

2010 – China Wind Industry Investment & Risk Analysis

Clean Energy Expo

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Azure International Beijing
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azure[™]
international

- Enabler of clean-tech business opportunities through management, tech transfer, finance facilitation, business incubation & engineering services. Successful management track record in coal gasification, wind, waste to energy Including realization of proof of concept commercial operation for clean coal gassification business and organic waste water treatment to process heat plants
- A specialized advisory and investment firm dedicated to the commercialization of clean, sustainable energy technologies that are economically viable and have significant market potential in China
 - **Quarterly updating of wind and other renewables markets; bottom-up and in unsurpassed detail**
 - Advisory services covering market intelligence and commercial/financial due diligence in the China wind industry including project development and WTG and component manufacturing & related engineering
 - Bespoke consulting services covering industry research, commercial and technical due diligence, industry monitoring, corporate strategy, energy strategy, energy efficiency solutions for industry, carbon foot-printing, national energy & climate policies

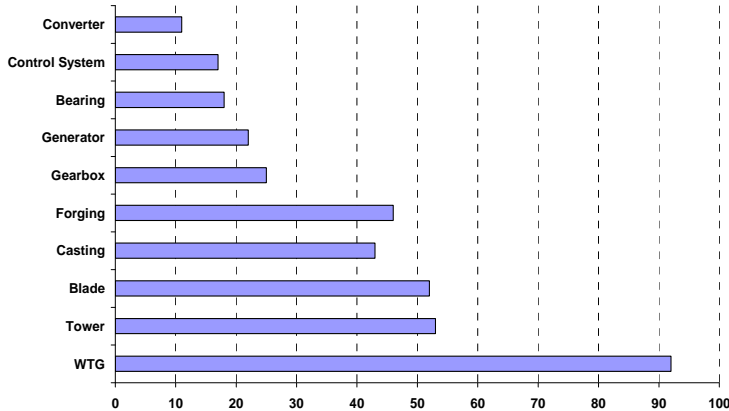


China dedicated wind expertise

- Focused knowledge leader



Number of main component suppliers



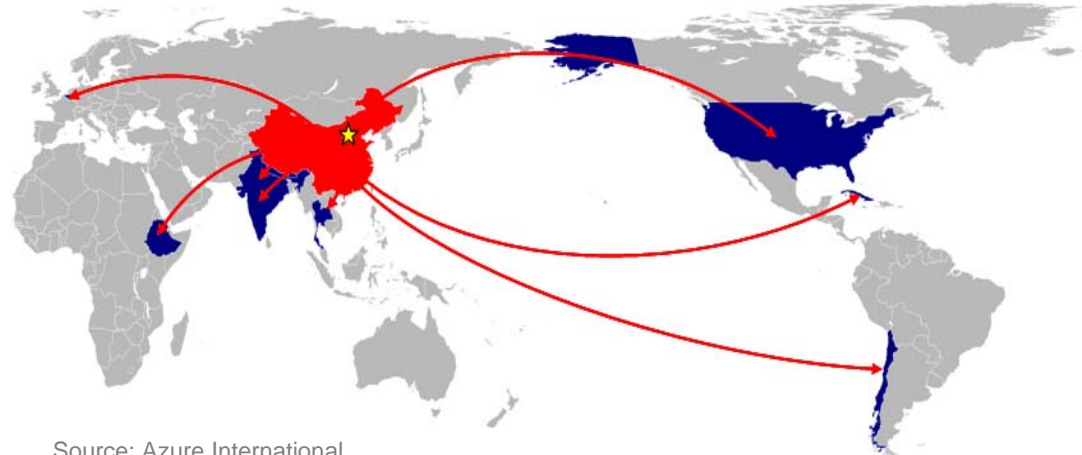
Source: Azure International

Tracking all wind activity in China since 2003

Providing wind technical support since 2005

Azure helps you understand and pursue opportunities within the Chinese wind market

Chinese turbine exports - 2009



Source: Azure International



Presentation overview

- Outline

Part (1) Turbine related commercial DD

Part (2) Turbine related technical DD

Part (3) Project investment related commercial DD

Part (4) Project investment related technical DD



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Part (1) Turbine related commercial DD

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Turbines: commercial DD support

- intro



- Two major questions:
 - Will supplier be around to honor warranty obligations and provide support beyond the warranty period? (Commercial DD)
 - Will the product work as specified/expected?

Source: Azure International data



Turbines: commercial DD support

- intro – what's going on and why

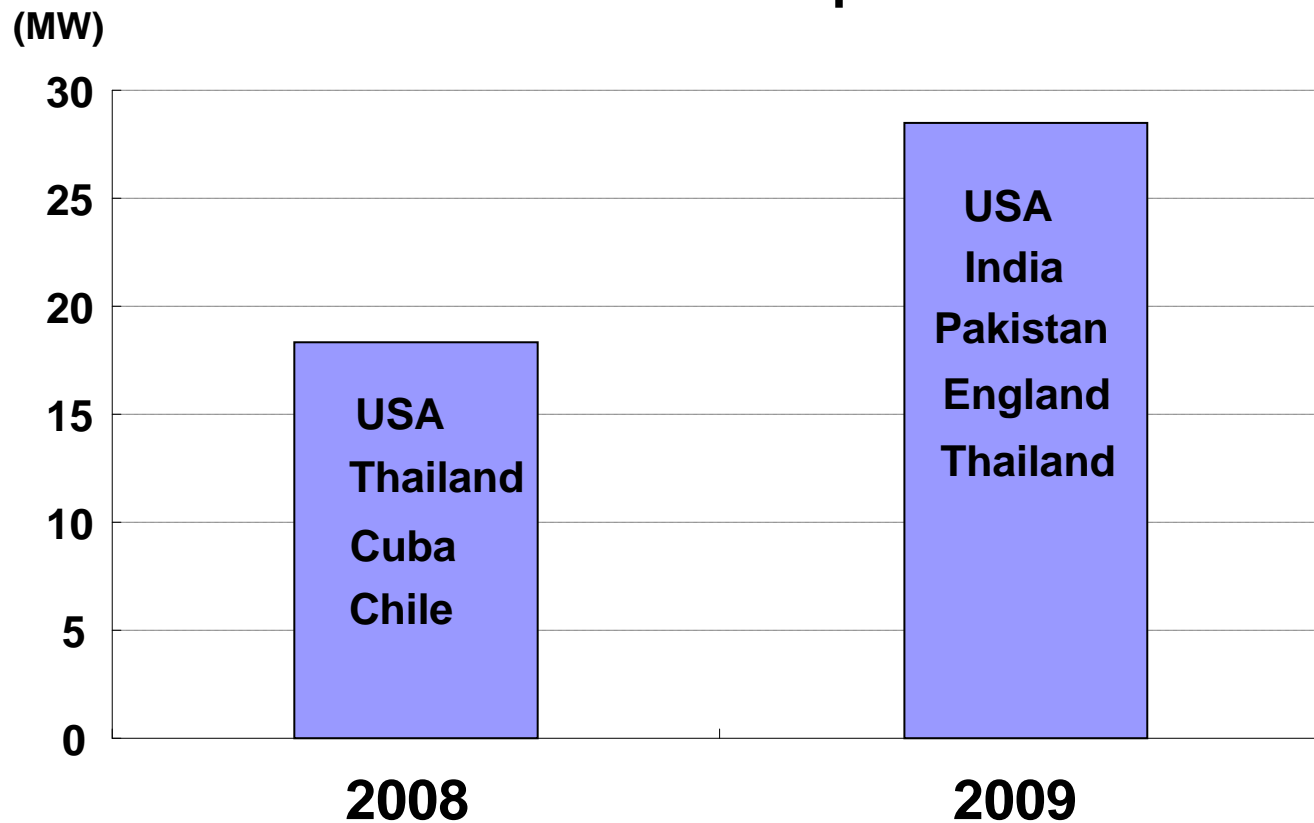
- For international buyers, it is helpful if the company is internationally listed as this provides a base of public knowledge about a company that is reliable including timely market disclosures and audited financial statements
- Goldwind (HKG:2208)
- Mingyang (NYSE:MY)
- A-Power (NASDAQ:APWR)
- GC China Turbine Corp (OTC:GCHT)
- Sinovel (A-share, TBD)...



Turbines: commercial DD support

- intro – China starting to export WTGs

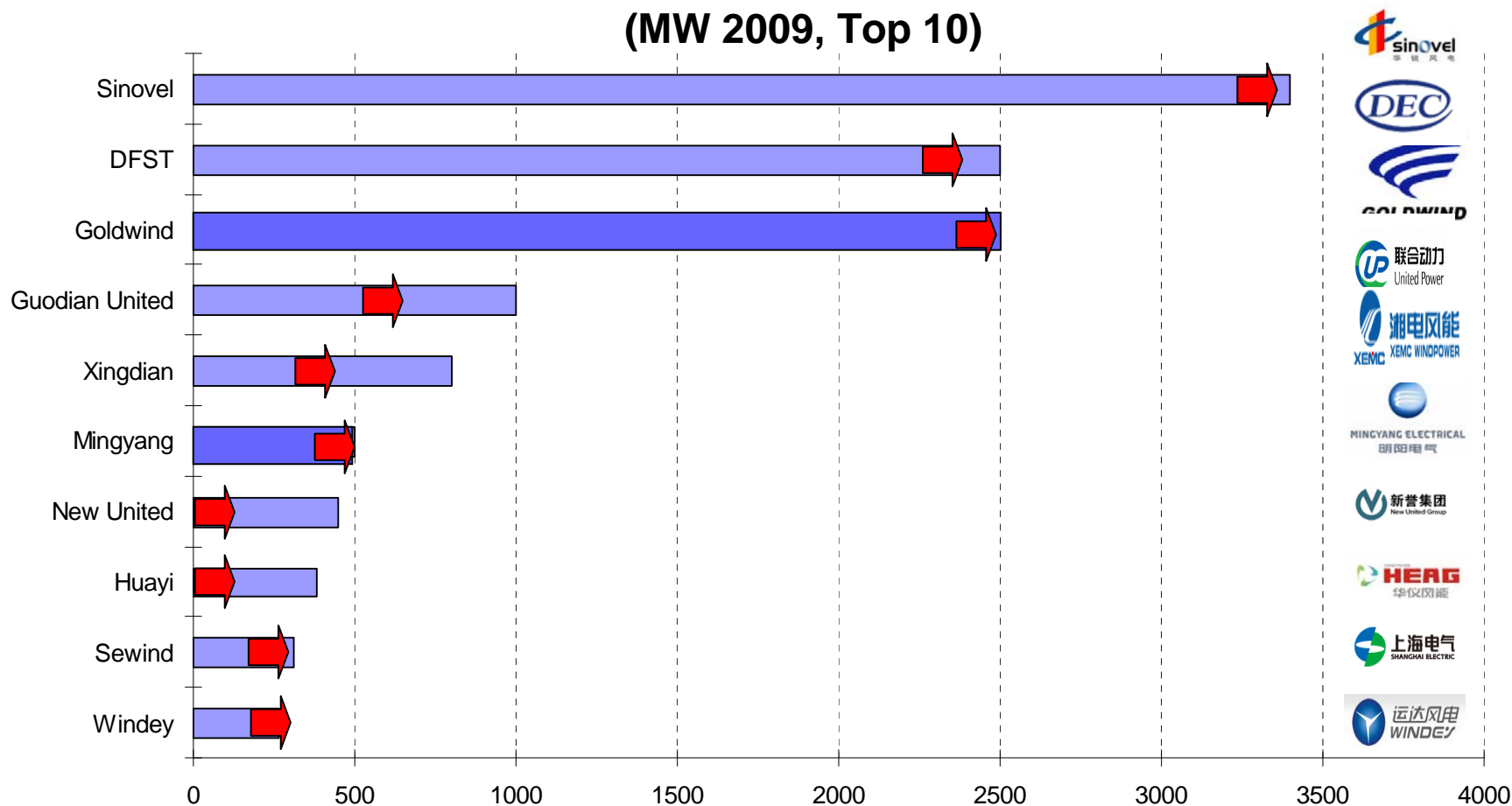
Chinese WTG Exports



Turbines: commercial DD support

- Ready to export: production capacity

Production Capacities of Chinese Turbine Manufacturers (MW 2009, Top 10)

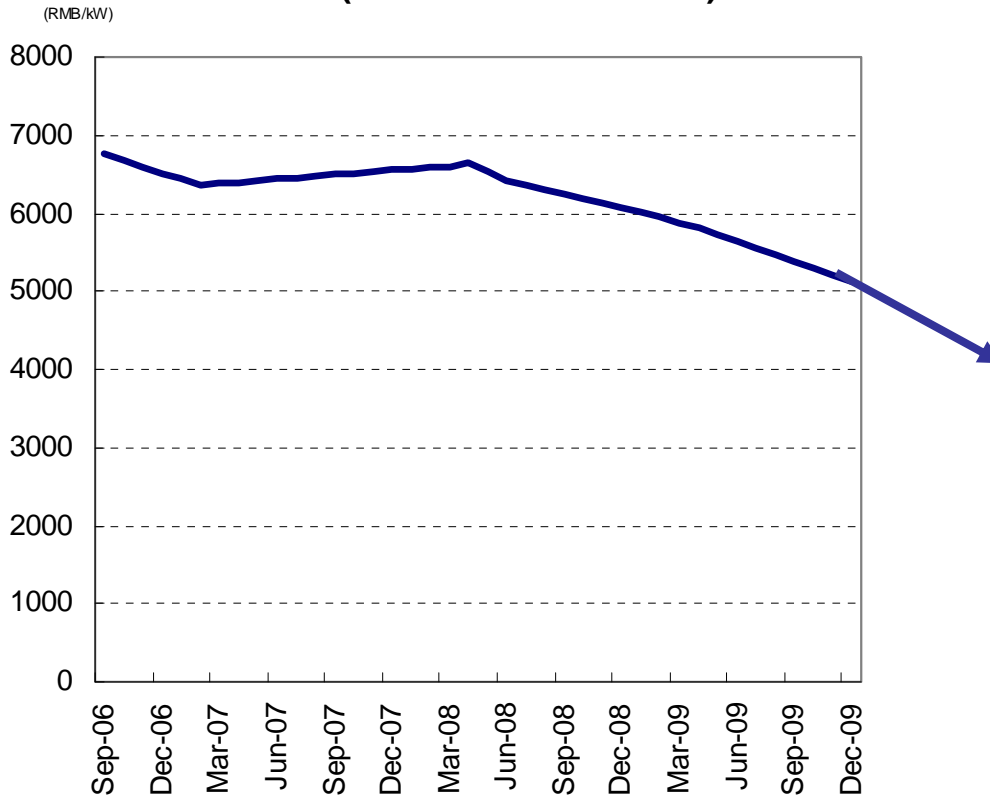


Source: Azure International

Turbines: commercial DD support

- Ready to export: pricing

The price of 1.5MW WTG
(standard conditions)



- Continued expected price declines make Chinese product interesting in export markets
- Value proposition 'deeply discounted capacity with manageable reliability tradeoff'
- But what do you get for your money?

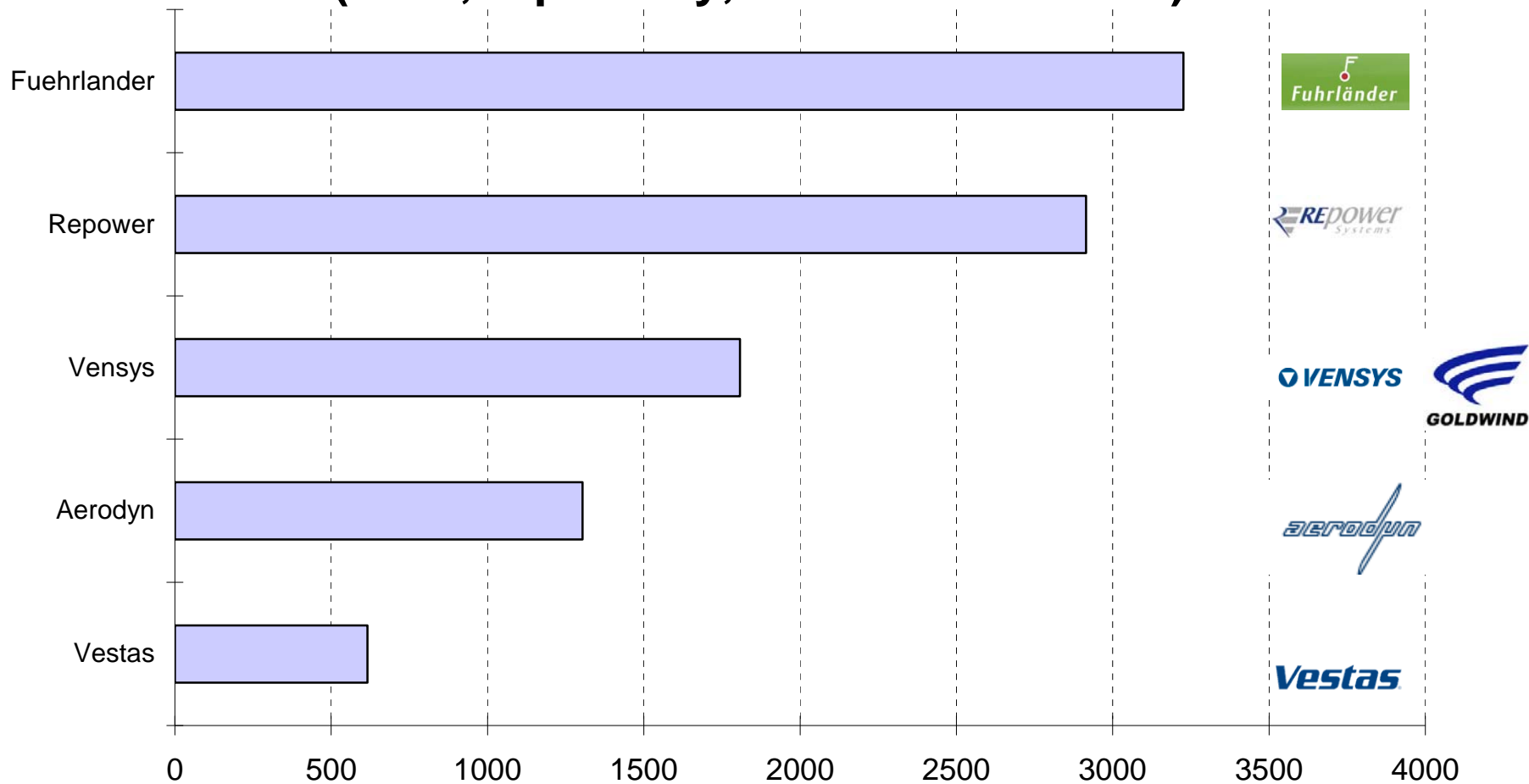
Source: Azure International data



Turbines: commercial DD support

- Ready to export: technology

Installed capacity by technology provider (2009, top 5 only, 80% market share)



Source: Azure International

Turbines: commercial DD support

- Ready to export: certification



Granted:



Applied:

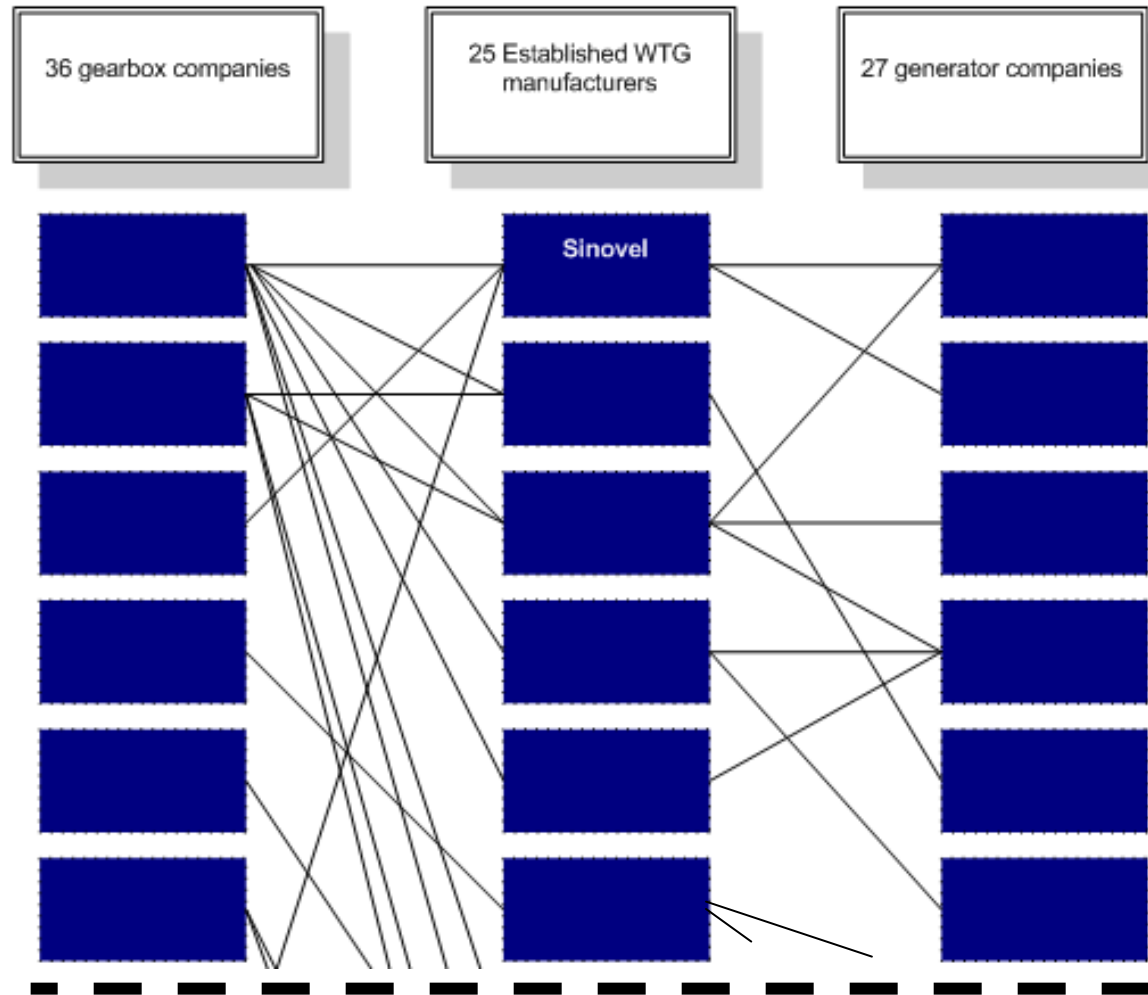


- One example of a leading certifying institution (most prolific for Chinese companies)
- Type certification process starts to be completed for some Chinese turbines
- More in the pipeline from other leading third party certification institutes

Turbines: commercial DD support

- Ready to export: certification

- Numerous suppliers for each main component
- Complicates certification and purchasing specification
- Configuration needs to be understood and evaluated
- Often many options for controller, power electronics, pitch and yaw drives and gear boxes, brakes ect...



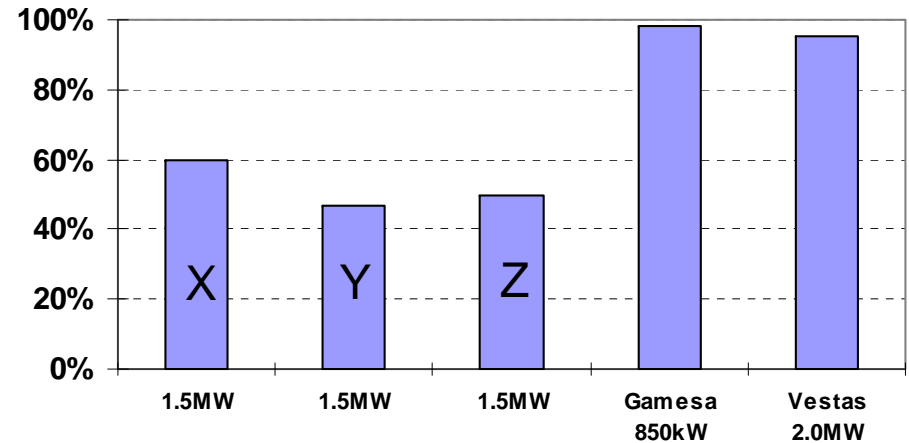


Turbines: commercial DD support

- Ready to export: technology

- Turbines produced in China differ significantly from original designs which usually are certified
- Type certification (GL, DNV, TUV ect...) presently for very few models
- Important for managing/communicating technical risk for export markets
- Design fidelity review a recommended part of procurement DD - Azure International

Design Fidelity - portion of content equivalent to original design (2008)



Source: Azure International

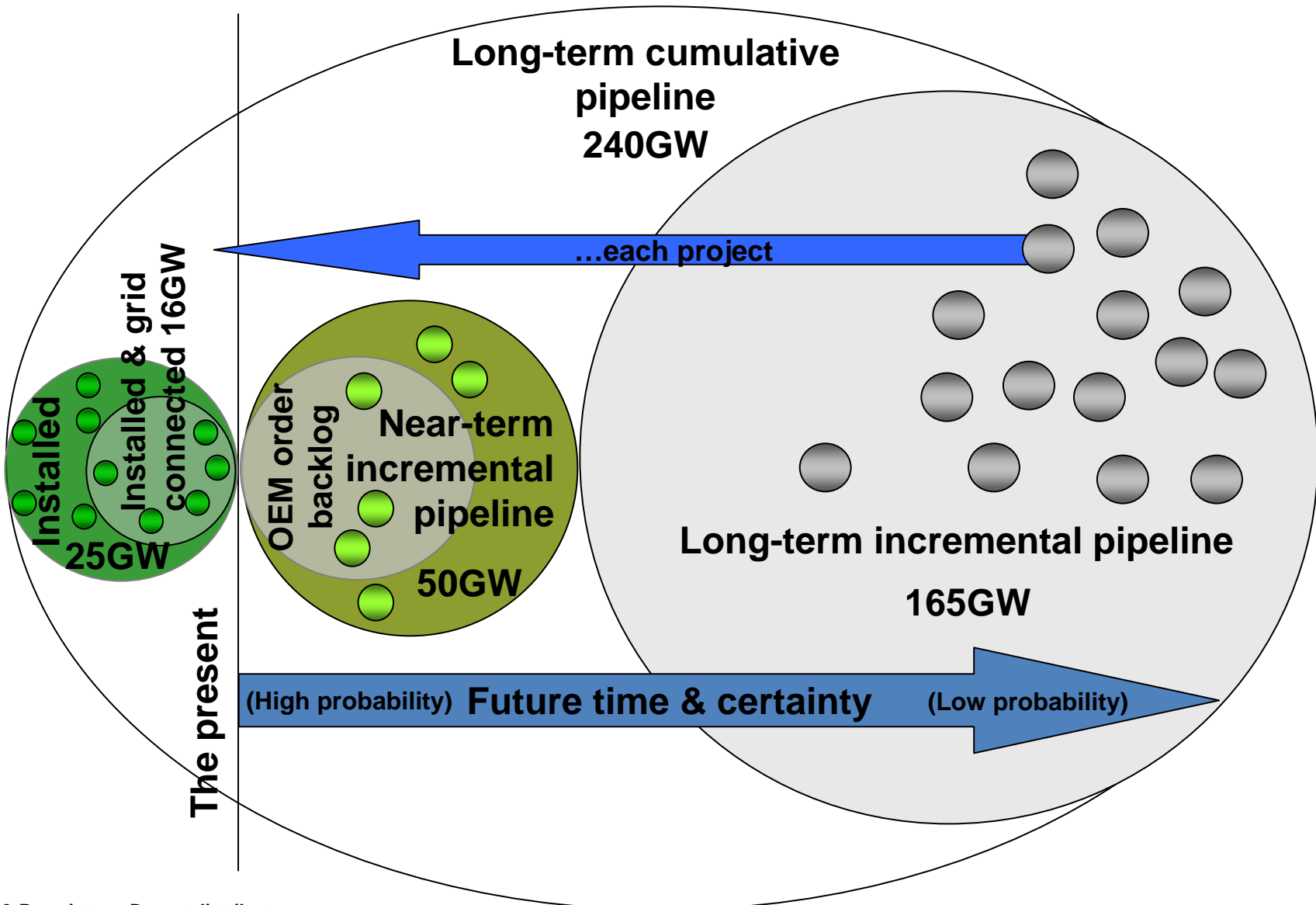
Note: This is a subjective ranking weighting main components for relative value, and for each, deviations from original design documentation by the potential to affect the operational life positively or negatively. Our engineering team is ready to assist you in technical and 'quality' related due diligences and assessments related to wind turbines and the component value chain in China.



Installation outlook – tracking pipeline

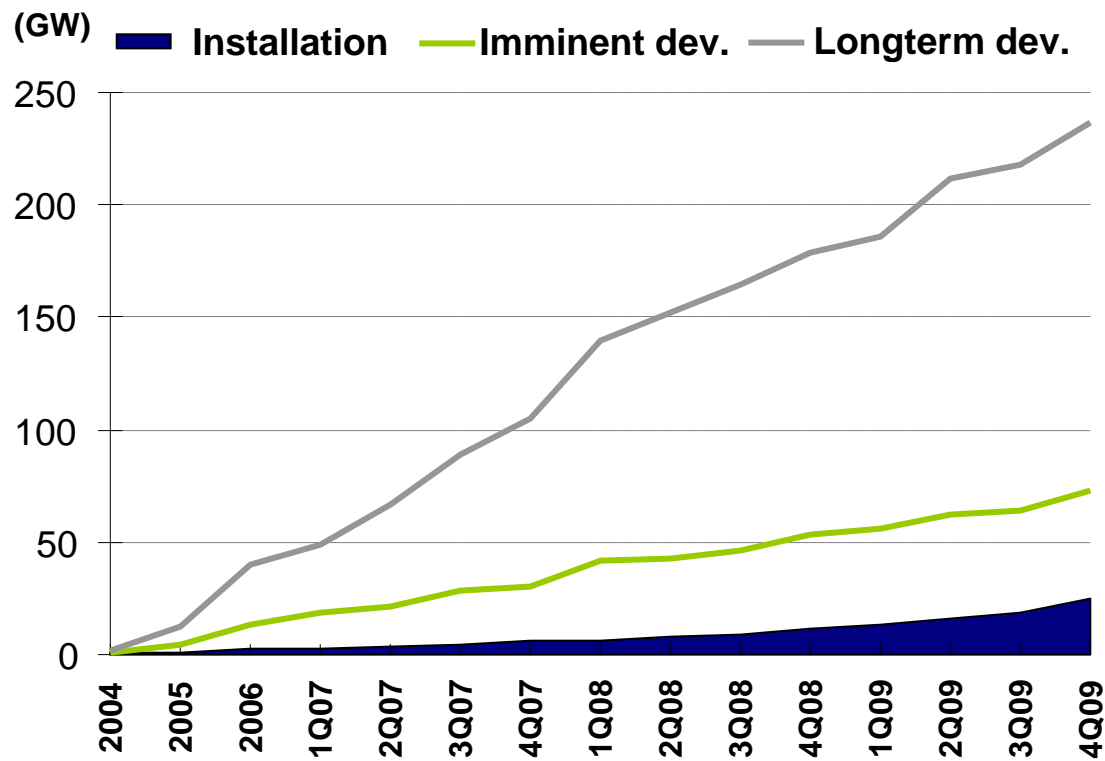
- Basis for bottom-up view

Updated quarterly in full bottom-up detail





Accelerating development activity? Pipeline development



Source: Azure International

According to data known as of 25 Dec 2009

Turbines: commercial DD support

- Ready to export: track record



Date	2010	Mid Term (~2015)	Long Term (~2020)
Target	10GW	-	30GW
Azure	42GW	100GW	240 GW

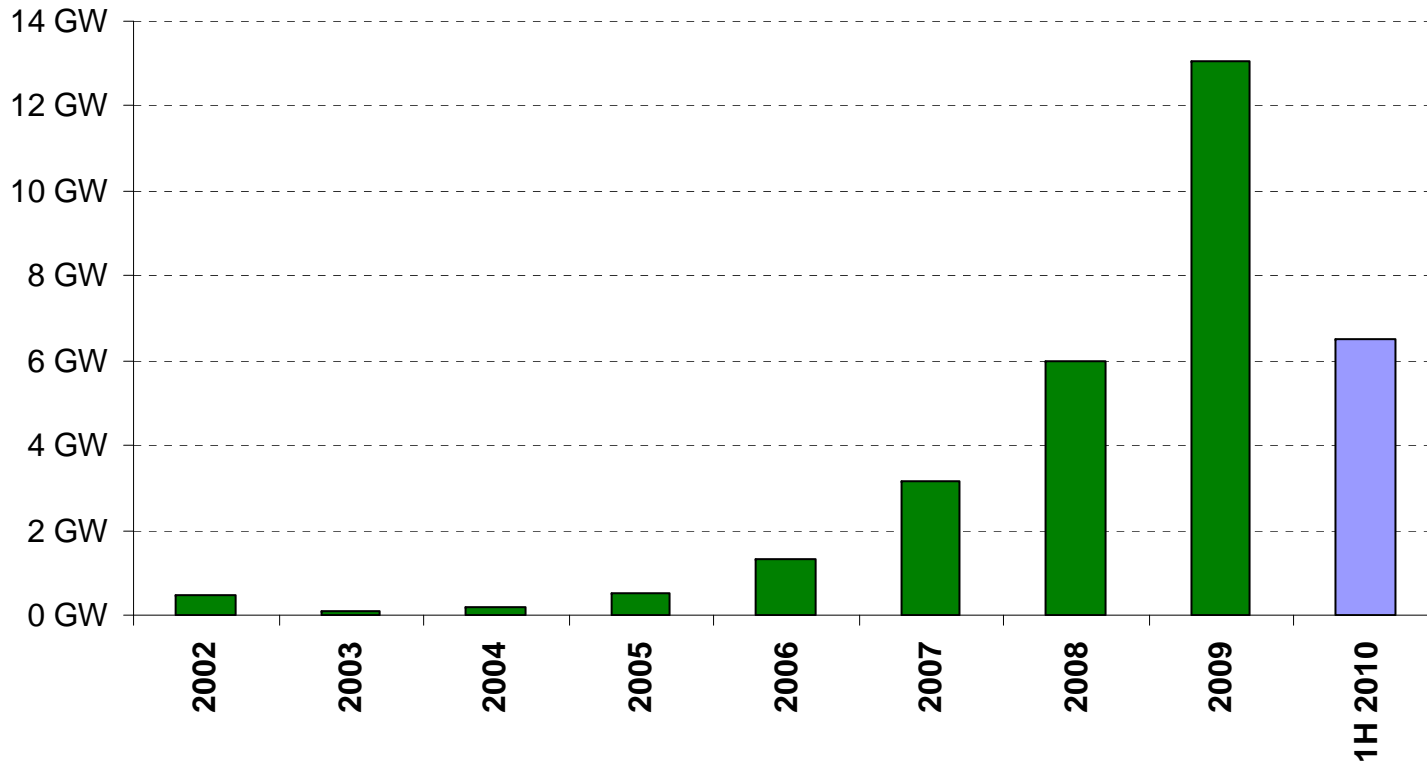
- Past and future order books of manufacturers and component providers
- Past and actual pipeline for all developers
- Enables identification of repeat customers, shifts in buying behavior, niches



Turbines: commercial DD support

- Ready to export: operating history

Industry experience: Installed Capacity, (Annually, GW)

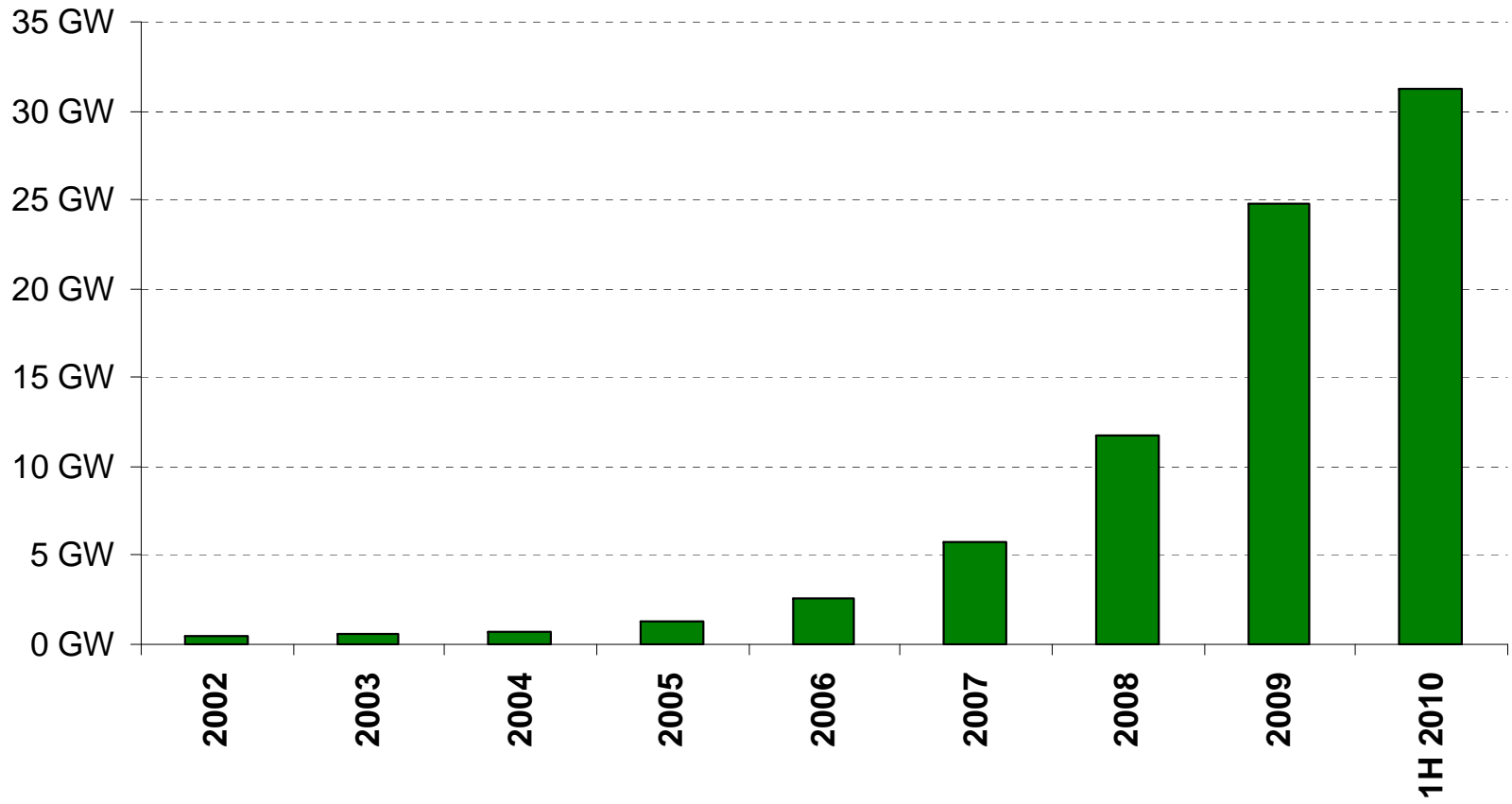




Turbines: commercial DD support

- Ready to export: operating history

Industry experience: Installed Capacity, (Cumulative, GW)

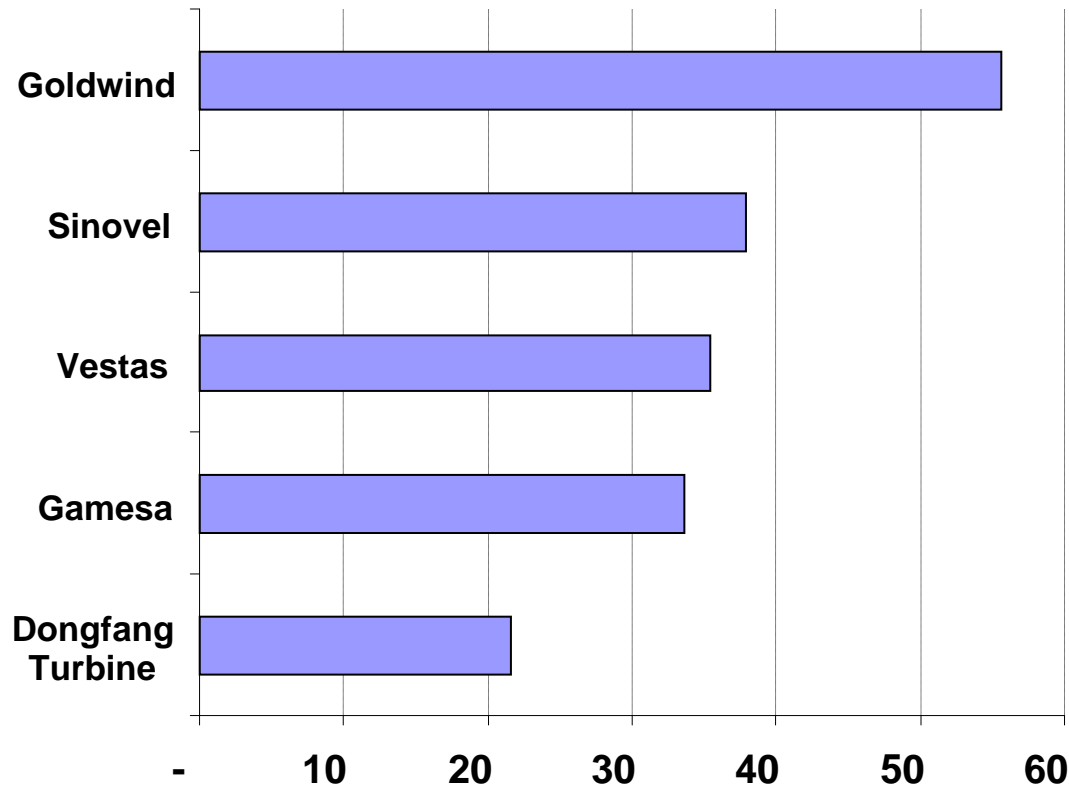




Turbines: commercial DD support

- Ready to export: operating history

Industry experience: TWh Available In China
(to end 2009)



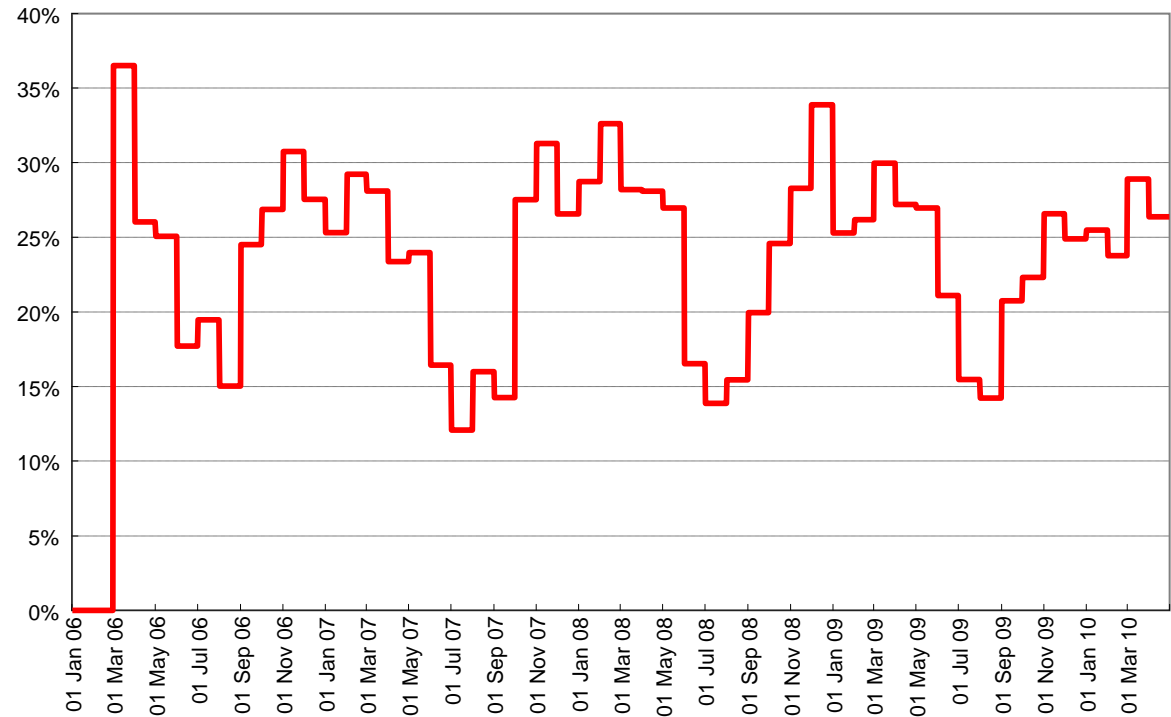


Turbines: commercial DD support

- Ready to export: operating history

- Relatively short operating history
- Azure International data shows turbines are operating reasonably well
- Data set covers 28% of 130TWh theoretically available generation for market ('06-'09) shows net performance of 24%

China wind performance from 2006/1/1 to 2010/4/30



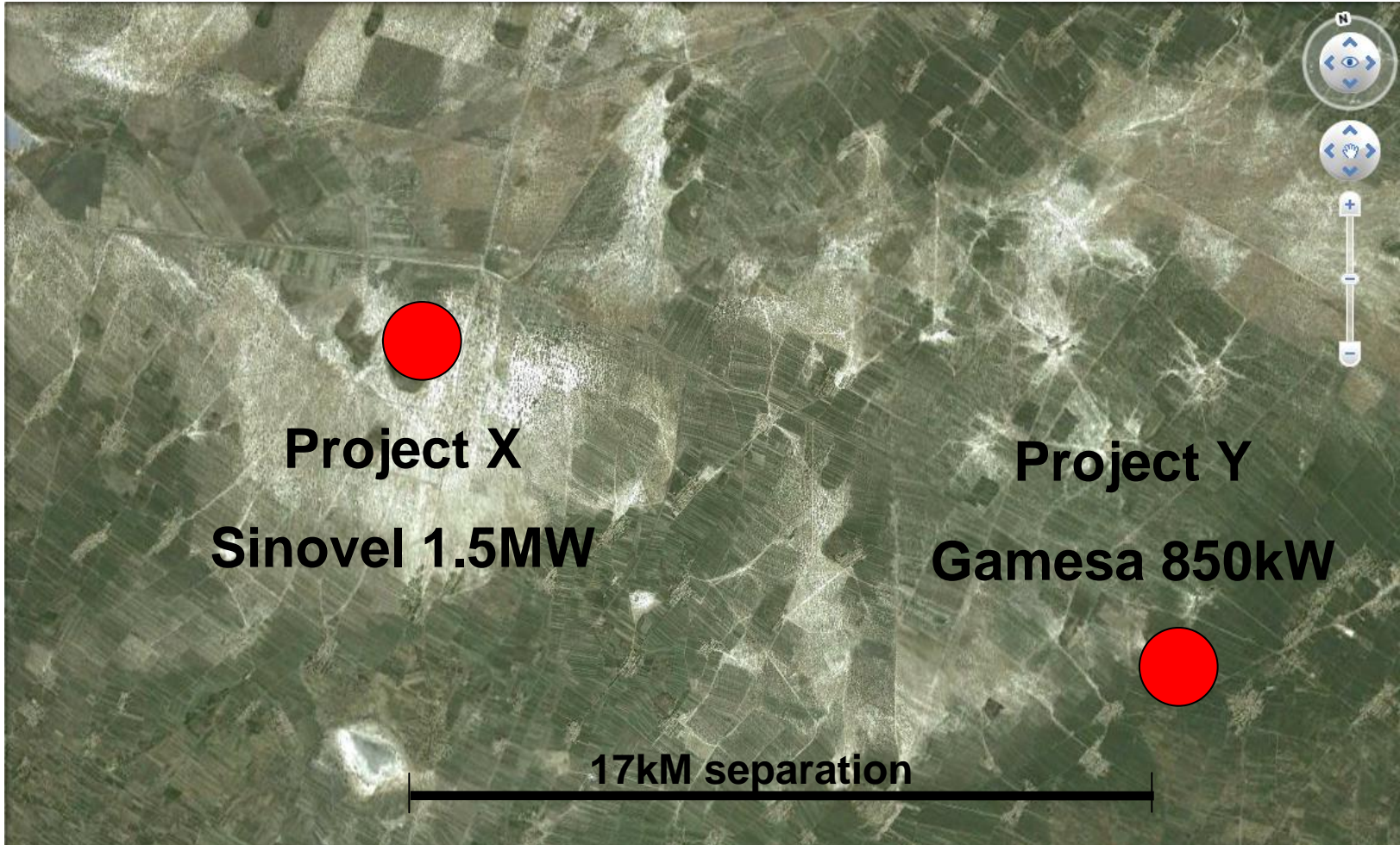
Source: Azure International Data

Can be compared to net results for Germany, where wind resource is lower



Turbines: commercial DD support

- Readying to export: operating example



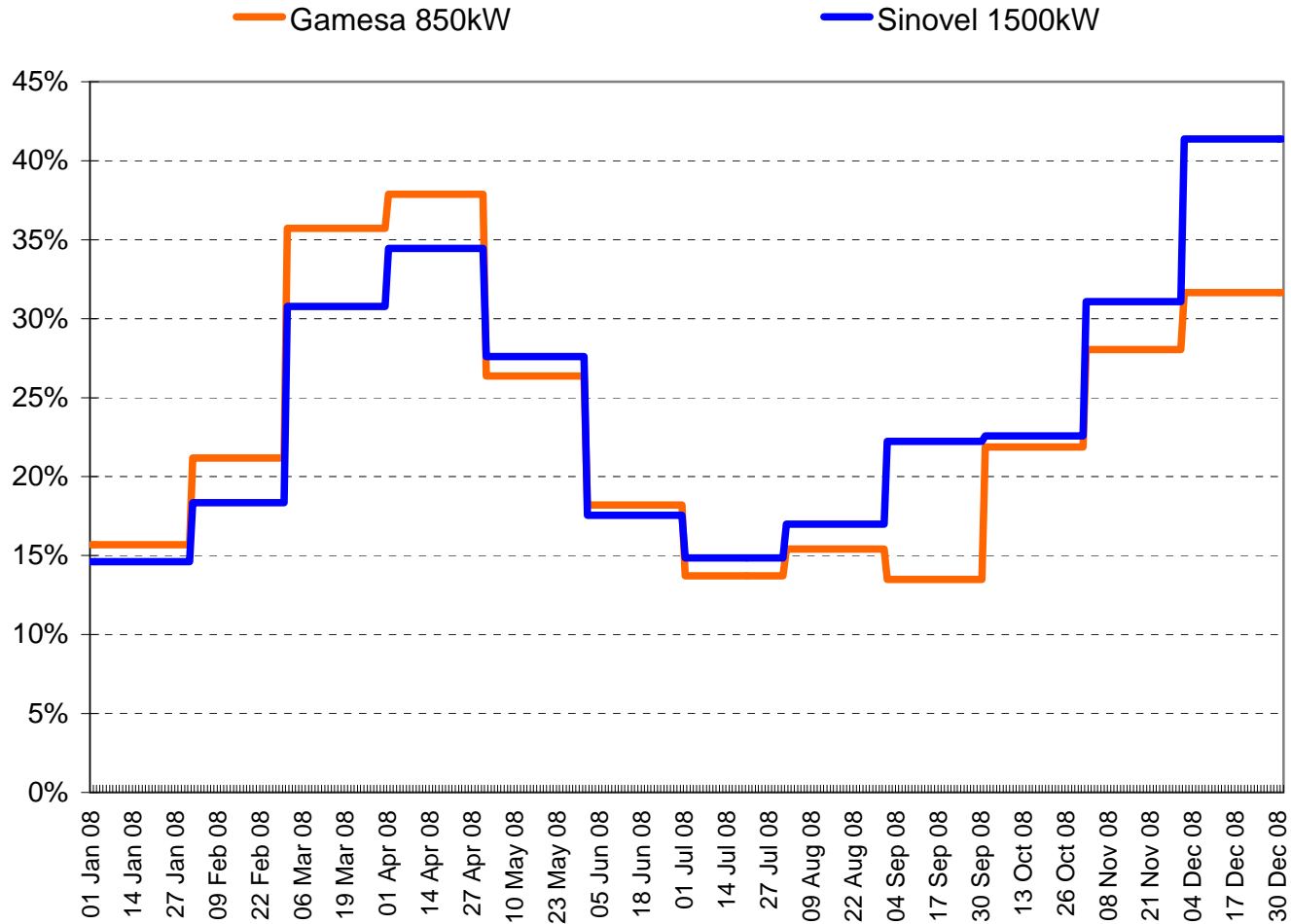
Source: Google Earth, Azure International data



Turbines: commercial DD support

- Ready to export: operating example

Performance comparison from Jan 2008 to Dec 2008



Source: Google Earth, Azure International data



Turbines: commercial DD support

- Ready to export: operating example



Summary score (2008 only)

Technical outcome

Sinovel 1.5MW swept diameter 77m, hub height 70m - IEC class II designation. Net average capacity factor 24%

Gamesa 850 kW swept diameter 58m, hub height 55m, - IEC class II designation. Net average capacity factor 23%

Commercial outcome

Sinovel 1.5MW: 2008 indicative price RMB 6100/kW

Gamesa 850kW: 2008 price RMB 6000/kW

Sinovel 1.7% more expensive, but delivers 4.3% more kWh p.a.

BUT! This is only 1-year of data with project still under operational warranty

The long-term performance including differences in maintenance and part replacement costs will determine the final winner!

Source: Google Earth, Azure International data

Turbines: commercial DD support

- Some recommended technical support

Azure has performed technical due diligence on a number of wind turbines manufactured in China (Goldwind, Sinovel, Dongfang, Suzlon, Changzhou New United, Guoce Nordic...)



DD typically covers review of tech. documents, factory visit to assess manufacturing capabilities, quality and testing procedures, analysis of performance data, risk assessments, finish product inspections etc...

Turbines: commercial DD support

- Some recommended technical support

- RFP preparation and review of proposals (~ 5 OEMS, including score grid to facilitate selection)
- 2nd round due diligence of selected short list suppliers
- Equipment purchase and service contracts review
- Post contracting factory or site inspection
- Site delivery & storage inspections



Turbines: commercial DD support

- Azure can support you with...



- Understanding the Chinese WTG market

- History of Chinese wind developments and introduction to main players

- Identifying suitable WTG manufacturers and partners

- Inputs to business plan: financing strategy, CAPEX and OPEX etc.

- Technical risk management/mitigation

- Counterparty risk analysis/mitigation

- Company background, ownership, history, production facilities

- WTG actual and future models, technology and in-house design capacity, certification, main component supply

- Operating track record, developers using OEMs products in China, Feedback from Chinese developers, assessment of order backlog and production plan

- Current export activity, ability of company to provide/arrange finance or guarantees

- First factory visit with Client

- Review of technical documents

- Assessment of manufacturing capabilities

- Turbine quality related risk analysis

- Analysis of available operation data

- Review of after sales services

- Analysis of hurdles and solutions regarding export

- Logistics and planning

- Contracting support

- Procurement support and management

- Scheduled factory visits and quality inspections

- Site visits to confirm maintenance protocol are implemented appropriately

- Follow-up until turbines are installed to confirm delivery process is completed as specified



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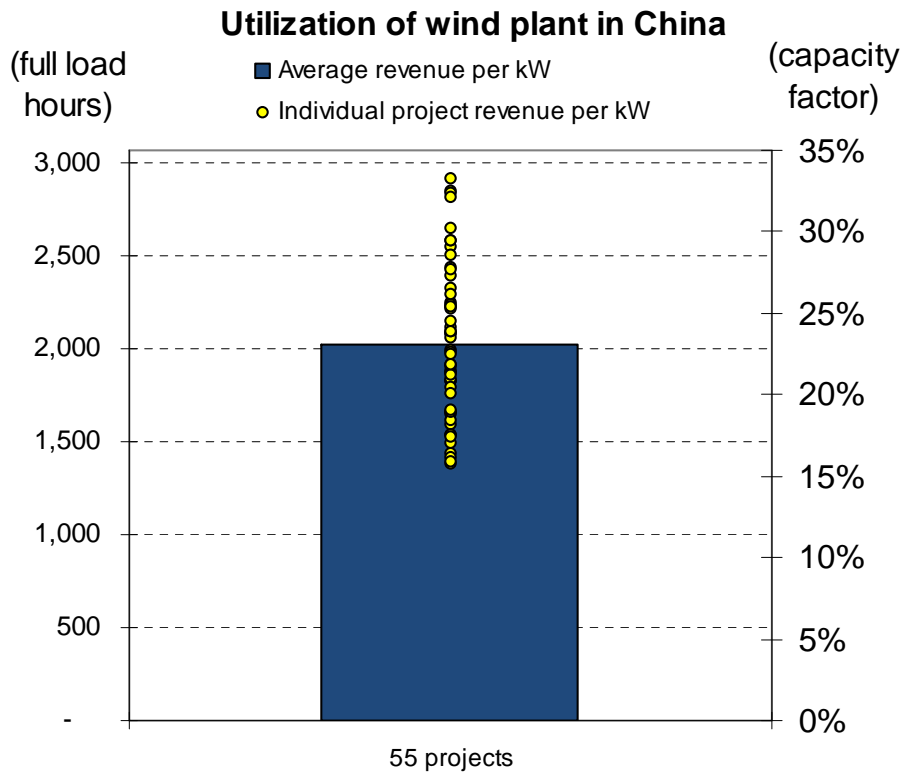
Part (3) Project investment related commercial DD

Part (4) Project investment related technical DD

Projects: commercial DD support

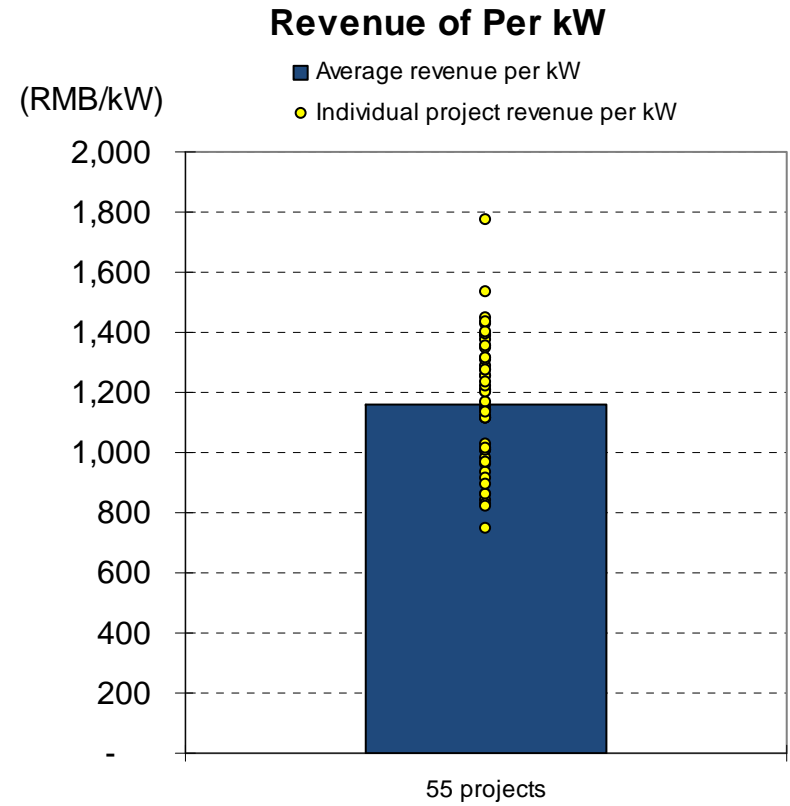
- Peer performance

Technical DD Related



Source: Azure International, UNFCCC

Commercial DD Related



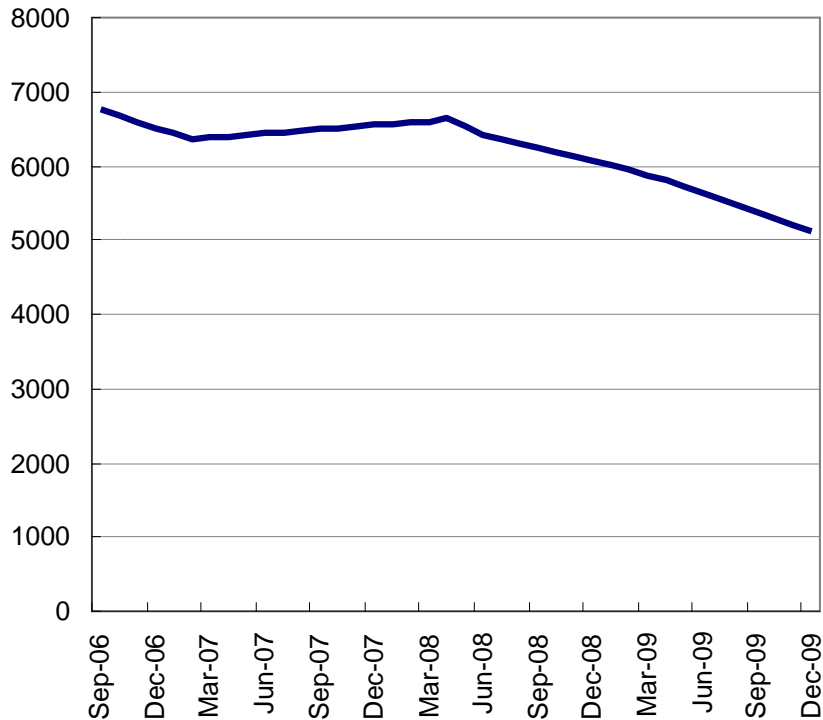
Source: Azure International, UNFCCC

Projects: commercial DD support

- Turbine price & project IRR

The price of 1.5MW WTG

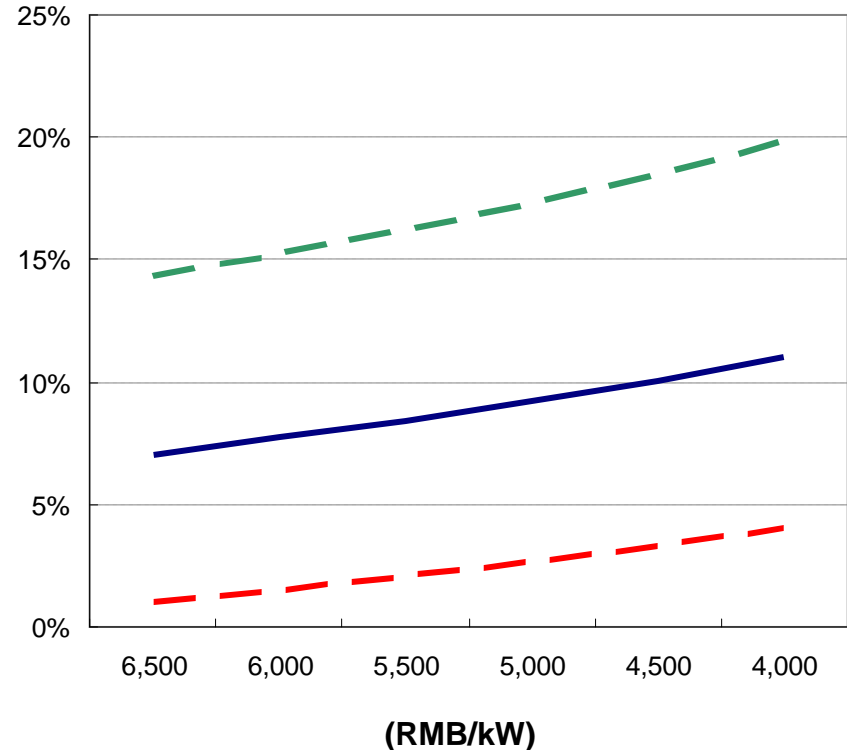
(RMB/kW)



Source: Azure International, UNFCCC

Project IRR and WTG price

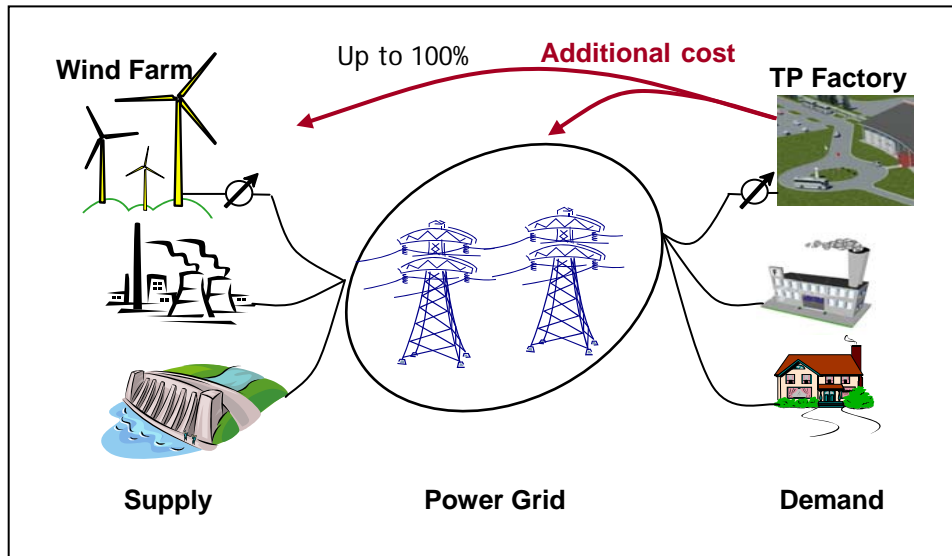
IRR (%)



Projects: commercial DD support

- Understanding grid limitations

- Review of local grid situation
- Interconnect queue
- Balance of plant
- Province-to-province connection & actual traffic
- Planning?





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Part (1) Turbine related commercial DD

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Projects: technical DD support

- example project in IMAR

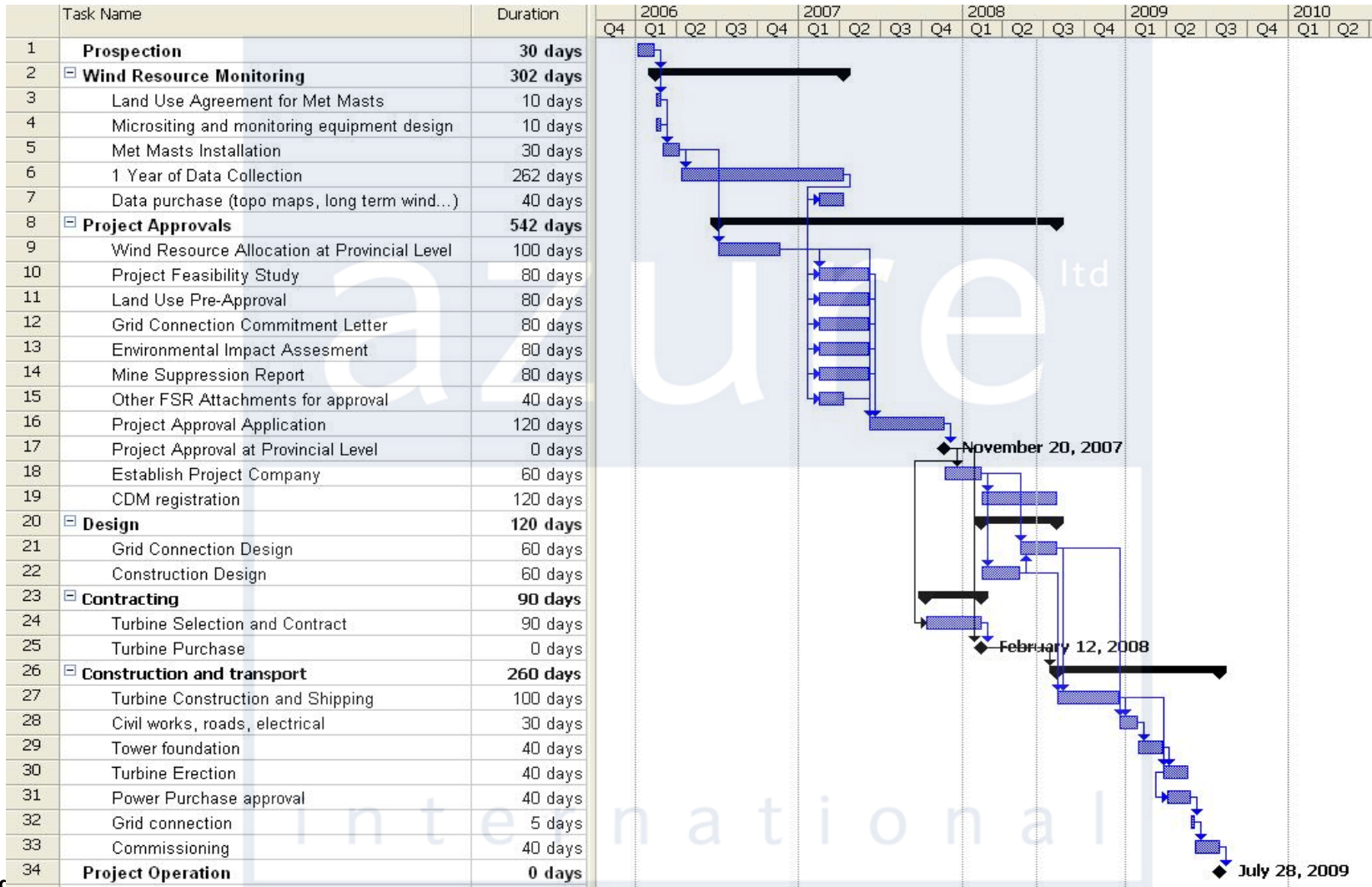
- First phase 50MW under development. Total capacity 1200MW.
- 3 70m met masts, 2 years data
- Wind resource analysis, turbine selection, energy production calculation, financial appraisal
- Development from 'greenfield' to first phase permits, dealing with local government officials and technical design institutes



Projects: technical DD support

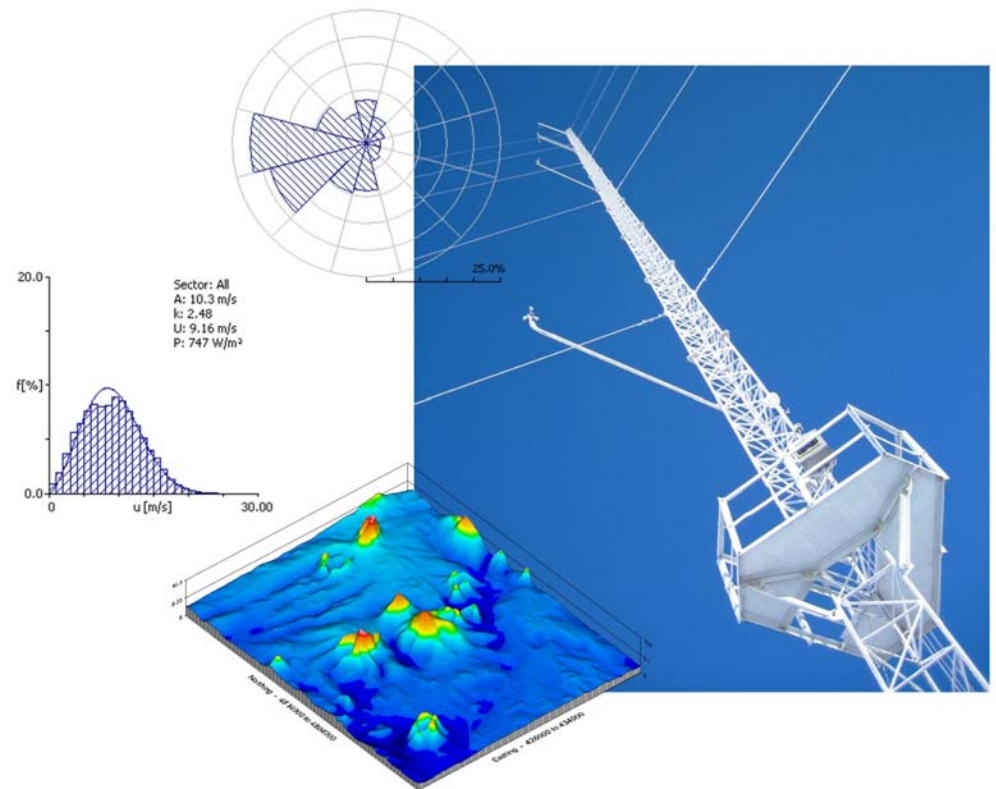
- example project in IMAR

Azure was responsible for tasks 1 to 25



Projects: technical DD support - example project in Heilongjiang

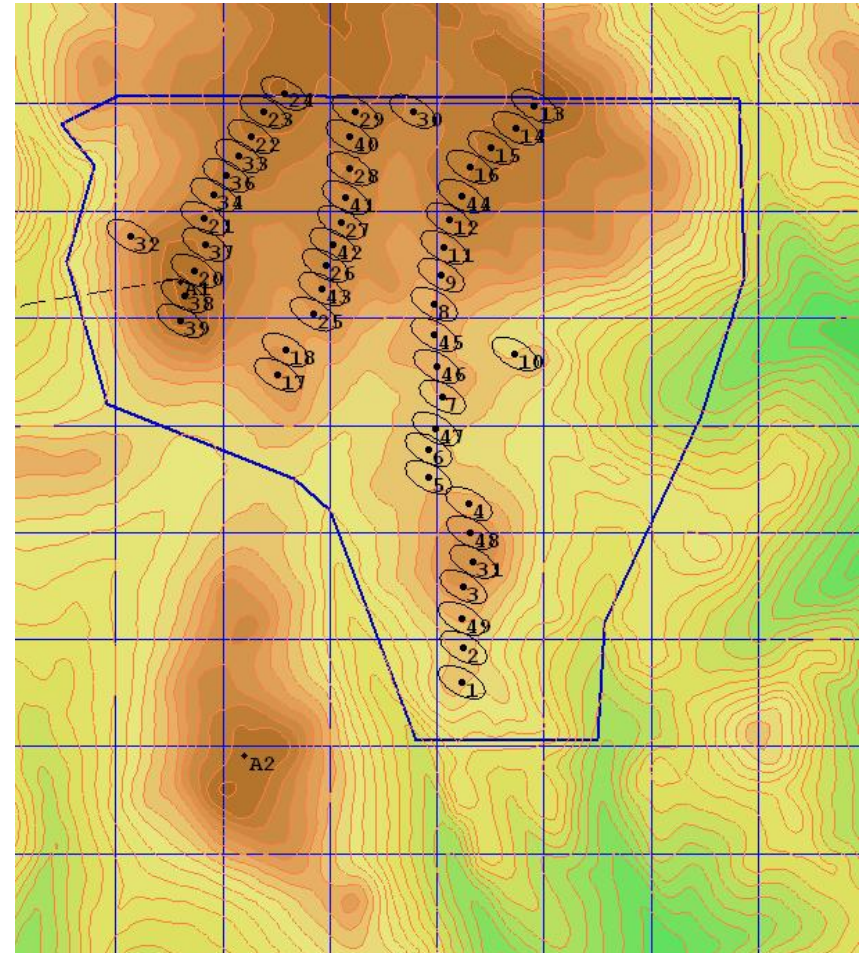
- Met mast design, micrositing, installation, maintenance
- Wind data collection and verification
- Scheduled quarterly reporting and final AEP and financial appraisal report
- Support on first steps development and permitting work



Projects: technical DD supporting valuation

- example portfolio/pipeline review

- Assessed projects in Inner Mongolia, Heilongjiang, Shandong, Hainan, Gansu, Xinjiang
- Site, substation, met station visits
- Data collection, correction and analysis, project energy production calculation
- Financial modeling, potential upsides review, permits and local relationship appraisal and recommendations on technical aspects of JV negotiations and next development steps
- On going development

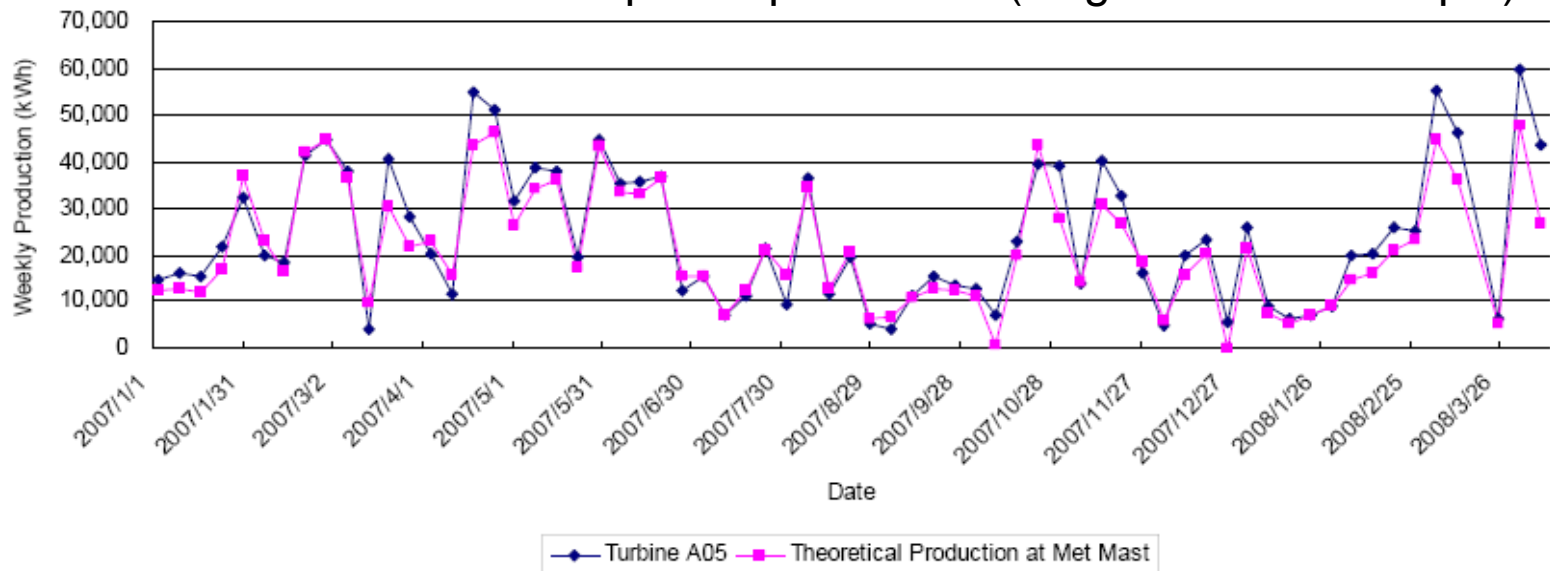


Projects: technical DD supporting valuation

- example portfolio/pipeline review

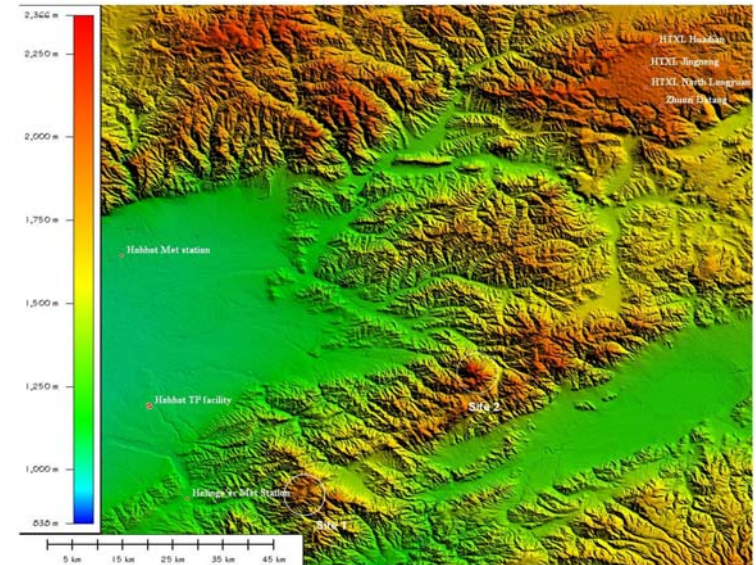
- Third party independent DD of 'Company B' 3 GW wind portfolio
- Appraisal of wind resource assessments
- Review of turbine contracts and turbine suitability and reliability
- Analysis of wind farm operation data
- Confirmation / rectification of financial assumption for forecasting future financial

Calculated vs. actual power production (single turbine example)



Projects: technical DD feasibility analysis - wind and solar for Tetrapak factory

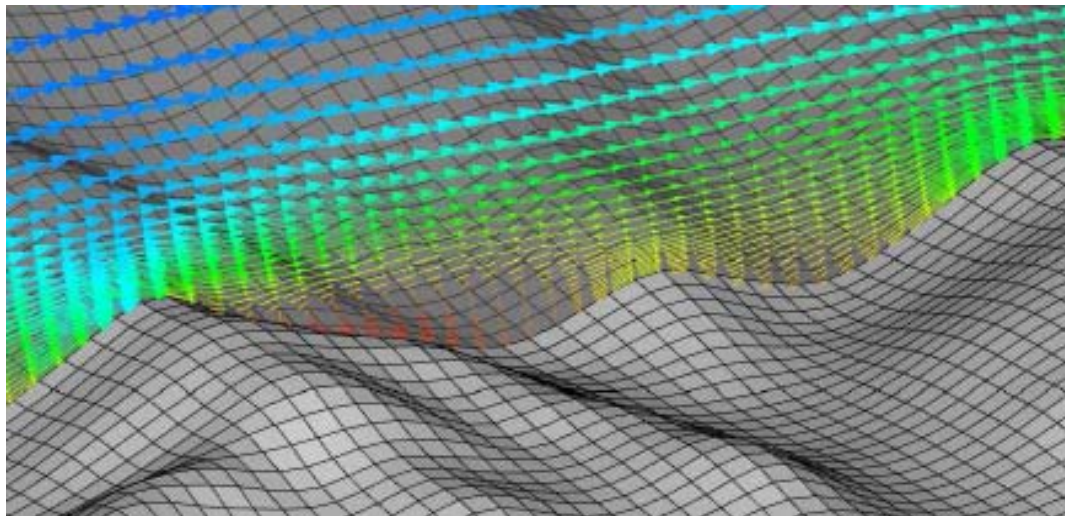
- Renewable energy supply options for a factory in Inner Mongolia
- Technical, environmental and financial modelling and feasibility of available options
- Options considered included: solar, on site wind, nearby wind, purchase of electricity from existing wind farms, implementation of a green electricity trading system in Inner Mongolia



Projects: technical DD support

- example project in Heilongjiang

- Participation in expert review of complex topography CFD based wind resource assessment and micrositing. The study was performed by Meteodyn with the Meteodyn WT software for a large state owned Chinese utility company. Aim of the review was to approve the micrositing.
- Review of more than 20 Feasibility Studies compiled by Chinese Design Institutes



Supporting wind investors in China

- Strategy, prospection, assessment, development



- Market and policy research and analysis

- Implementation strategy / business plan

- Prospection of wind farm acquisition / investment opportunities

- Flash assessments, early rejection of unsuitable projects

- Target company due diligence

- Wind farm permit due diligence

- Wind resource and energy yield assessment
Wind turbine technology and assessment and associated risk analysis

- Wind turbine due diligence

- Grid connection assessment based on local wind and grid development plans

- Final recommendation for investment decision

- Wind farm acquisition / JV contract negotiation support

- Setting up China dedicated team / company

- Wind farm development support

- Securing remaining approvals and contracting engineering companies

- WTG procurement support, purchase agreement negotiations

- WTG quality, storage, delivery control and inspection

- Wind farm O&M team structure and logistic advisory

This report addresses the following questions among many others:

- Add some defensible rational caution to the buy-side investment strategy
- Understand critical governance issues that will affect the company in the long-run
- How does the market share differ from what the management says, and how is it developing quarterly?
- How does CDM affect Longyuan's profit margins?

Azure International - Longyuan Report Table of Contents

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- How do new VAT accounting rules affect the company?
- What about regional exposure to hotspots like Inner Mongolia within the overall pipeline?

This report addresses the following questions among many others:

- Which Chinese wind turbines are more likely to export successfully?
- What is the history, technology, track record of these OEMS
- What developers are using the turbines and what is their feedback
- Approach to exploiting Chinese financial support depending on company situation

Azure International - Evaluating Chinese OEMS readying for export (~10 OEMs)

- Indicative table of contents

0.0	Executive summary
1.0	Introduction
2.0	Industry background
3.0	Manufacturer ranking based on installation and indicative generation
4.0	For a selected number of Chinese WTG OEMs credibly angling towards export, analysis on:
4.1	Company summary
4.2	Company background and ownership structure
4.3	History in the wind industry
4.4	Production facilities (capacity and location)
4.5	Technology and in-house design capacity
4.6	Assessment of counterpart risk
4.7	WTG models currently offered in China
4.8	Future models in development
4.9	Track record of wind turbine models
4.10	Component supply
4.11	Production facilities preliminary technical assessment
4.12	Developers using WTGs in China
4.13	Feedback from Chinese developers
4.14	Order book and production plans
4.15	Current export activity
4.16	Ability of manufacturer to bring financing from China

Simplified report

Complete report

- What does available operational data tell us about the turbines
- Understand group and parent company relationships
- Start to unravel counterparty risk and develop an opinion
- +100 pages of facts and analysis

This report addresses the following questions among many others:

- How does the IMAR government interact with the IMAR Grid (west)?
- How does wind power fit within the overall development of a power industry in IMAR?
- How do fluctuations in base-load vs. seasonal wind output interact at the local nodes within the IMAR grid that are relevant to your project?

Azure International - IMAR Grid & Wind Report

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- How much more wind power can IMAR physically develop in the near future?
- What is overall generation vs power exports from IMAR, now and in the future?

Other reports available:

- A) Wind Development Bottom-Up (updated quarterly)
- B) Wind Turbine Manufacture Bottom-Up (updated quarterly)
- C) Wind Gearboxes Bottom-Up (updated annually)
- D) Large Castings Bottom-Up (updated annually)
- E) Blades Bottom-Up (updated annually)
- F) China Offshore Industry: Sponsored by WWF Norway, and available at:
http://assets.wwf.no/downloads/china_norway_offshore_wind_final_wwf_march_2010.pdf

Bespoke assignments (suggestions/examples):

- Market segments, new products, competitor analysis, policy & market analysis
- Customer, partner, strategic buyer identification
- Project pipeline identification/acquisition (China, Australia, USA, Europe)
- Turbine and component quality due diligences, procurement support
- Investment related commercial and technical due diligences
- Wind measurement, project design, micro-siting, turbine selection
- Permitting & approvals, company structuring & setup
- Energy strategy: carbon foot-printing and emissions optimization & offset

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