited to regulate the increasing wind power production in the country.

### OUTLOOK FOR 2015 AND BEYOND

Sweden expects a slight decline in installations in 2015 due to the low power and green certificate prices at present. However, this will not be the case if the government's proposal on the new target is passed by the parliament and, in particular, if additional support is granted for offshore wind power. If no adjustments are made, the Swedish Wind Energy Association expects Sweden to reach about 20 TWh of wind power production in the country by 2020.

*With input from the Swedish Wind Energy Association  
(Svensk Vindenergi)*

<sup>1</sup> See more information about the Swedish/Norwegian support system at: <http://www.energimyndigheten.se/en/Sustainability/The-electricity-certificate-system/>

# TURKEY



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## WIND ENERGY MARKET IN 2014

**T**urkey added 804 MW of new wind power in 2014 for a total installed capacity of 3,763 MW. Turkey's installed capacity has grown at over 500 MW per year since 2010 and Turkey's National Transmission Company expects annual installations to reach 1,000 MW per year from 2015 onwards.

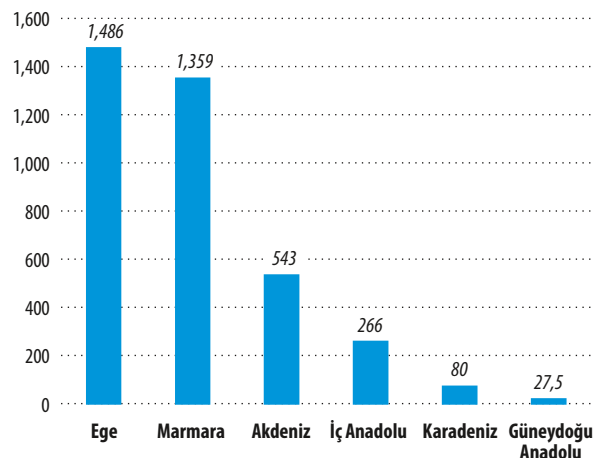
The Turkish market at present has a large pipeline of projects. The Turkish Wind Energy Association estimates that under the current regulatory framework a total installed capacity of about 10.5 GW will be reached within the next ten years, but it could be as high as 20 GW with the right amendments to the regulatory framework. Regardless, Turkey's vast wind resources are likely to attract significant investment in the coming years.

Turkey's best wind resources are located in the provinces of Çanakkale, İzmir, Balıkesir, Hatay and İstanbul. As of the end of 2014, the Aegean region had the highest installed wind capacity with a total of 1,486 MW, followed by Marmara region with 1,359 MW and the Mediterranean region with 543 MW.

The Turkish wind market is mostly dominated by local developers: the 1,210 MW currently under construction is divided between the Borusan-EnBW Partnership, Gürış and Bereket Enerji.

The leading players in the Turkish wind market are Polat Energy (457 MW), Demirer Holding (331 MW) and Bilgin

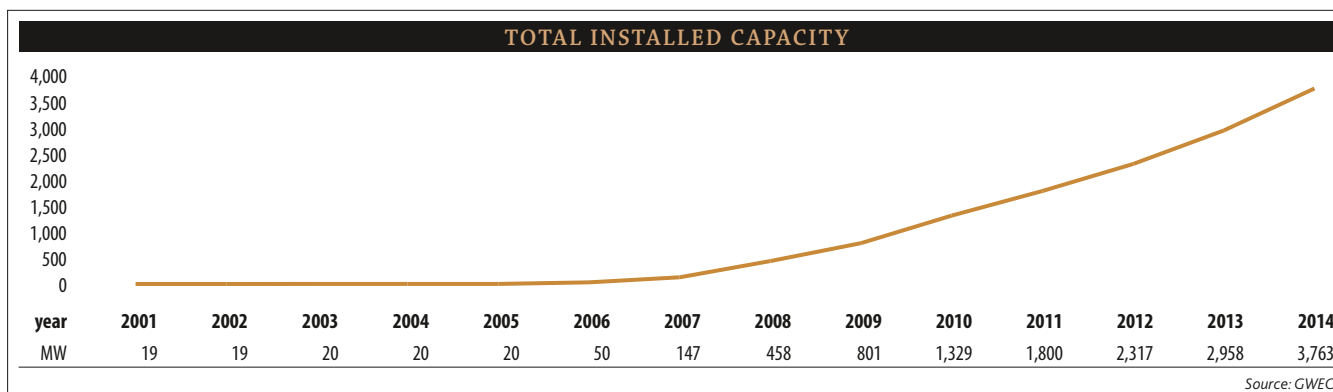
Installed Capacity by Province in 2014 (MW)



TUREB

Energy (295 MW), followed by Aksa Energy (237 MW) and Eksim (235 MW).

Turkey has one of the fastest growing power markets in the world which until now has not seen any adverse impact from the global financial crisis. With very limited oil and gas reserves, Turkey is increasingly turning to renewable energy sources to improve its energy security, and seeks to provide 30% of its electricity from renewable energy by 2023. However, to match the rapidly growing energy demand, more investments are needed.



## Support framework for wind energy

After the amendment of Turkey's Renewable Energy Law (No. 5346 dated 18th May 2005) the feed-in tariff was set at USD 7.3 cent/kWh (EUR 6.5 cent) for wind power, for a period of ten years and will apply to power plants that come into operation before 1st January 2016. The law allows for an additional bonus of up to USD 3.7 cent (EUR 3.3 cent) for up to five years for using locally manufactured components. Wind power producers are also free to sell to the national power pool or engage in bilateral power purchase agreements.

Additionally, another incentive is the 85% discount for the right of easement on State owned land for transportation and transmission. This incentive applies to facilities that begin operations before 31 December 2020. The discount will apply during the first ten years after the establishment of the wind farm. The amended law also allows for the construction of renewable energy projects in national and natural parks, protected regions, conserved forests, wildlife development zones, special environmental protection zones and natural protected areas, provided that the necessary permissions are obtained from the Ministry of Environment and/or regional protection boards.

## LATEST POLICY DEVELOPMENTS

A new Energy and Electricity Market Law was published in April 2013 and included a new Electricity Market License regulation which entered into force in November 2013.

According to this regulation, there are now two stages for the licensing procedure: pre-license and license. In the pre-license period, applicants are given 24 months (can be extended to 36 months under certain conditions) to seek the necessary permits for urban planning, construction, land acquisition etc. If the necessary permits cannot be obtained over a period of 24 months, or the requirements specified by Turkey's Electricity Market Regulatory Authority (EMRA) cannot be fulfilled, the applicant will not be granted an electricity generation license.

Another change under the Electricity Market License regulation is related to wind power project transformer capacity, which is established on a regional basis. The Turkish Electricity Transmission Company (TEİAŞ) will

announce this capacity, which determines how much wind power can be connected to the regional grid system, every year on a fixed date.

## Grid connection

There is an ongoing process to add 3,000 MW of new grid capacity across Turkey. Developers have started conducting measurements and will be able to apply for pre-licenses in April 2015. A new grid capacity announcement is expected to take place in April 2015 in parallel with pre-license applications from the previous licensing round.

## KEY BARRIERS TO WIND DEVELOPMENT

Although many improvements have been achieved in the regulatory framework and new steps towards a more liberalised power market have been taken, some barriers to wind development in Turkey still remain, including:

- immature electricity and gas market, which impedes the predictability of market prices
- technical difficulties in transmission and lack of continuous and predictable grid connection capacity allocation; and
- long administrative procedures with the involvement of numerous central and local authorities

## OUTLOOK FOR 2015 AND PROSPECTS FOR THE FUTURE

The Turkish Wind Energy Association expects Turkey to reach an installed capacity of 5,000 MW by the end of 2015 and 6,200 MW by 2016. To ensure that these targets are met, the transmission system operator has announced investments in grid reinforcements for the period from 2015 to 2020.

Presently, Turkey is one of the biggest on-shore wind markets in Europe with an 11 GW pipeline of wind power projects.

*With input from the Turkish Wind Power Association (TUREB)*



# UNITED KINGDOM

Offshore wind farm Liverpool Bay, North West England © Bertram

**T**he UK has exploited its excellent wind resources with an eye on its target to secure 15% of its energy from renewable sources by 2020, focusing primarily on renewable sources of electricity.

In 2014, wind power provided over 9% of the UK's total electricity supply, up from 7.8% in 2013, enough to cover the electricity needs of more than 6.7 million UK households.

2014 also saw a number new records: a new monthly high of 14% of all UK electricity generated by wind power was reached in December 2014, beating the previous record of 13% set in December 2013.

However, as wind power has grown, there has been more discussion of the impacts of projects at the local and political level, and coupled with a changing financial regime, this has had a negative effect on investments.

## WIND ENERGY MARKET IN 2014

At the end of 2014, the UK's wind power capacity was 12.4 GW, made up of 7.95 GW of onshore and almost 4.5 GW of offshore wind. In 2014, a total of 93 new wind farms were built in the UK, of which 89 were onshore (924 MW) and four were offshore (813 MW). The larg-

Installed onshore wind capacity by region in 2014

Region	MW
1 Scotland	559
2 East Midlands	95
3 North East	75
4 Northern Ireland	66
5 Yorkshire & Humber	41
6 South West	37
7 East of England	23
8 Mid Wales	11
9 North West	6
10 South Wales	6
11 London	3
12 South East	2
13 West Midlands	1

est was the 389 MW West of Duddon Sands offshore wind farm, and the largest onshore site was the 136 MW Harestanes wind farm in the Scottish Borders. The top three developers in the UK onshore market were Scottish Power (19%), RWE (9%), and Eneco (8%).

Siemens confirmed their final investment decision on their new GBP 160mn (EUR 218mn/USD 241mn) offshore wind turbine manufacturing facility in Hull, and MHI Vestas Offshore Wind announced plans to bring manufacturing of blades back to the Isle of White for their new 8MW offshore turbine. TAG Energy supplied monopiles for the E.ON Humber gateway project from its Teesside facility which later in the year was acquired by Offshore Wind Structures (Britain) Limited, a joint venture between EEW & Bladt. JDR Cables secured orders for array cables for the Dudgeon Offshore wind farm and for two German projects: Sandbank & Nordsee 1.

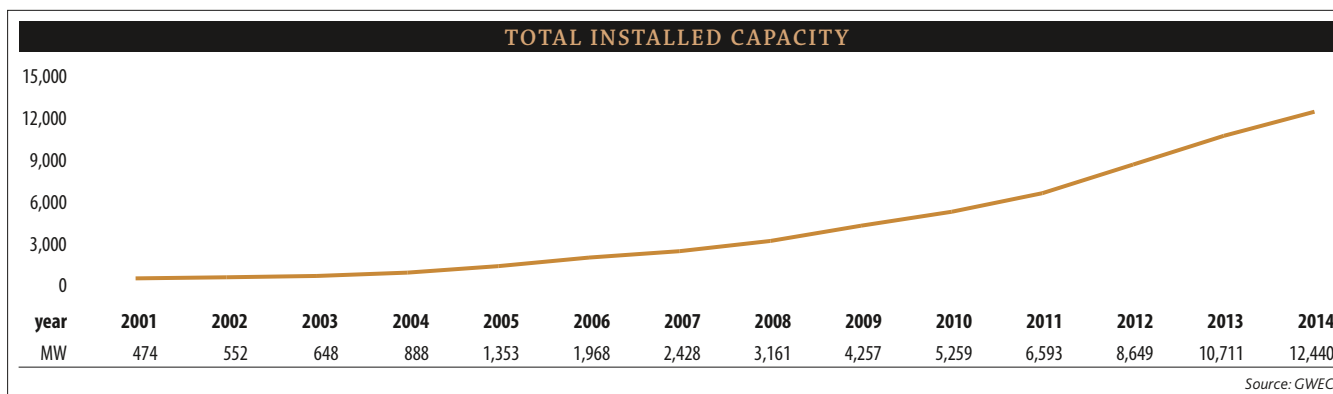
The top four turbine market players for >500 kW class turbines installed in 2014 were Siemens (42%), Gamesa (13%), Vestas (13%) and Enercon (13%).

## Support framework for wind energy

Currently wind is supported in two ways: the Renewables Obligation provides financial support for projects larger than 5 MW, and smaller projects can benefit from a feed-in tariff.

The Renewables Obligation requires power suppliers to derive a specified portion of the electricity they supply to customers from renewable sources. Renewable power generators receive Renewables Obligation Certificates (ROCs) for each MWh of electricity generated. These certificates can then be sold to power suppliers in order for them to meet their obligation. Currently, onshore wind receives 0.9 ROC/MWh of the renewable obligation value and offshore wind receives 2 ROC/MWh.

For smaller renewables, suitable for domestic, business or agricultural use, the feed-in tariff is the relevant support scheme. The support rates vary according to technology and size.



## LATEST POLICY DEVELOPMENTS

The major policy developments in 2014 were due to regulations coming out of the Energy Act, which was passed in December 2013. Its major impact was to introduce the Contracts for Difference (CfD), which will be the sole support mechanism for renewable energy from 2017 onwards. In April 2014 the first contracts were awarded for offshore wind under this scheme.

Several organisations have been established in the UK for the promotion and support of offshore wind such as the Catapult<sup>1</sup> (technology innovation and research centre for offshore wind, wave and tidal energy) and GROW: Offshore Wind<sup>2</sup>, which made grants available to UK firms in 2014.

For onshore wind power the policy environment has been more challenging. The planning process in England depends on the size of the proposed development. Wind farms with a capacity of over 50 MW will go through a "development consent" process and will be determined by the Secretary of State. Wind farms under 50 MW will be determined by the relevant local planning authority. In 2014, the UK Secretary of State announced a decision to extend the period to call-in<sup>3</sup> onshore wind farms from the planning process. In 2014, 24 projects were recovered<sup>4</sup> and a further five issued with holding directions (telling the Planning Authority not to make a decision) or withdrawn from a Local Planning Authority. The Secretary of State took decisions on 28 projects, of which only three were approved. In addition, the Conservatives announced in April 2014 that they would not financially support new (e.g. not already consented) projects if they won the next General Election due to be held in May 2015.

Despite this, the industry has made progress in the field of community engagement and communication of wind power's benefits. In Wales a community benefits register was introduced following the example in Scotland; and later in the year a similar initiative was launched in England. Scotland and Northern Ireland also initiated new principles on community benefits and engagement. RenewableUK's Chief Executive co-chaired a Government - industry taskforce to determine principles for offering shared ownership possibilities to communities.

## CURRENT STATUS OF OFFSHORE WIND

Currently the UK has just under 4.5 GW of offshore wind installed, making it the world leader. In April 2014 six offshore projects with a total capacity of 3.1 GW were awarded 'Investment Contracts' through FIDeR (Final Investment Decision Enabling for Renewables)<sup>5</sup> under the new regime. These projects are: Beatrice, Burbo Bank Extension, Dudgeon, Hornsea 1 and Walney Extension. There is no formal target for offshore wind, but the government's renewable energy roadmap envisages a minimum of 9 GW by 2020.

Provided a clear long term market which allows for cost reduction is evident, prospects for offshore wind remain very strong due to the UK's excellent resources. Read more details about UK offshore wind development in the Global Offshore Chapter.

## KEY BARRIERS TO WIND ENERGY DEVELOPMENT

A slow and unpredictable planning process, made worse by political interference, is the biggest barrier for continued onshore wind energy development. Lack of a long-term market framework along with the new competitive regime may stop developers from undergoing the costs needed to bring projects forward.

## OUTLOOK FOR 2015 AND BEYOND

The general elections taking place in 2015, along with continued uncertainties over the details of the financial regime, mean that investment levels are likely to struggle in 2015. On the positive side, offshore wind manufacturing facilities from both Siemens and MHI Vestas Offshore Wind in the UK will likely be ready in the course of 2015.

*With input from RenewableUK*

<sup>1</sup> <https://ore.catapult.org.uk/>

<sup>2</sup> <http://www.growoffshorewind.com/>

<sup>3</sup> A 'call-in' refers to the Secretary of State's (SoS) ability to take a project out of the decision-making power of a local planning authority, and to decide himself whether or not to grant consent for the project. Sometimes, before a project is called in, it is issued with a holding direction (Article 25), which stops the local authority determining the project while the SoS decides whether to call in the project.

<sup>4</sup> A 'recovery' refers to the Secretary of State taking the decision-making power away from the Planning Inspectorate (PINS), once a project has gone to appeal, and making a decision on a project himself after having received a recommendation from PINS.

<sup>5</sup> <https://www.gov.uk/government/publications/final-investment-decision-fid-enabling-for-renewables-investment-contracts>

# UNITED STATES



© Duval

## WIND ENERGY MARKET IN 2014

In 2014, the US wind industry installed 4,854 MW of new capacity - over four times more new wind energy than in 2013 - across 19 states. The new installations bring total wind power capacity in the US up to 65,879 MW, enough to power about 18 million average American homes.

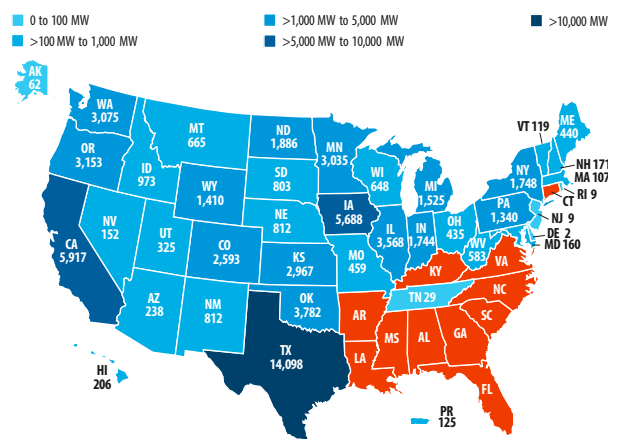
Wind energy has become a mainstream generation technology in the United States in recent years and is still on a steep growth curve. The good news is that over the past five years wind power's cost has dropped an impressive 58%, according to the Lazard's Levelized Cost of Energy Analysis<sup>1</sup> report from September 2014.

As a result of continued technological improvement and domestic manufacturing, wind has become one of the most affordable sources of electricity today in the US and one of the leading choices for new generation by utilities. Wind has also become a major economic contributor: since 2008, over USD 100 bn (EUR 87.6bn) in private investment has flowed into the US wind industry.

## LATEST POLICY DEVELOPMENTS

Wind energy's rapid development in the US is especially impressive considering the unstable policy environment in which it has been forced to operate. The federal Production Tax Credit (PTC), the primary federal incentive for wind energy, has operated under short-term extensions of usually one and two years (the alternative Investment Tax Credit, relied on by offshore and community wind developers, has faced similar short-term extensions). The US Congress has allowed the PTC, which provides up-front tax relief of USD 2.3 cents/kWh (EUR 2 cents/kWh) for the first 10 years of a project, to expire several times. While the PTC has been key in spurring technological advances that have driven down the cost

Wind power installations by State



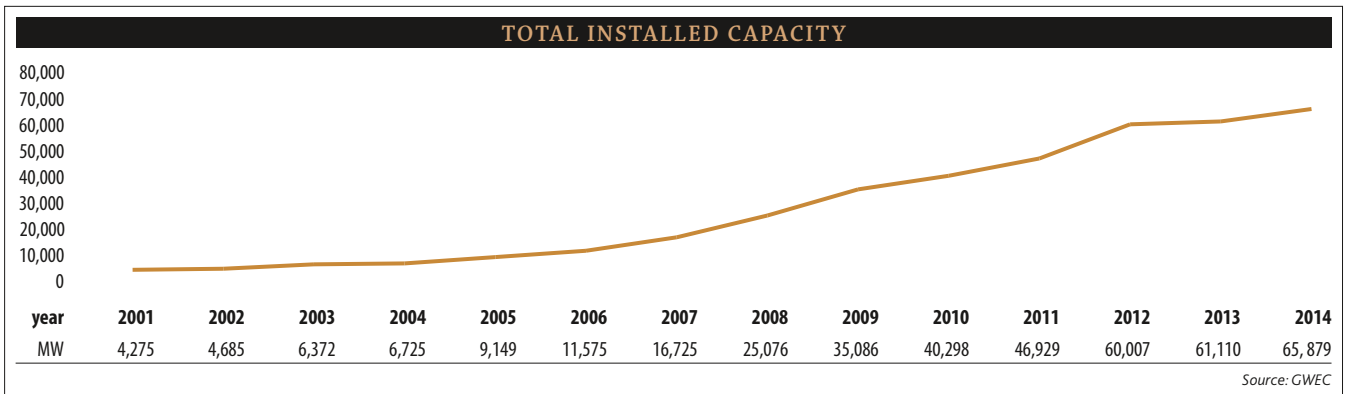
Source: American Wind Energy Association

of wind, the frequent expirations and related uncertainty have created a boom-bust cycle for the industry.

Perhaps the best indication of what the industry is capable of doing in a stable policy environment is its dramatic growth between 2005 and 2012, the longest stretch to date during which Congress did not allow the PTC to expire. American wind power saw 800% growth over the period, and average annual growth of 31%. Total investment in new wind farms reached USD 105 billion (EUR 92bn), and a vast majority of all wind power capacity in the US today was installed. In the record year of 2012 alone, the industry installed over 13,000 MW.

The 4,854 MW installed in 2014, while a strong rebound from the previous year's nadir resulting from a PTC expiration, still falls far short of what the industry was able to complete in 2012 when it had more long-term policy certainty.





The US Congress once again allowed the PTC to expire at the end of 2013, and then extended it in December 2014 - but only through the end of the year, resulting in what amounted to a two-week extension. Fortunately, however, a change in the eligibility rules that the industry secured two years ago requires that projects must start construction, rather than be completed, prior to the PTC expiration in order to qualify for the credit.

### OUTLOOK FOR 2015 AND BEYOND

The US wind industry is expecting a busy year in 2015. As of the end of 2014, over 12,700 MW of wind power was under construction in 23 US states. Texas has more capacity under construction than is currently installed in any other state. Additionally, more than 5,000 MW of projects with power purchase agreements (PPAs) already in place have not yet started construction, but are on track to do so in 2015 or early 2016.

Meanwhile, utilities continue to sign some of the lowest cost long-term contracts ever seen for wind energy. Since the beginning of 2014, there have been more than 3,300 MW of PPAs for wind power signed across 14 states. In total, over 12,000 MW of long-term contracts for wind power have been signed since the start of 2013. These PPAs include purchasers such as Amazon, Google, Microsoft, Walmart and Yahoo, who are turning to wind energy to provide stably-priced electricity for their data centers.

An important development in 2014 came when the US Department of Energy previewed its pending Wind Vision report. Slated to be released in 2015, it states that US wind energy capacity can double by 2020, and provide 10% of America's electricity - and then double again by 2030, to 20%. It projects that by 2050, wind can provide as much as 35% of the nation's electricity.<sup>2</sup>

The Wind Vision becomes all the more compelling when considering that the American industry is on pace so far to meet the 2030 goal, as outlined in an initial report produced by the George W. Bush administration in 2008 (2008, DOE).<sup>3</sup> The vision is already becoming reality.

The US Environmental Protection Agency's (EPA) proposed carbon regulations also are a strong signal that America needs wind power. In meeting the landmark rule

to limit carbon dioxide emissions from existing power plants, many states will find wind energy to be one of the biggest, fastest and cheapest ways to comply as their implementation plans are prepared in the coming two years. As shown by the 2014 Lazard report, wind is by far the most cost-effective generation option for reducing emissions. The 65,000-plus megawatts now producing zero-emission electricity represent enough displaced fossil generation to avoid the carbon pollution of over 28 million cars.

One benefit that often goes unnoticed is the water saving from using wind energy - a key benefit in drought-prone parts of the US; and the associated enhancement to reliability during heat waves. Droughts from the Southeast to the West Coast have highlighted our dependence on fresh water. The 2008 DOE report which showed the feasibility of reaching 20% wind by 2030 also found that this would save 4 trillion gallons of water, more than the annual consumption of 9 million Americans.<sup>4</sup>

American offshore wind energy is at last on the verge of becoming a reality, bringing an energy source familiar in Europe to the US for the first time. Projects have been proposed in both state and federal waters off the Atlantic and Pacific coasts, as well as in the Great Lakes and the Gulf of Mexico, and construction will start on the first US offshore wind project in 2015.

In today's rapidly shifting US environmental and energy policy landscape, an important goal of the wind industry is an extension of the PTC and a policy framework that appropriately values its attributes, including zero-emissions power and no water use. A policy environment that values such attributes will free the industry to realize the Wind Vision outlined by the US Department of Energy - doubling its contribution by 2020, reaching 20% by 2030, and providing over a third of the nation's electricity by 2050 while saving consumers money.

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

- 1 <http://www.lazard.com/PDF/Levelized%20Cost%20of%20Energy%20-%20Version%208.0.pdf>
- 2 "WINDPOWER 2014 inaugurates vision of a far larger industry," American Wind Energy Association news release, May 6, 2014.
- 3 "20% Wind Energy by 2030: Increasing Wind Energy's Contribution to U.S. Electricity Supply," U.S. Department of Energy, July 2008. <http://20percentwind.com/20percentwindenergyreportrevOct08.pdf>
- 4 "20% Wind Energy by 2030: Increasing Wind Energy's Contribution to U.S. Electricity Supply," U.S. Department of Energy, July 2008. <http://20percentwind.com/20percentwindenergyreportrevOct08.pdf>

# ABOUT GWEC

## OPENING UP THE FRONTIERS

**GWEC** is a member-based organisation that represents the entire wind energy sector. The members of GWEC represent over 1,500 companies, organisations and institutions in more than 80 countries, including manufacturers, developers, component suppliers, research institutes, national wind and renewables associations, electricity providers, finance, insurance companies and law firms.

Our mission is to ensure that wind power establishes itself as the answer to today's energy challenges, providing substantial environmental and economic benefits.

GWEC works with national and international policy makers and industry associations to help open new markets for wind power i.e. UNFCCC, the IEA, international financial institutions, the IPCC and IRENA. GWEC has a proven track record of success in helping to build the wind power industry in emerging markets around the world, including Brazil, China, India, Mexico and South Africa.

**MOVE AHEAD INTO NEW MARKETS  
AND JOIN GWEC TODAY!**

Our GWEC membership helps us to get access to the global wind industry and opens up a world of new business opportunities. It helps us to promote the message that wind energy is the key to a sustainable future

Thorbjørn Rasmussen,  
Chief Sales Officer, Mita-Teknik

## GWEC MEMBERSHIP BENEFITS

- **Access to first-hand market analysis** – we provide authoritative research and analysis on the wind power markets around the world.
- **Speaking opportunities** at leading industry events attended by government officials and influential industry players
- **Exclusive networking opportunities**, including contacts with companies, national governments and trade associations around the world, which helps GWEC members stay one step ahead of the competition.
- **Tailor-made communication** advice and tools for members to optimise global reach as well as target specific emerging markets.
- **Optimisation of your marketing budget** with discounts to events (booths and delegate passes), advertising space with our major industry media partners and on GWEC's communication channels.

Find out more about GWEC's policy work, publications, events and other membership benefits on our website.



[www.gwec.net](http://www.gwec.net)

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