

# Wind Energy in China: a Global Perspective

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Many countries across the globe are instigating wind energy schemes in an attempt to reduce their dependence on fossil fuels. Wind energy has been recognised as a highly attractive form of renewable energy as it is a free natural resource and conceptually, relatively easy to harness. Many scientists believe that the large-scale adoption of wind energy will greatly reduce global warming and the deleterious effects of man made climate change.

At the end of 2010, the worldwide installed capacity of wind-powered generators was 198GW and the related energy production was around 2.5% of global electricity usage. As of 2011, 83 countries around the world are now using wind power on a commercial basis.

In 2010, over \$90 billion was invested in wind power projects, an increase of 33% over the prior year. In comparison and to provide a sense of scale, in 2010 large scale solar plants secured only \$19 billion in investment.

For China, with its stated clean technology objectives and ready availability of suitable locations for installations; wind energy appears to be an attractive renewable energy option. Greenpeace.cn has recently reported in their “China Wind Power 2011” Report<sup>1</sup> that,

*“....China’s installed wind power capacity doubled in size four years in a row and in 2010 surpassed that of the United States to become the world’s largest”*

This article attempts to relate and review global wind power activities in a Chinese context.

## Global activities

The Global Wind Energy Council<sup>2</sup> has recently (12 July 2011) forecast a bright future for wind power with the Secretary General, Steve Sawyer commenting:

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<sup>1</sup> <http://www.greenpeace.org/eastasia/Global/eastasia/publications/reports/climate-energy/2011/china-wind-power-2011-summary.pdf>

<sup>2</sup> Global Wind Energy Council <http://www.gwec.net>

*“Wind power continues to lead the renewable electricity sector, with more new capacity installed in 2010 than for any other technology. Equally important to note is that in 2010 for the first time, more wind power was added in developing countries and emerging markets than in the industrialised world.”*

According to the Chairman of the REN21 Global Status Report<sup>3</sup>, Mohamed El-Ashry:

*“Today, more people than ever before derive energy from renewables as capacity continues to grow, prices continue to fall, and shares of global energy from renewable energy continue to increase.”*

The report also stated in relation to wind power that:

*Globally, wind power added the most new capacity (followed by hydropower and solar PV), but for the first time ever, Europe added more PV than wind capacity.*

However, on a more salutary note, it should be noted that 2010 Global wind power capacity was only enough to meet an estimated 2.0-2.5% of global energy consumption.

The relative rankings of the key wind power generating countries are shown in the tables below:

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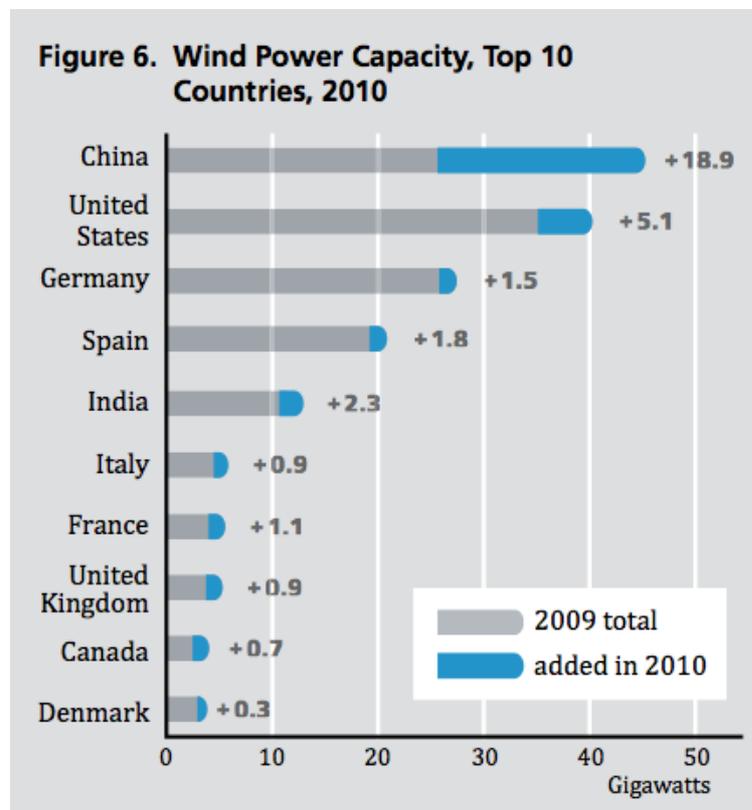
<sup>3</sup> Renewable Energy Policy Network for the 21<sup>st</sup> Century  
<http://www.ren21.net/REN21Activities/Publications/GlobalStatusReport/GSR2011/tableid/56142/Default.aspx>

Table R2. Added and Existing Wind Power, Top 10 Countries, 2010

Country	Cumulative at end of 2009 (GW)	Added in 2010 (GW)	Cumulative at end of 2010 (GW)
China <sup>1</sup>	17/25.8	+ 14/18.9	31/44.7
United States	35.1	+ 5.1	40.2
Germany	25.7	+ 1.5	27.2
Spain	18.9	+ 1.8	20.7
India	10.9	+ 2.3	13.2
Italy	4.8	+ 0.9	5.8
France	4.6	+ 1.1	5.7
United Kingdom	4.4	+ 0.9	5.3
Canada	3.3	+ 0.7	4.0
Denmark	3.5	+ 0.3	3.8
<b>World Total</b>	<b>159</b>	<b>+ 39</b>	<b>198</b>

Source: REN21 Global Status Report

1 For China, the lower figure is the amount classified as operational by the end of 2010; the higher is the total installed capacity.



Source: REN21 Report 2011 Page 20

## Europe

In Europe, the National Renewable Energy Directive<sup>4</sup> sets a target of a 20% share of energy from renewable sources by 2020. It is this Directive and accompanying long term objectives which are underpinning the installation of wind power resources.

Research and development is being carried out into all aspects of the industry as it attempts to emerge as the main source of renewable energy throughout Europe.

The European Wind Energy Association (EWEA)<sup>5</sup> stated in a press release dated 2 August 2011 that they have confirmed the following wind power electricity production figures and their forecast scenarios for 2020 and 2030:

*Electricity production from wind power is expected to increase from 182 Terawatt hours (TWh) or 5.5% of the total EU demand in 2010, to 581 TWh or 15.7% of the total demand in 2020.*

*By 2020 the electricity production from wind energy will be equivalent to the total electricity consumption of all households in France, Germany, Poland, Spain and the United Kingdom together.*

*By 2030 1,154 TWh (28% of total demand) would be produced by wind power, more than the EU's predicted 241 million private households are expected to consume in 2030. Today, wind power produces electricity equivalent to the consumption of 50 million average EU households<sup>6</sup>.*

Currently, the total installed capacity within the EU is 84.3 GW.

The Spanish Wind Power Association (AEE)<sup>7</sup> stated on 27 April 2011, that Spain in 2010 became the number one country in Europe for electricity generation using wind power<sup>8</sup>, overtaking Germany by generating 44 TWh of power as opposed to the German output of 36TWh.

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<sup>4</sup> [http://ec.europa.eu/energy/renewables/targets\\_en.htm](http://ec.europa.eu/energy/renewables/targets_en.htm)

<sup>5</sup> The European Wind Energy Association (EWEA) <http://www.ewea.org/>

<sup>6</sup> According to the EC PRIMES model, an average EU household's consumption is 3.76 MWh in 2010.

<sup>7</sup> Asociacion Empresarial Eolica (AEE) <http://www.aeeolica.org/>

<sup>8</sup> Barometer EurObservER <http://www.eurobserv-er.org/>

However, Germany is still the European leader in terms of installed capacity with a total of 27GW as opposed the Spanish capacity of 21 GW. To keep these figures in perspective it is also important to consider the relative amounts of overall electricity demand covered by wind power: in 2010 in Spain it was 16.4% whilst in Germany it was 6.2%.

Major factors that led to these relative utilisation numbers were:

- (i) The relatively high wind levels in Spain in 2010;
- (ii) A greater number of modern wind turbines in Spain; and
- (iii) According to AEE, better integration of wind farms into the Spanish electricity grid.

In terms of feed in tariff, new German wind farms received 92 Euros per MWh, compared to the average of 77 Euros received by Spanish wind farm operators.

### **USA Wind Power Activities**

The USA added just over 5 GW of wind generation capacity in 2010 bring their total wind power capacity to 40.2GW a 15% increase over 2009. Wind power now accounts for 2.3% of electricity generation, up from 1.8% in 2009. This represents sufficient power to supply the needs of 10 million US homes.

The majority of wind generation in the USA is based in Texas with over 25% of installed capacity. Out of the remaining 38 states with wind energy, 14 had wind energy installations greater than 1 GW.

Within the USA, one of the key issues for policy makers is to take into account the current economic climate and relatively low growth rates and to also focus wind energy activities on job creation. It was recently reported at the Windpower 2011 event<sup>9</sup> that:

*Wind power's vast supply chain, which produces the 8,000 components making up a typical wind turbine, continues to grow deeper roots here in the U.S.A.. Today the industry employs 75,000 people, and over 400 wind-related manufacturing plants dot the map in 43 states, from California where the industry began 30 years ago,*

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<sup>9</sup> WindPower Expo <http://www.windpowerexpo.org/>

*through the Midwest which now leads wind development, to the Southeast even though its first wind farm is still on the drawing board.*

It was further stated that:

*Overall, America is ahead of schedule to make 20 percent of its electricity from wind by 2030, the goal identified during the Bush administration.*

Offshore wind generation is also a key priority for the USA. In February 2011, Secretary of the Interior, Ken Salazar, and Secretary of Energy, Steven Chu, presented the *National Offshore Wind Strategy: Creating an Offshore Wind Industry in the United States*.

The goal of this plan is the deployment of 10 GW of offshore wind capacity by 2020 and 54 GW by 2030. They also announced \$50.5 million in funding opportunities for projects that support offshore wind energy deployment.

A recent letter from a coalition of 24 state governors to the President has also called for more long term support and certainty for the wind industry, particularly in relation to the wind energy tax credits that expire in 2012.

## **China**

A report in the UK Newspaper, The Guardian<sup>10</sup>, quoted a forecast published in the journal Science<sup>11</sup> that China could cut its CO<sub>2</sub> emissions by 30% in the next two decades if it uses wind power to meet its growing energy demands.

The article also stated:

*Using meteorological data to assess the potential for wind power in China, (the world's largest emitter of CO<sub>2</sub>) the researchers also suggested that wind could theoretically supply all of the country's energy.*

Lead author of the study, Michael McElroy, a professor of environmental studies at Harvard's School of Engineering and Applied Sciences said,

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<sup>10</sup> Guardian.co.uk 11<sup>th</sup> September 2009

<sup>11</sup> [www.sciencemag.org/content/325/5946/1378.short](http://www.sciencemag.org/content/325/5946/1378.short)

*“the world is struggling with the question of how do you make the switch from carbon-rich fuels to something carbon-free...the real question for the globe is: what alternatives does China have?”*

On the basis of the evidence above there should be little surprise in noting that in 2010 50% of the global increase in wind power capacity came from China. China added 18.9 GW of new capacity which equates to an increase of 37% over the amount added in 2009.

This additional capacity resulted in China becoming the global leader in wind power with a total capacity of 44.7 GW.

China’s installed capacity was distributed predominantly in the following provinces:

- Inner Mongolia >30%
- Gansu 10%
- Hebei 10%
- Liaoning 9%

Examples of more local installations provide further insight to the renewable revolution that is taking place within China.

According to the Xinhua<sup>12</sup> news agency;

*...a city on the ancient Silk Road in China intends to develop solar and wind energy to drive the local economy and protect the vulnerable environment characterised by its desert-threatened oases.*

*At the start of July (2011), the National Energy Administration (NEA) voiced its support for Dunhuang in the northwest Gansu Province to build itself into the country’s first nation-level pilot city of new energy development. According to the city’s development plan, the electric power generated by solar and wind energy in Dunhuang is expected to equal that produced by 2.2 million tonnes of coal by 2015.*

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<sup>12</sup> [http://news.xinhuanet.com/english2010/indepth/2011-07/31/c\\_131020720.htm](http://news.xinhuanet.com/english2010/indepth/2011-07/31/c_131020720.htm)

*The amount of power will be nearly three times as much as the city's energy consumption by then.*

*The local government hopes the new energy industry will drive the local economy, which currently relies on the water-consuming agriculture sector.*

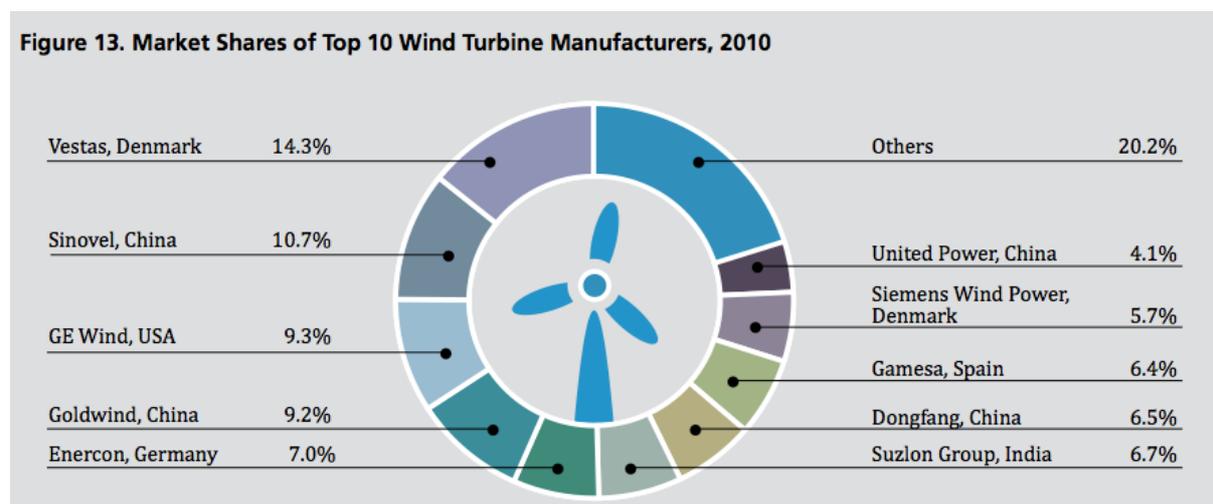
Finally before leaving this review of the current status of wind power within China it is worth noting that wind power is also the second largest employer in the renewable power sector with over 630,000 jobs worldwide, 150,000 of them in China.

### **Industry Trends**

As would be anticipated from the growth in installed wind power capacity, manufacturing capacity increased. The development of new projects was however subject to 'headwinds' in relation to the relatively low level of natural gas costs and the knock on effect with regards to the economic modelling of the viability of new projects.

However, within China, the strong government support, which compared to western governments, is also relatively long term and not determined by 3-5 year election cycles, ensured that companies such as Sinovel, Goldwind, Dongfang and United Power recorded strong growth thanks to the supportive regulatory and political environment.

The major global players in the industry are summarised in the chart below:



Source Source: REN21 Report 2011

There are currently over 100 companies involved in the wind turbine sector in China and the government has indicated it wishes to see a rationalisation and reduction in the numbers. The major players within the sector are all state owned enterprises.

Within Europe the major industry trend is centred around offshore developments where the environmental concerns and 'Nimbyism' – 'Not in My Back Yard Syndrome' can be avoided.

The largest installation in Europe in 2010 was the RePower 6MW<sup>13</sup> offshore unit located in the Thornton Bank project off the coast of Belgium.

In the USA 14 new turbine manufacturing plants were established in 2010.

On a global basis the most common turbine size was 1.6MW, up from 1.4 MW in 2009. In individual countries the preferred sizes were as follows; UK 2.5MW, China 1.4MW and 1.2MW in India.

### **Health issues**

Experts are divided about the impact of the giant wind turbines on health. Concerns include sleep deprivation from the noise of the turbines and the potential effect of low-frequency noise, known as infrasound.

However in a recent report, the National Health and Medical Research Council<sup>14</sup> in Australia stated that,

*“there was no published scientific evidence to positively link wind turbines with health effects”*

The potential negative health effects of wind turbines does not appear at the moment to be an issue that will slow the development and installation on a global basis, although in some countries such as Australia it is being raised by politicians as an issue to be addressed with further research.

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<sup>13</sup> <http://www.repower.de/wind-power-solutions/wind-turbines/6m/>

<sup>14</sup>

[http://www.nhmrc.gov.au/files\\_nhmrc/publications/attachments/new0048\\_public\\_statement\\_wind\\_turbines\\_and\\_health.pdf](http://www.nhmrc.gov.au/files_nhmrc/publications/attachments/new0048_public_statement_wind_turbines_and_health.pdf)

## Summary

The installation of wind power energy plants has, without doubt, reached a level of “critical mass”. It is no longer viewed as an “interesting renewable alternative”, rather, most developed and many developing countries recognise it is an essential element of any viable long term renewable energy policy.

China now appears particularly well placed in this market place, primarily domestically as it is in a position to benefit from long term planning and industry support as set out in the 12<sup>th</sup> Five Year Plan for Renewable Energy Development. Although the cautionary note, “*the sector needs to move from rapid expansion to a stage of healthy development*” is well made.

With the generation of significant levels of IP and manufacturing expertise related to the production of wind turbines, it also appears that significant export opportunities exist for domestic Chinese manufacturers now and for many years to come.

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