Wind in China
for
South African Wind Energy Center

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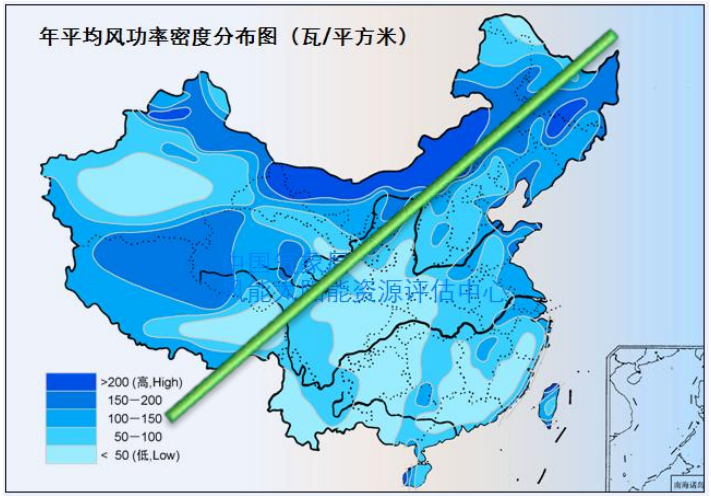
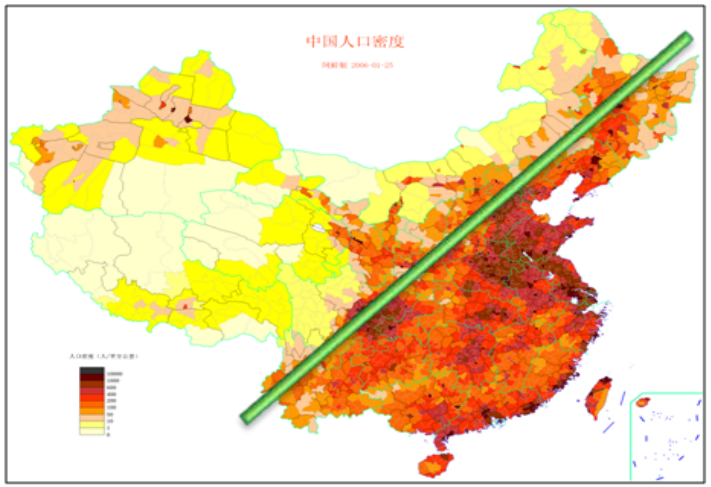
Wind in China

Development & Target

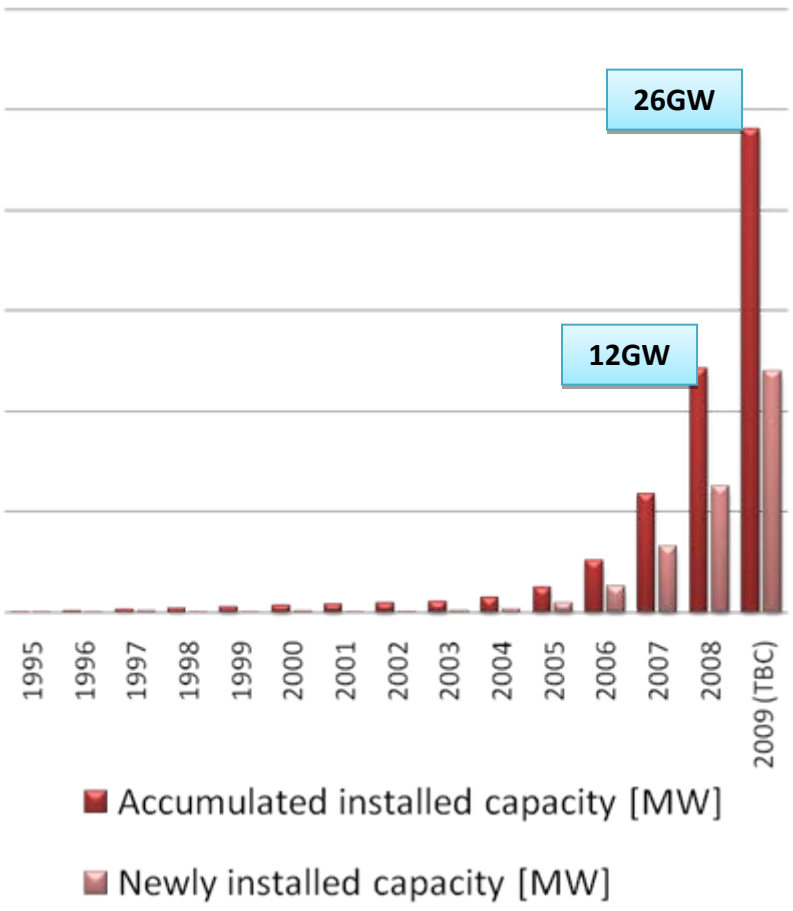
- Vast in territory, China is a country with **abundant wind resource**.
- According to various investigations, in general, in China, wind resources both onshore and offshore can sum up to **700 to 1200GW** (600-1000GW for onshore, 100-200GW for offshore) which could be utilized **for potential wind farm development.**
- **Contradiction**: generally, Areas with rich wind resources are having relatively less population density.
- However, wind energy utilization and associated **whole value chain development** have been well growing since 2005, and with great potential.





Source: Internet

- In 2006, “Renewable energy law”, revision in end of 2009.
- In 2007, China's Renewable Energy Medium and Long-Term Development plan annouanced: Renewable Energy will account for **10% of the total energy consumption by 2010**, and **15% by 2020**.
- **Fixed feed in tariff (2009):** China will be divided into four wind resources regions, and in the four wind resource regions.
- Since 2003, 5 rounds of national wind farm **concession projects**.
- **Plan of constructing large scale wind farm base**.

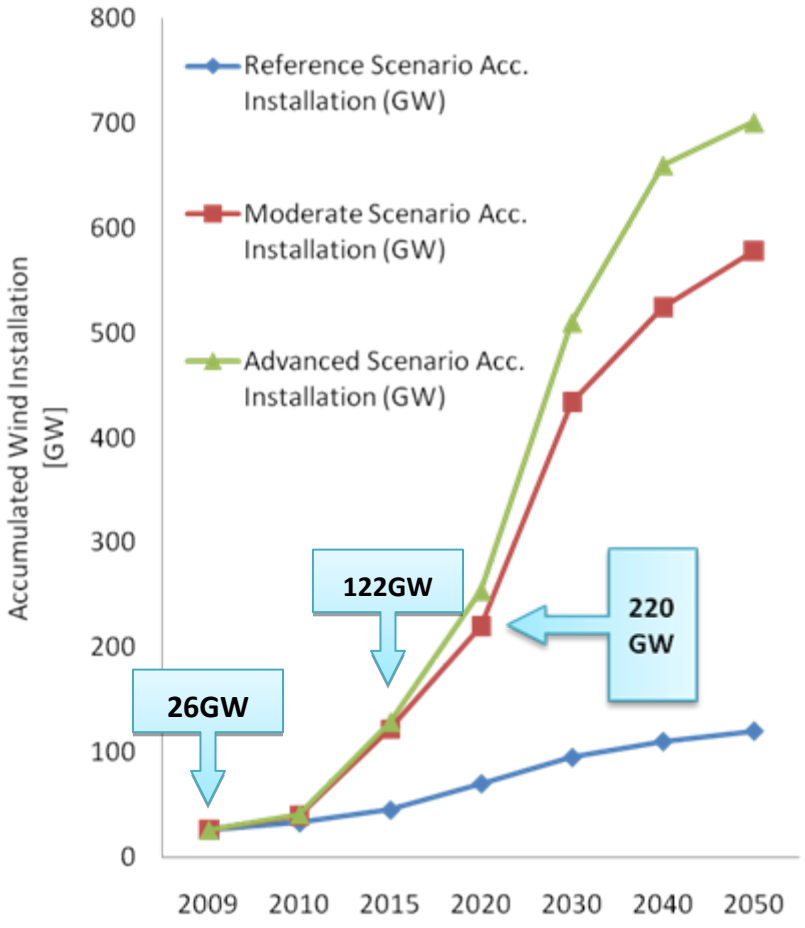


Source: CWEA

Moderate Scenario (GWEC):

- The annual growth rate in China is assumed to be **16% from 2015-2020**.
- China's wind power capacity will reach **122 GW** by **2015**.
- By **2020**, the installed capacity of wind power will be **220 GW** and the annual installed capacity will reach 20 GW.

In this scenario, the projected wind generation output could reach 540 TWh by 2020 and 1,065 TWh by 2030. This means that wind power could account for **8.7% of total electricity supply in China by 2020.**



Source::GWEC

R Huitengxile wind farm, China

Donghai Bridge offshoreWind farm, China

Jilin Da'an wind farm, China

IMAR Damao Wind farm, China

Wind in China

Status of Wind Players

Wind Farm Developer

Wind Farm developer (investor) [in MW]	by 2009	Acc. by 2010
LongYuan Power Group*	2600	5098
China Datang Corportation Renewable Power Co., Ltd.*	1740	3806
Huaneng Renewable energy Holding co. Ltd.*	1645	2874
China Huadian New Energy Development Co. Ltd.*	1230	1683
China Guangdong Nuclear Power Wind Power Co., Ltd.	854	1360
Beijing international New Energy Co., Ltd. (Beijing Jingneng Group)	798	1200
Guohua Energy Investment Corporation (China)	590	1476
China Eenergy Conservation Wind Power Investment Corporation.*	400	775
China Power International New Energy Holding Ltd.	320	861
China Resources Wind Power Development Co., Ltd.	310	
Beijing Tianrun New Energy Investment Co. Ltd	310	
China Wind Power Group Ltd.	296	
Hebei Construction Co., Ltd	260	494
Hong Kong Construction New Energy Co., Ltd	160	
State Development & Investment Power Co., Ltd	152	
Sinohydro Renewable Energy Co., Ltd	149	
Ningxia Electrical Power Group Co. Ltd	144	
Fujian Zhongming Group	130	
Shengneng Beifang Co., Ltd	129	
Nuneng Group	100	
Honiton Energy Co., Ltd	100	
Other Developers	1386	
Total	13803	26000

- Wind farm developers, are mainly State Owned Enterprise (SOE).
- It's foreseeable that those big SOEs will still be the major wind farm investor in the future.
- Nearly all foreign wind farm investors ever endeavor in China for wind farm investment were pulled out of the market due to:
  a) Strong competition from SOE (approval & grid);
  b) Different financial system (balance sheet finance);
  c) Different development procedure.
  d) Change on incentives of utilizing foreign capital.

Source: CWEA

Wind Farm Project

Once the target is set, SOEs will make it happen.
It's a bit different from that in other country, but in China it does work.
However, Quantity <> Quality

Source: CWEA

Wind Farm Economics

1 RMB = 1 ZAR

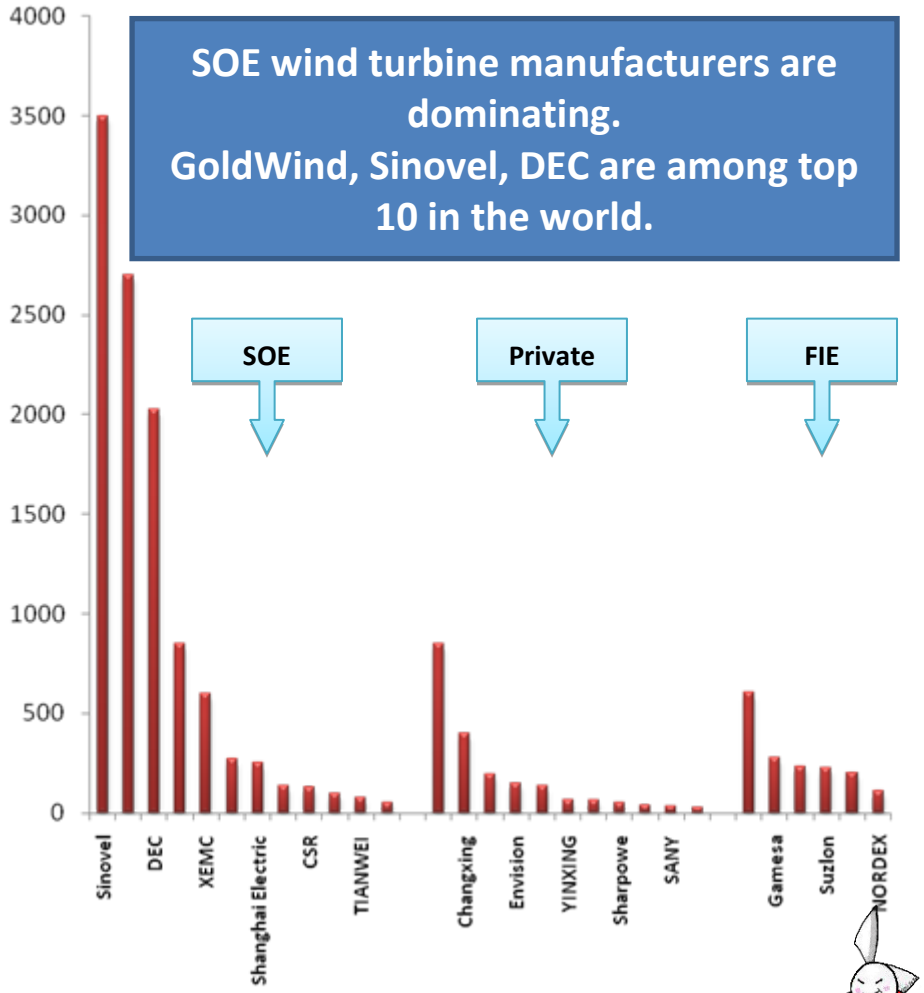
CDM could be utilized by developing country for additional income.

However, CDM after 2012 is still unknown to the public.

- The 4-level fixed feed in tariffs are associated with the local wind resources.
- Regulation in power industry that the IRR of equity investment shall not be too high, i.e. 8%.
- Some favorite tax policy:
  a) VAT of electricity sales is 8.5% which is half of normal.
  b) VAT rebate for equipment and transportation service (through VAT of electricity sales)
  c) CER sales could add RMB 0.07 on top of the tariff.
- Unexpected problems, such as: power curtailment, major component failure, etc. will greatly influence the financial return.

Wind Turbine Manufacturer

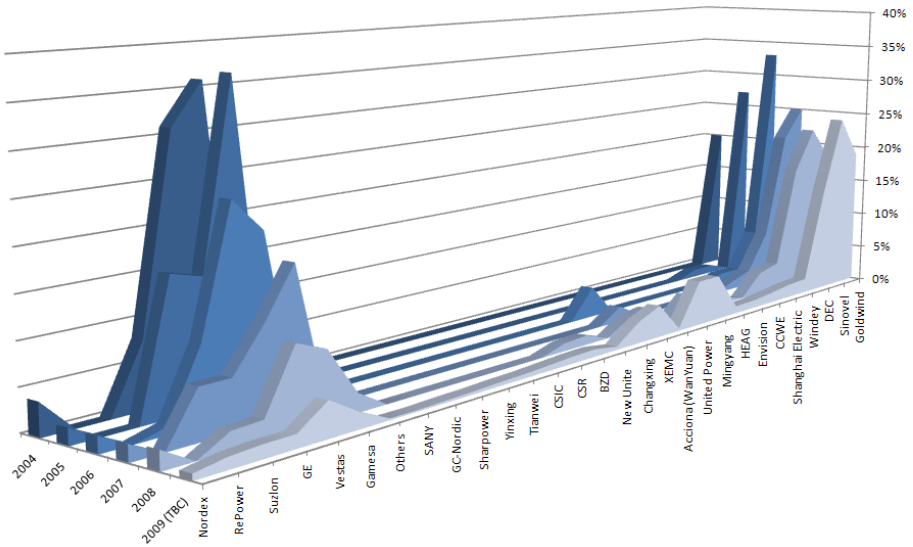
- There have been over 80 various wind turbine manufacturers in China up to now.
- SOE is also playing a major role as supplier.
- Market concentration was started end of 2009 with around 20 wind turbine manufacturers who have serial production capability.
- Technology source are different:
  a) License agreement which is very popular
  b) In house development
  c) Co-development
- Most of the top 10 foreign wind turbine manufacturers have their manufacturing facilities in China.



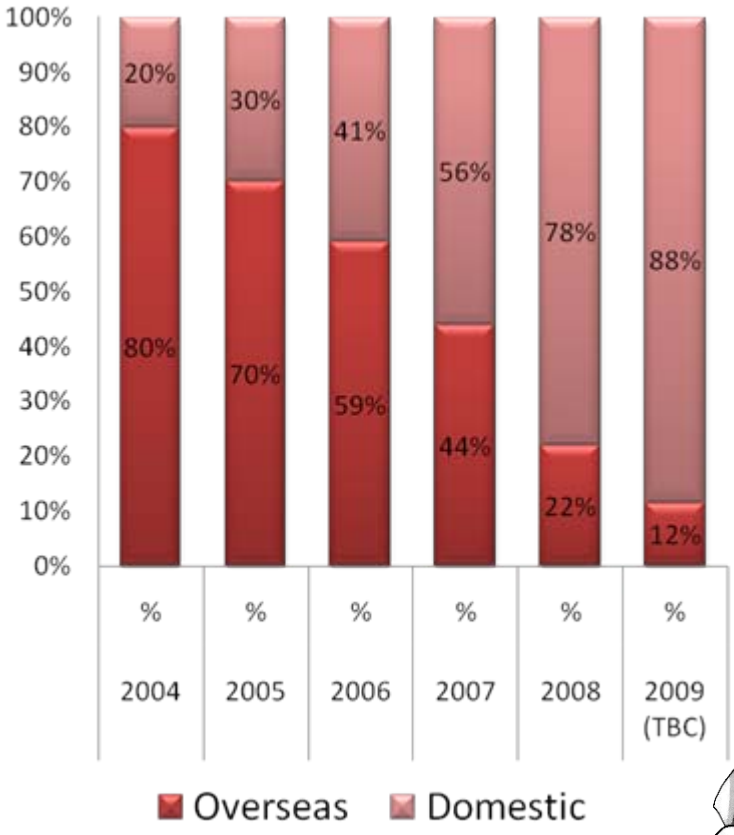
Source: CWEA

Wind Turbine Manufacturer

- After 2005, as the domestic wind turbine supplier became more mature, its market share increase steadily year by year.
- By end of 2009, domestic turbine wind turbine suppliers accounted for 88% of the total market volume and only around 12% for foreign ones.



China wind industry has built up manufacturing capacity.

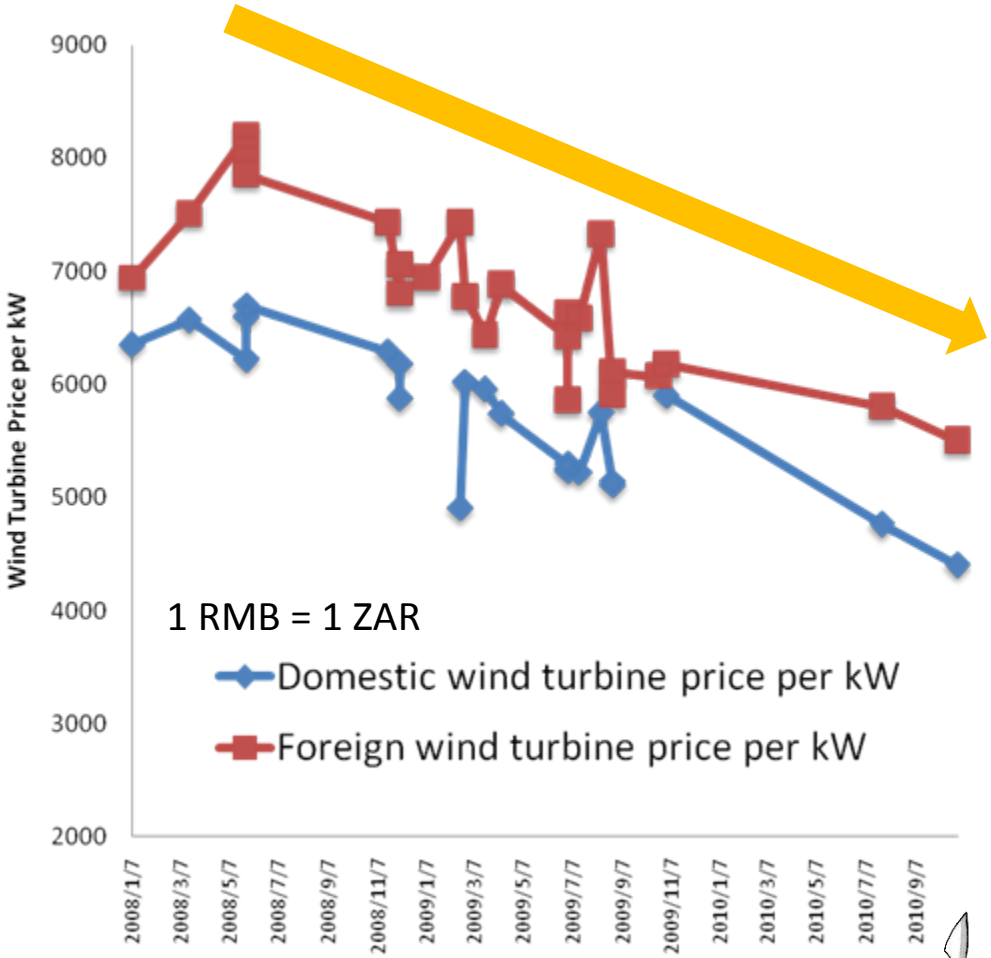


Source: CWEA

Wind Turbine Price (per kW)

- Price of domestic wind turbine went down from around RMB6500, to RMB4400 in 2010, about 47% drop.
- The price of foreign wind turbine went down as well, from around RMB7500 in 2008 to RMB 5500 in 2010, about 36% drop.
- In general, price per kW for the foreign made wind turbine is about 20-25% higher than that made by domestic wind turbine.

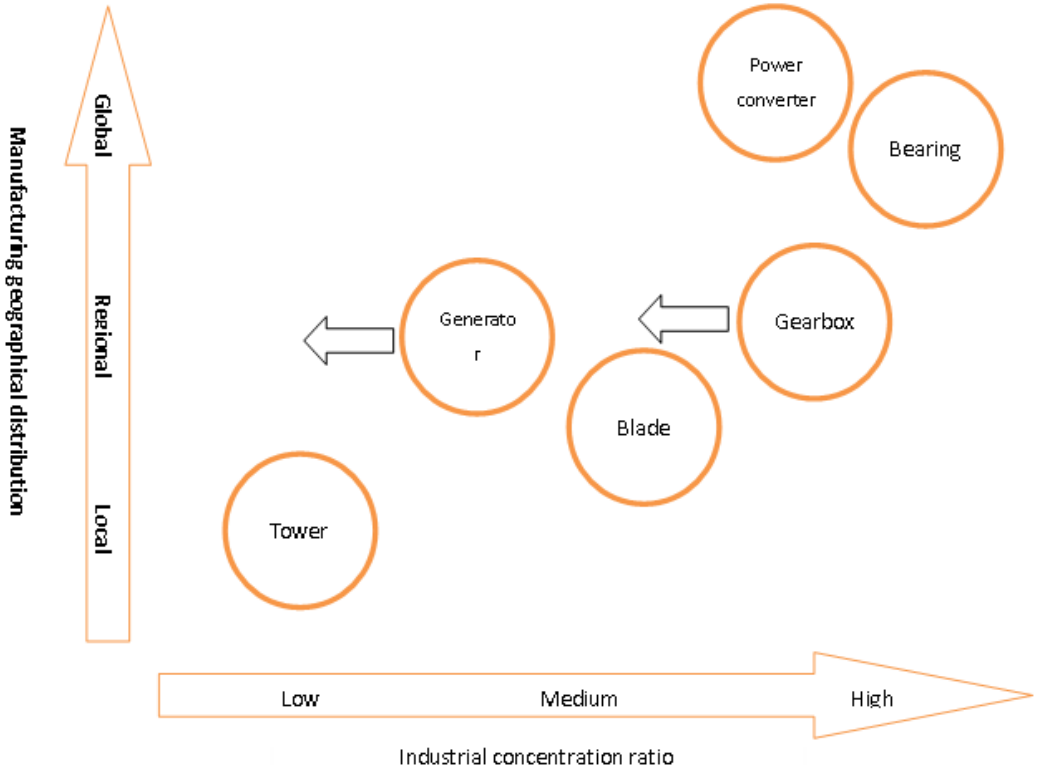
Believe or not, the aggressive wind turbine manufacturing capacity bring down wind turbine price drastically.



Source: self collection upon the bid opening results of over 200 samples

Wind Turbine Component Supplier

- Most of the wind turbine components could be manufactured in China (Blade, tower, gearbox, generator, cables, etc.).
- Before, there was “local content ratio (75%) requirement” which was abolished already in end of 2009. Yet it contribute greatly on localization of wind turbine.



Wind in China

Challenges

Challenges

- Poor wind farm planning cause profit loss.
- Development and construction of grid is far behind wind farm installation which lead to wind farm disconnection from the grid.
- Impact to electric power system stability when wind penetration is high.
- Technical standards and guidelines are incomplete yet.
- Strong manufacturing capability and lack of technology innovations.

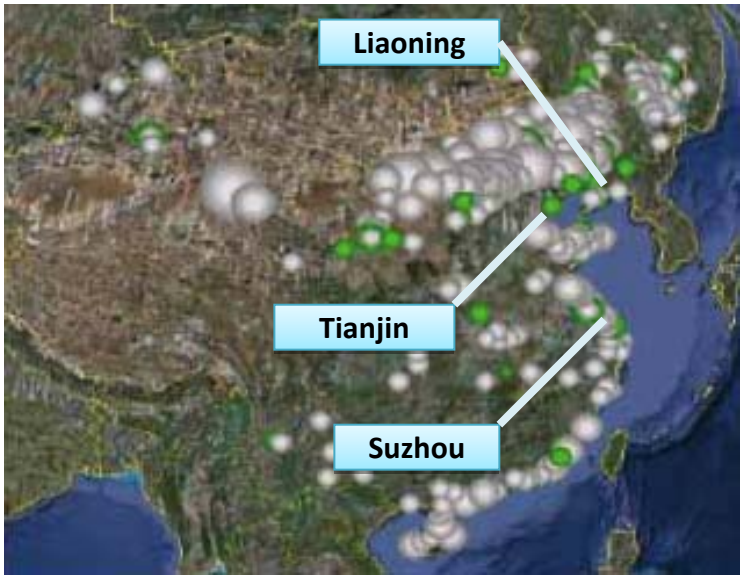
In particular:

- **Lack of proper training for skilled worker for wind turbine manufacturing and site construction and maintenance.**
- **Poor quality control during manufacturing (design) or wind farm construction.**
- **Availability of local manpower for wind industry.**

Challenges

By 2009,150,000 jobs have been created by wind industry and this figure will reach 500,000 when the installed capacity reaches 220GW (China wind power outlook 2010, Greenpeace, GWEC, CREIA).

- However, for the training of O&M people, existing vocational training facilities are normally locaed in the cities with sound industrial capability, such as Tianjin, Jiangsu, Shanghai or Shenyang, etc., which are a bit far away from the wind farm project site.
- There is a demand and trend of recruit and train local people via which re-location possibility could be reduced which is also good for stability of working staffs.



Challenges – some disasters

- Nacelle caught on fire due to mis-operation (or mistake in commissioning)

- Wind turbine collapsed due to improper torquing (or quality flaw in material)

China wind development has been pursuing "Quantity" for the past years, and now it's a time to draw more attentions on "Quality".

China top authority has launched an investigation on quality problems occurred recently.

Wind in China

Views of WTG manufacturer on training

Views of WTG manufacturer on training

- Though WTG manufacturer is only part of the whole value chain of the wind business, it's a vital stage as the major investment of the wind farm are spent on wind turbine procurement.
- Wind turbine has to be running for 20-year design lifetime to achieve the financial return.

From the view of wind turbine manufacturer, to achieve a high-quality wind farm project, we're expecting high-quality to be achieved by adequate training in the following aspects:

Vocational

Player	Poorly trained	Well trained
Component Manufacturer	a) Improper use of tools; b) poor workmanship during manufacturing; c) Ignore quality control procedure; d) Either injure human body or damage the tools or product	a) Use tools properly; b) Observe quality procedure; c) Be safe.
WTG Manufacturer		
Logistic and Installation company	Quality issue during transportation and installation which will jeopardize both human body and the wind turbine.	a) Observe transportation requirement; b) Use tools properly and achieve the requirement in design to eliminate the risk in future operation; c) Be safe.
O&M	a) Improper use of tools; b) Improper treatment on failure might cause big losses; c) Injury on site.	a) Use tools properly; b) Mitigate the failure rate by observing set O&M procedure. c) Be safe.

Engineering

Player	Inadequately trained	Well trained
Wind turbine design	a) Design flaw results in technical change implementation on site which is costly. (10-100-1000); b) High failure rate & early failure at major component. c) In capable of providing adequate solutions to be grid friendly.	a) Well design wind turbine; b) Less effort spent on site; c) Robust product of lifetime cycle; d) Grid friendly.
Wind farm investor	a) ONLY pursue on low kW cost; b) Extra investment in lifetime operation due to major component replacement.	a) Scientific wind farm planning; b) Discrete financial calculation to maximize the project profit.
Grid connection designer and operator	Poor integration of wind farm into the local grid which might cause profit losses of the wind farm	Optimized wind farm grid integration taking into account the nature of the local wind condition & the wind turbine capability and functionality
Testing & Certification	Poor verification & testing result will mis-interpret the reality	Design guidelines strictly observed for the sake of product quality

Existing training & education facilities:

- In China there have been various training facilities run by various organizations, and more are coming:

a) **Engineering level courses (Different level)**

Various universities set up wind related subject and courses, such as China Electric Power Research Institute (CEPRI), Shenyang University of Technology (a domestic wind turbine designer), Hehai University, Hefei University of Tecnology, etc. National level research centre built in the wind related companies, LongYuan, GoldWind, Sinovel, etc.

b) **Vocational training (Hands on or on-site training)**

Well known "Sino-German Suzhou Bailu training centre which is full equipped (G58), expansion plan is ongoing. Other vocational training school, such as: Liaoning wind power training centre.

c) **Training provided by wind turbine supplier and wind farm investor**

Training by wind turbine manufacturer at its manufacturing facilities. Wind farm investor who has already built up its capacity will provide training internally.

d) **International cooperation program & occasional training program**

InWent or Eu-China program, etc.

Thank you!

End