



**Azure International
Technology & Development (Beijing) Limited**

**WTG Production and Installation volumes in China
during 2008 - 2011
- Chinese WTG industry to impact global market?**

**Sebastian Meyer
Director, Research & Advisory**

**Presented at Global Wind Power 2008
30 October 2008**



Azure International

- About us

- **A specialized advisory and investment firm dedicated to the commercialization of clean, sustainable energy technologies that are commercially viable and have significant market potential in China**
 - **“Tracker” and advisory services covering market intelligence and commercial/financial due diligence in the China wind industry including project development and WTG and component manufacturing.**
 - **Bespoke consulting services covering industry research, market intelligence, due diligence, industry monitoring.**

- **Developer of sustainable energy projects in China, with focus on wind, biofuels, waste to energy and coal gasification**
 - **Management capacity in engineering, energy development, project management, marketing & PR, strategic planning, knowledge transfer, domestic and international project and equity finance**
 - **Broad experience within the energy industry, with a focus on new, cleaner energy technologies**
 - **Hands-on knowledge and extensive professional experience in the Chinese, European and North American markets**

Presentation overview

Will the domestic Chinese wind market to affect the global WTG market? – Update Oct 2008

- **Demand**
 - **Activity update**
 - **Economy / Power Sector & RPS**
 - **Operating track record**
 - **Supply**
- **Analysis**
- **Conclusion**

Demand – the domestic market

- Development activity update (1H 2008)

7.9 GW installed (as at end June 2008)

1H08 installed 2GW vs. 1H07 960MW ↑ 113%

~ 232 “projects” operating

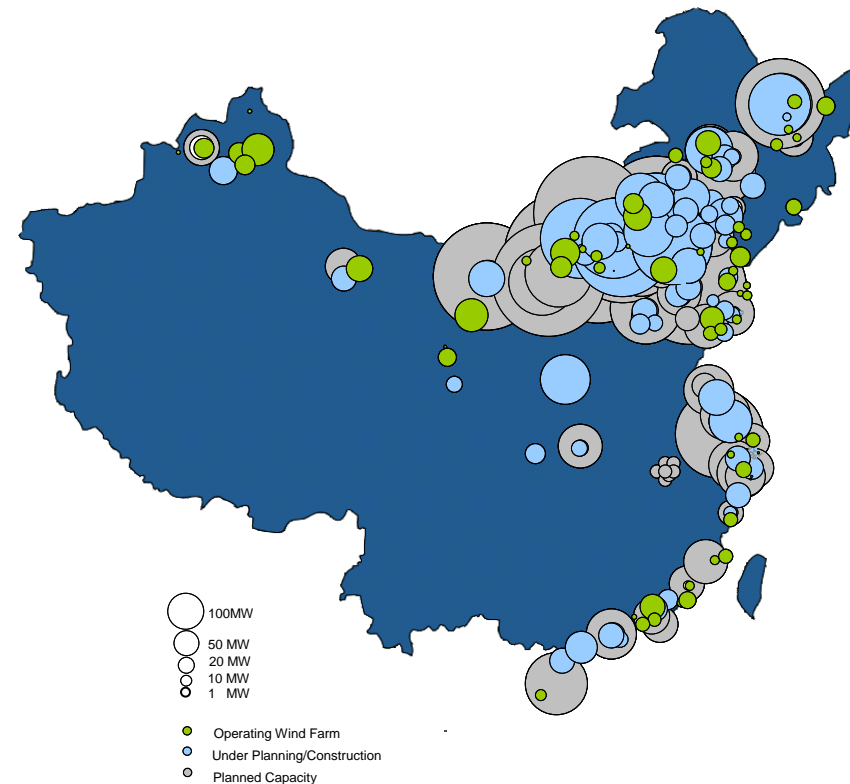
~ 255 sites with 19 GW of orders outstanding

~ 513 sites represent 35 GW of “imminent dev”

~319 active project dev Cos.

~ 30 parent Cos. represent 90% project installations and turbine orders as of 2007

Accelerating development activity



Source: Azure International
Note: Activity summary as at 1H 2006

Demand – Companies with pipeline

- Led by the SOE gencos

- Sector participation led by energy related SOEs motivated by RPS
- Competition, not just by companies but by types of companies will be good for the long-term development of the sector
- International (5%) and private domestic (7%) of existing equity weighted interests, but as much as 20% each of long-term potential pipeline

Leading wind players according to development activity

Leading developers: Ranking by development activity

Equity weighted cap		Equity weighted cap		Equity weighted cap		Equity weighted cap & orders		Equity weighted near-term development (2008–2012)	
Co.	YE2006 (MW)	Co.	YE2007 (MW)	Co.	1H2008 (MW)	Co.	(MW)	Co.	(MW)
1 Longyuan	700	Longyuan	1,375	Longyuan	1,645	Longyuan	3,306	Longyuan	5,036
2 State Grid	366	Datang	578	Datang	1,096	Huaneng	2,658	Datang	3,498
3 Datang	316	State Grid	541	State Grid	632	Datang	2,655	Huaneng	3,366
4 Ningxia Power	157	Shenhua	487	Shenhua	623	Huadian	1,938	Huadian	2,488
5 CECIC	129	Huaneng	380	Huaneng	464	Shenhua	1,639	Shenhua	2,127
6 Shenhua	124	Ningxia Power	289	Ningxia Power	331	Guangdong Nuclear	1,363	CPI	1,933
7 Huaneng	104	Huadian	239	CECIC	296	CPI	1,210	Guangdong Nuclear	1,883
8 Guangdong Yudean	100	CECIC	173	Huadian	231	State Grid	1,196	Shandong Luneng	1,479
9 HLJ Huafu	71	Beijing Energy Investment	153	CPI	194	Beijing Energy Investment	1,060	State Grid	1,429
10 HK Construction	58	Shandong Luneng	135	Beijing Energy Investment	188	CECIC	794	Beijing Energy Investment	1,210
	2,125		4,348		5,701		17,819		24,449
	80%		73%		72%		66%		70%

According to known data as at 18 Oct 2008

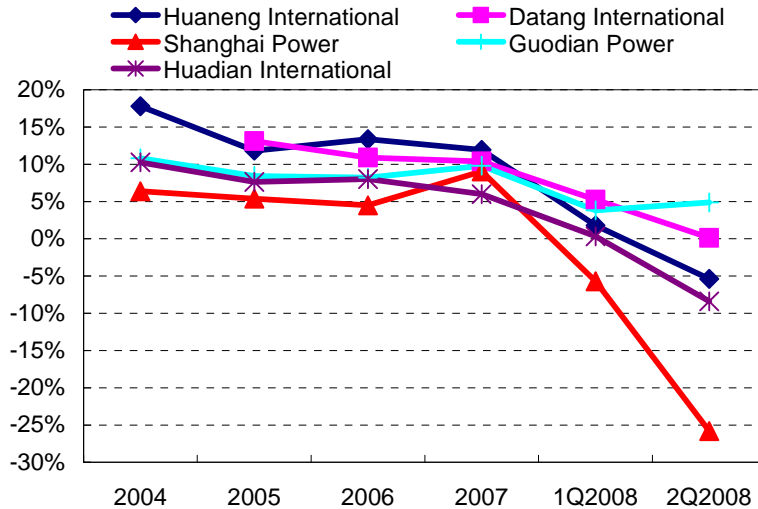
Source: Azure International

Note: Big 5 +1 domestic power producers highlighted in yellow

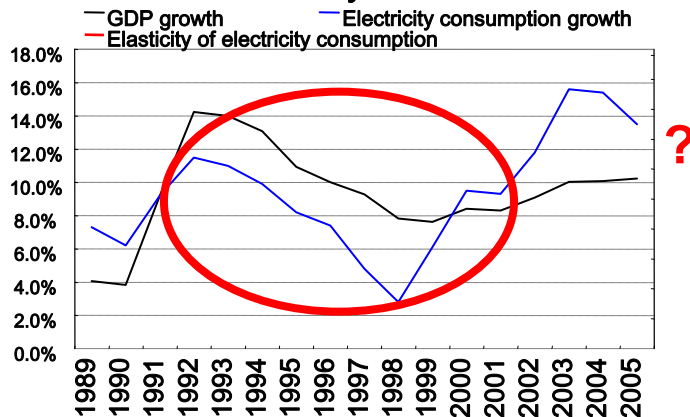
Difficult times in power generation

- Equity capital could become more scarce

Net margins of listed subsidiaries of Big 5



Electricity & GDP



Big 5 net loss in 1Q 2008, RMB 2 billion lost- SERC

Big 5 net loss in 1-3Q 2008, RMB 50 billion - rumor

Coal cost increases over '06-07 only limited pass through to power prices in July (5%) and August (5%) 2008

Less capital to invest; if no profit still can reinvest cash, but long term cannot sustain growth levels

Post 30,000 hours where will power price be? (+/- 1~2% project IRR)

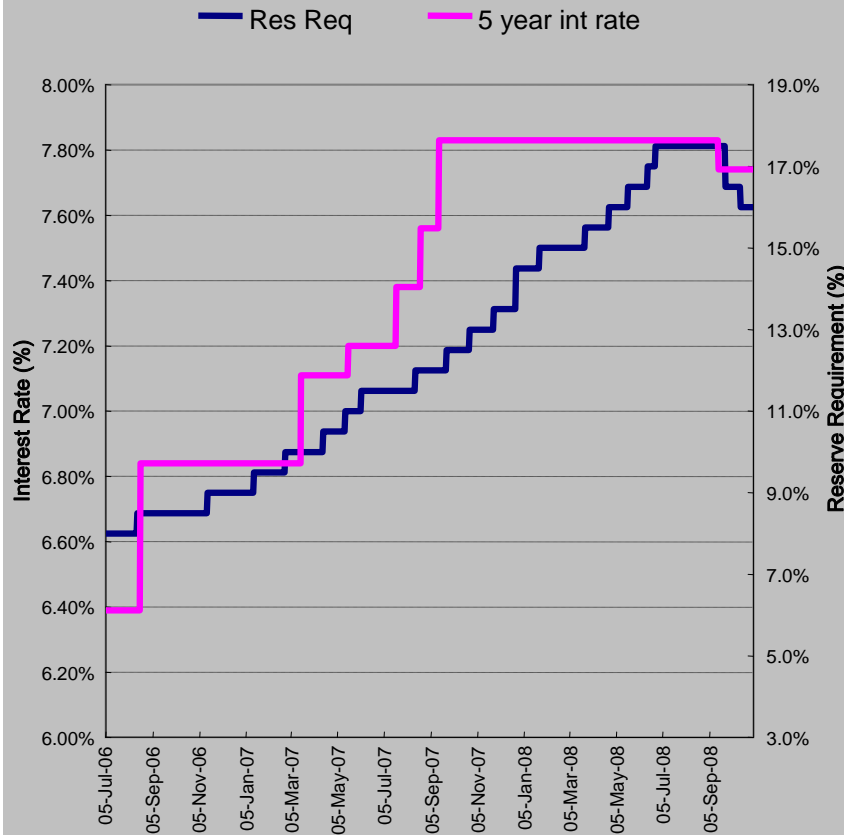
E=1.2: Post Asian Crisis China power demand declined more than overall economy slowdown; Economy now more energy intensive

Source: Shanghai Exchange; Zhongtai; Azure international

Macro economy measures

- Debt capital drying up and more expensive

Reserve Ratios & Interest Rates



Chinese financial sector remains fairly insulated to global crisis

Macro controls aimed at slowing growth are now being reversed to beef-up the economy.

Each 0.5% change in loan reserve rate ties-up or frees some RMB 200Bn

Lending environment remains relatively restricted which could slow investment in wind because...

Most wind projects (SOE) financed up to 80% by on balance sheet debt

Compared to thermal power, wind projects are more sensitive to long-term interest rates

Some regional subsidiaries of State-owned Commercial Banks have been prevented from disbursing approved loans

Demand - RPS powerful driver of sector

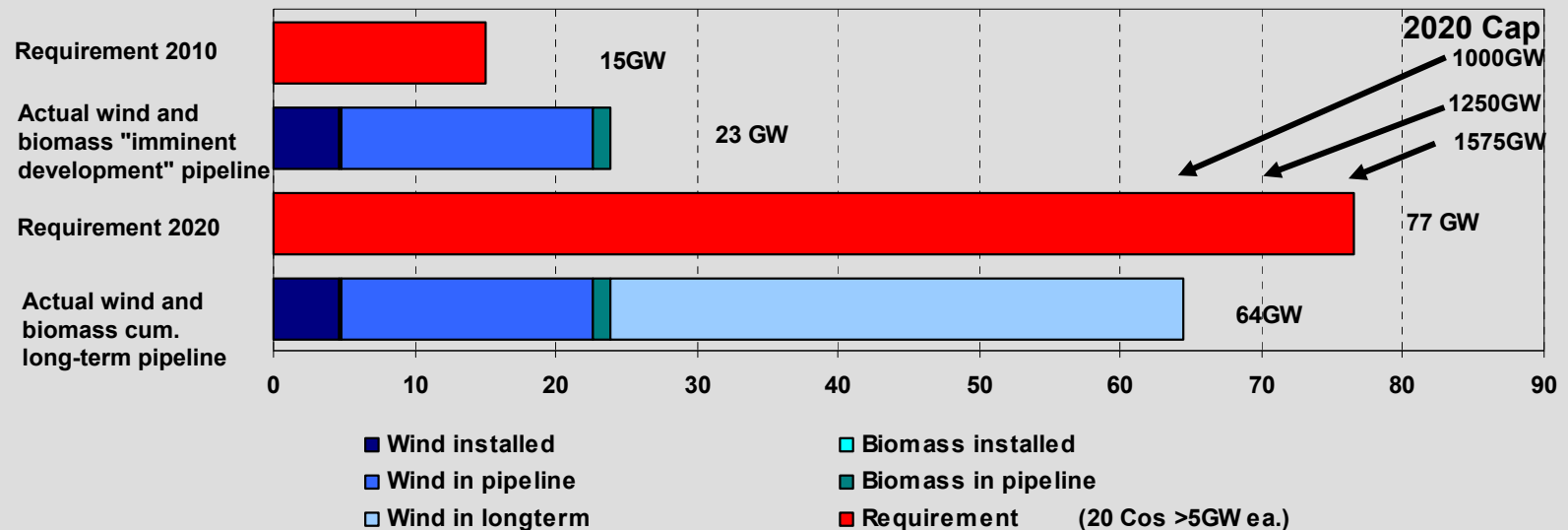
- What if power sector growth slows?

un-precedented thermal/hydro cap. Expansion (+100GW in 2007 alone / cum cap forecast at 1,575 GW by 2020*)

2010F overall power gen capacity 840GW at 3% implies 25GW of non-hydro renewables; with 60% cap from companies >5GW = 15GW mandated by 2010

2020F overall power gen capacity 1250GW at 8% implies 100GW of non-hydro renewables; with 60% cap from companies >5GW = 60GW mandated by 2020

RPS Implied Cap Target

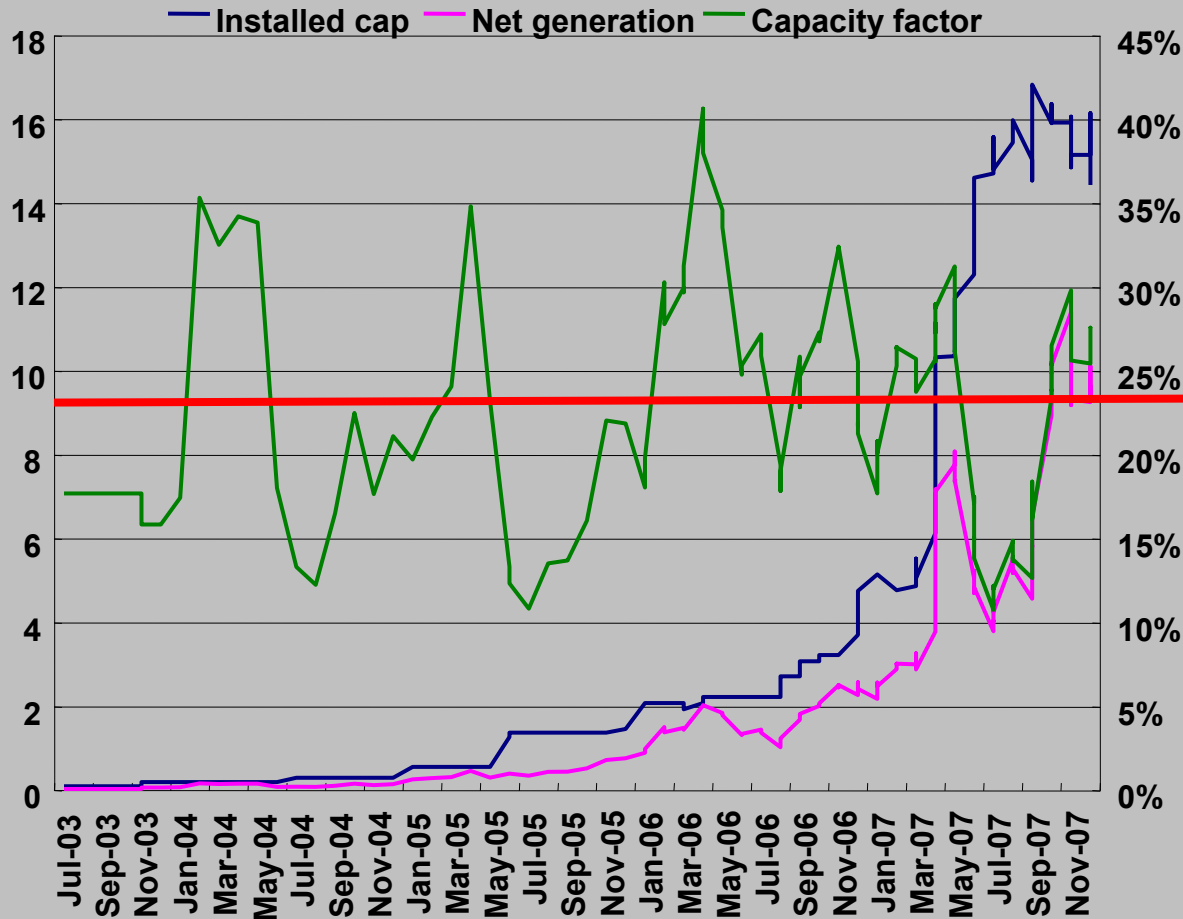


Source: Azure International, * 1575 GW forecast by Merrill Lynch

Project track record (CDM & RE surcharge)

- Better understanding financial performance

Cap & Generation for CDM Wind Projects in China



Source: Azure International

17% of “available cap hrs” 1 July '03 – 31 Dec 07

First verified CER 1 July 2003

49 projects CERs issued (1 Sept)

7.4m CERs predicted; only 3.7m verified

8.8TWh predicted; only 3.9TWh verified

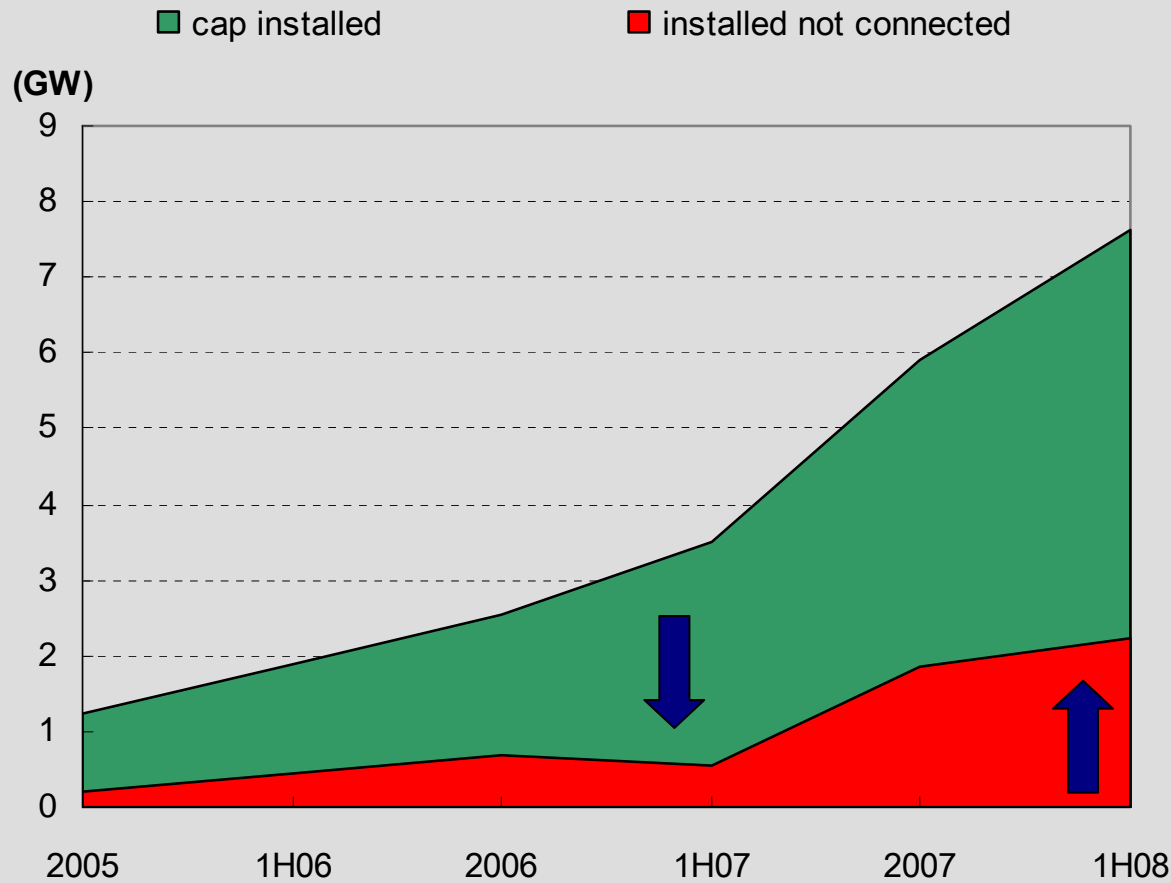
results strongly affected by timing of commissioning

23% ave net cap factor

Installed vs Connected

- CDM data confirms delays

Cumulative wind capacity installed & connected



Source: Azure International

Average interconnection delay 3-4 months

= 25% to 30% of a year

@ beginning 2008 2GW installed not connected

@ end 1H08 2.2GW installed not connected

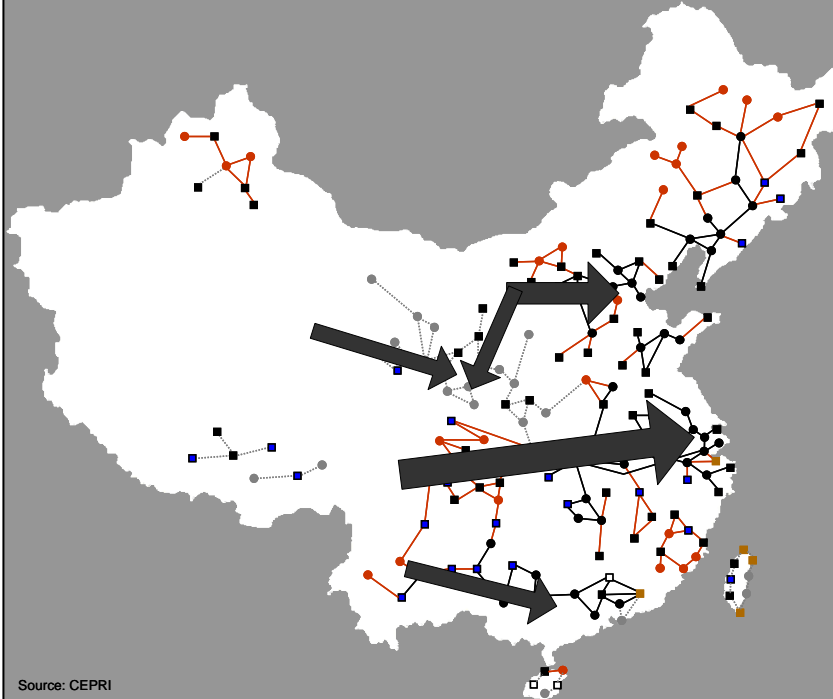
Interconnection rate relative installation pace suggests 3GW by year-end

= Project IRR ↓ 1/2% worse than expected

Grid resistance

- Cannot be decreed away, better incentives needed

T&D Grid and main corridors planned



PPA after construction banks starting to demand before.

Stability challenge for high penetration areas

RE surcharge mechanism creates working capital drain (slow refund mechanism)

Except where local grid companies have stakes in wind projects, generally they do not benefit from increased RE penetration under existing system

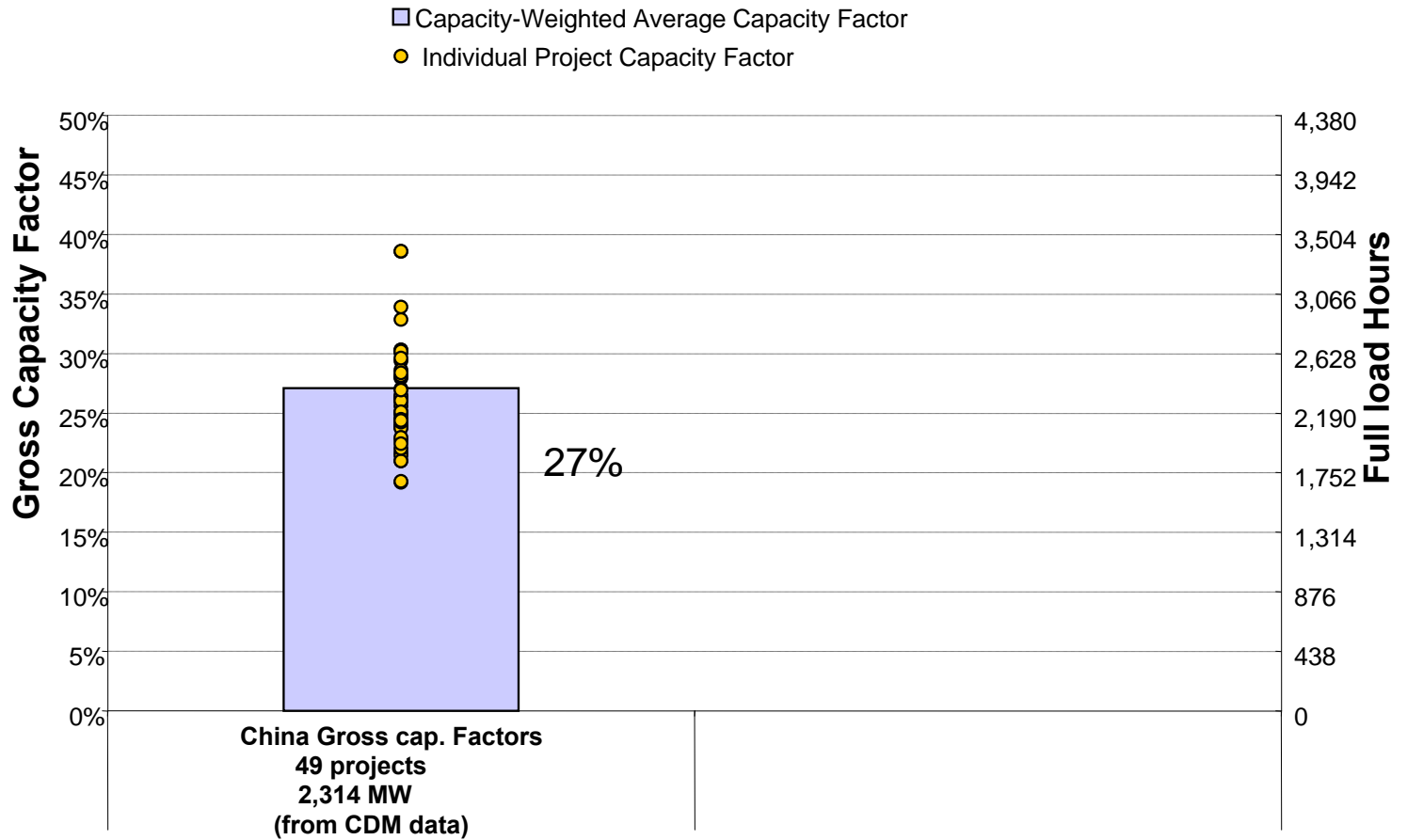
Administrative measures attempt to address / improve situation

Grids respond with interconnect agreement language putting risk on developers

Capacity utilization in China

- Planned

China net capacity utilization (CDM) - Planned

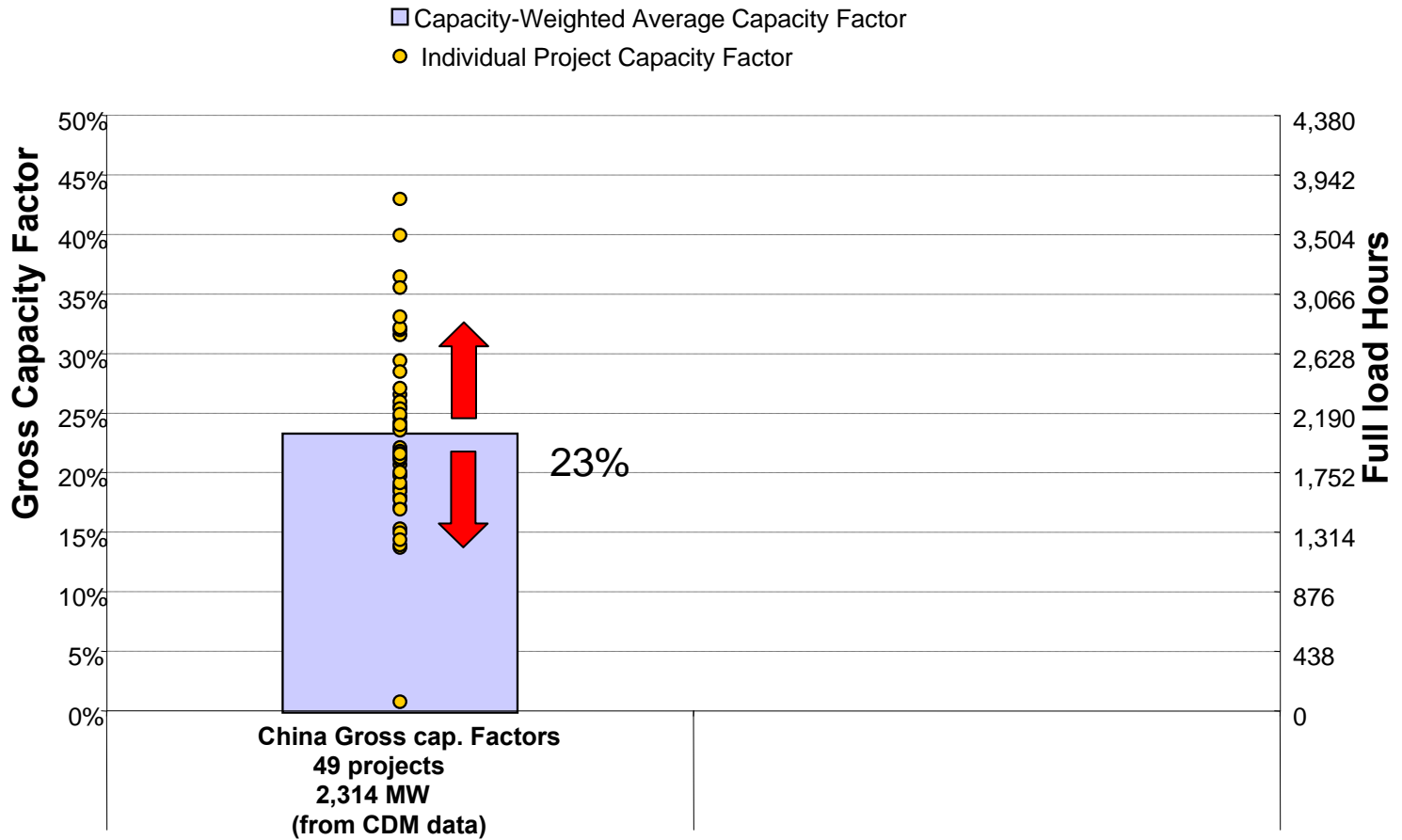


Source: Azure International

Capacity utilization in China

- Actual

China net capacity utilization (CDM) - Actual



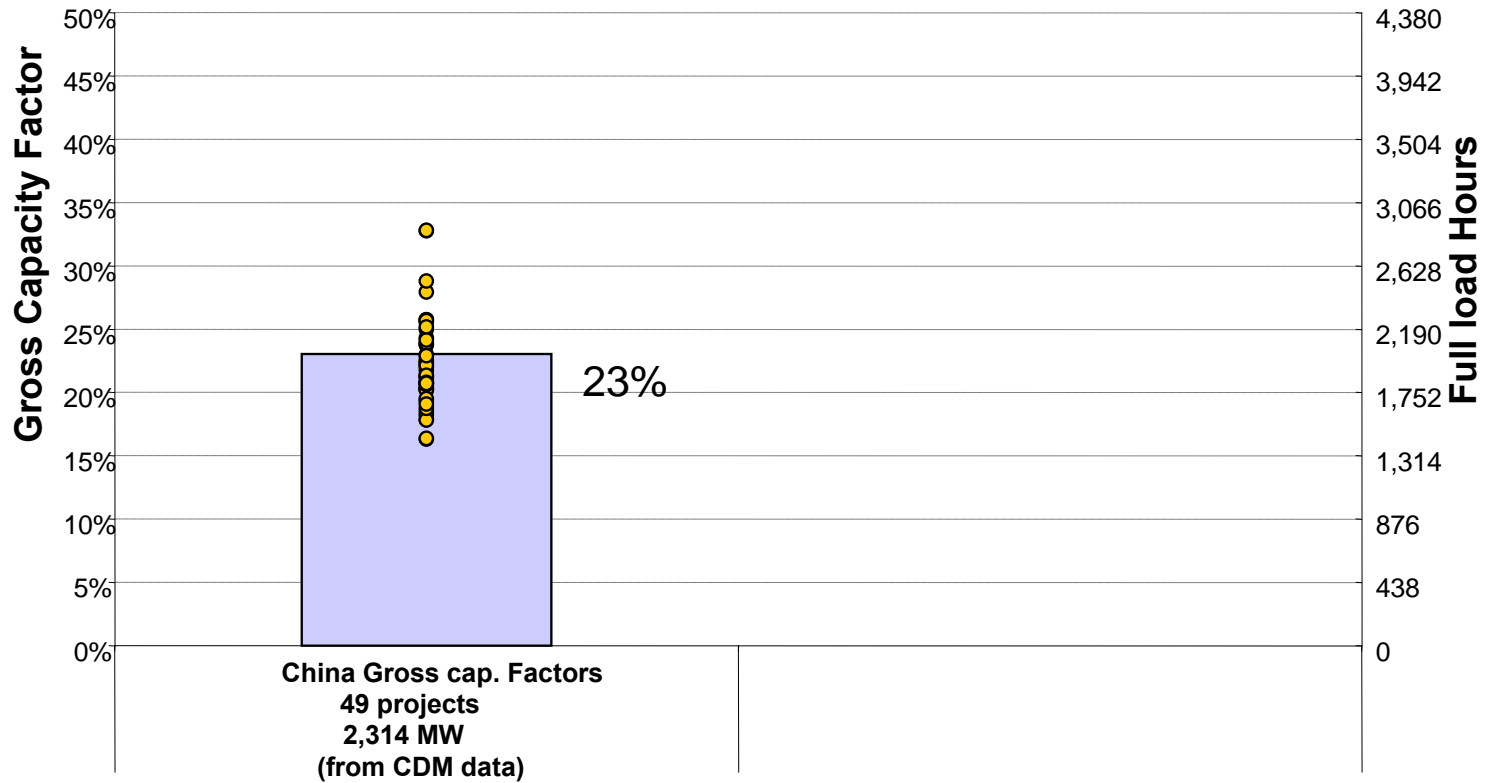
Source: Azure International

Capacity utilization in China

- Excluding initial delays

China net capacity utilization (CDM) - Likely

- Capacity-Weighted Average Capacity Factor
- Individual Project Capacity Factor



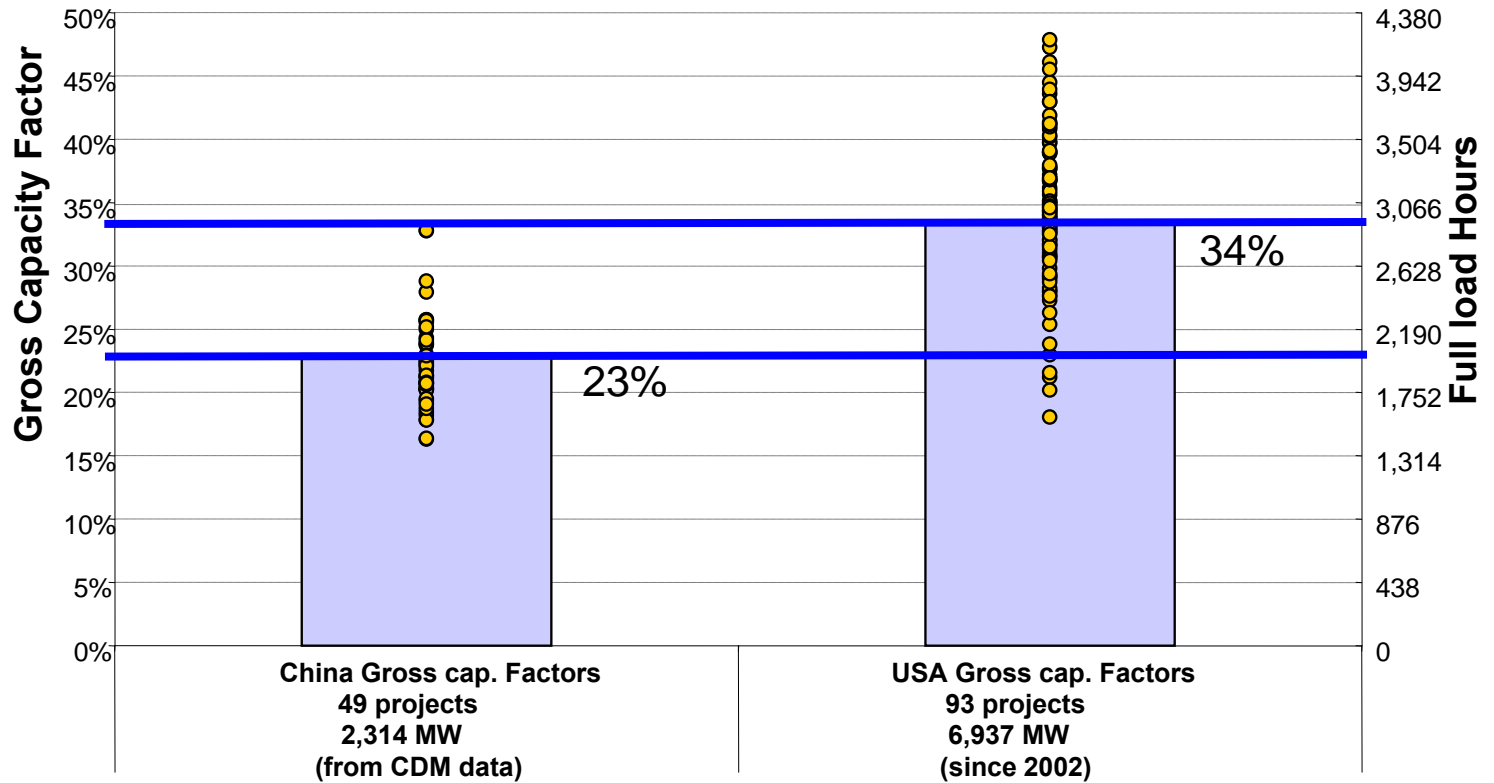
Source: Azure International

Capacity utilization in China

- Excluding initial delays vs. USA 2007

China net capacity utilization (CDM) - Likely

- Capacity-Weighted Average Capacity Factor
- Individual Project Capacity Factor



Source: Azure International (China) Laurence Berkley Lab Database (USA)

Average actual performance post startup



Accuracy of Prediction

Yearly Variations in Wind Speeds

Grid Faults

Turbine Faults

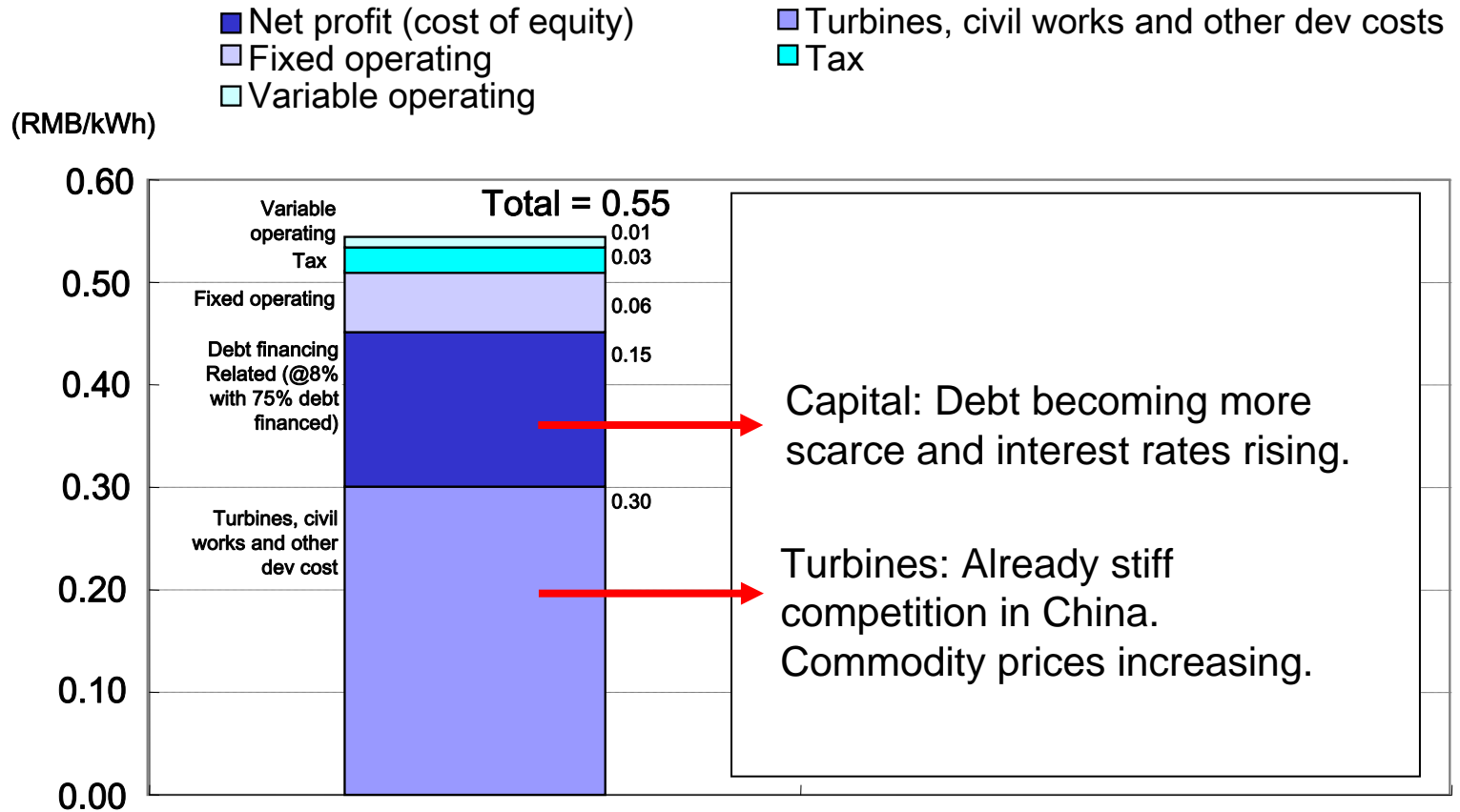
Park Operation and Control

Note: Wind project costs are largely fixed; margin over costs need not be large for good project profitability

Estimated cost per kWh

- Existing situation based on available CDM data

Estimated full life cycle cost of wind power in China (RMB/kWh)



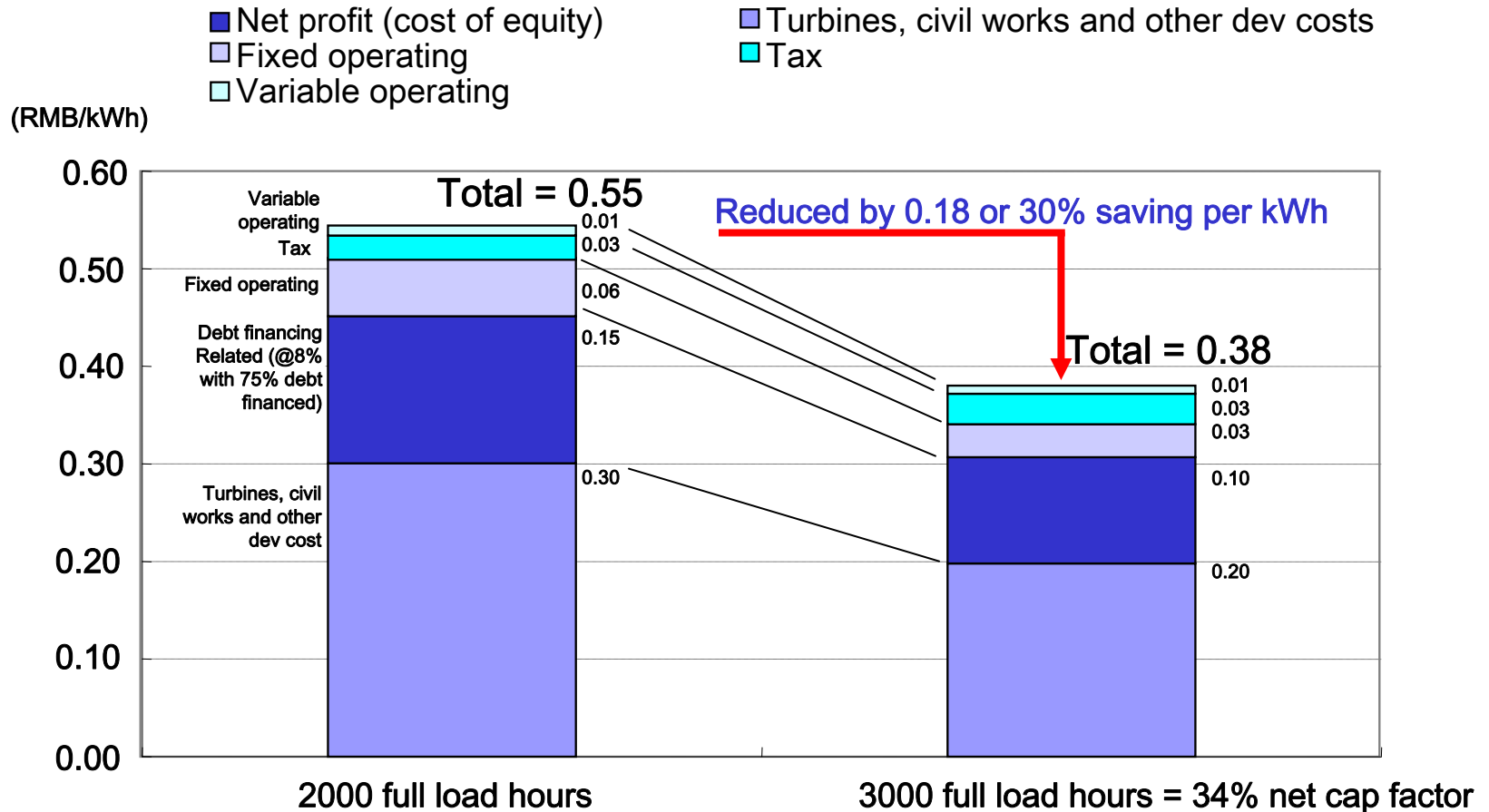
2000 full load hours = 23% net cap factor

Source: Azure International

Estimated cost per kWh

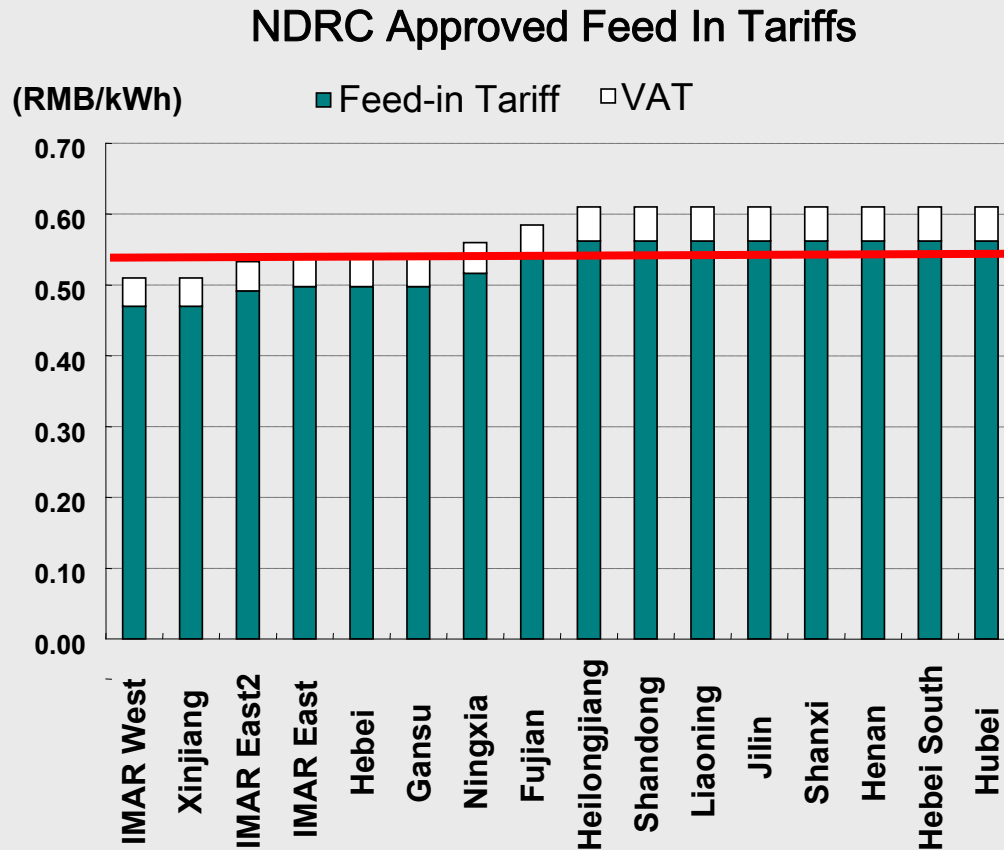
- With improved capacity utilization

Estimated full life cycle cost of wind power in China (RMB/kWh)



Emerging fixed feed-in tariff regime

- Better understanding of revenue



Source: Azure International

Ave net feed in tariff = RMB 0.53/kWh for 30k hrs @ EUR 12/tce add RMB 0.10/kWh thru 2012

On 9 Jun 07, 23 projects approved in 4 provinces

On 3 Dec 07, 72 projects approved in 8 provinces

On 10 Jan 08, Guangdong approved the fixed tariffs

On 23 July 08, 48 projects approved in 10 provinces

143 projects in 14 provinces covered thus far represent over 85% of pipeline identified to date (100GW)

Supply - buoyant

- Cheaper turbines

Established international and Established domestic companies each with potential for 2GW by the end of 2007

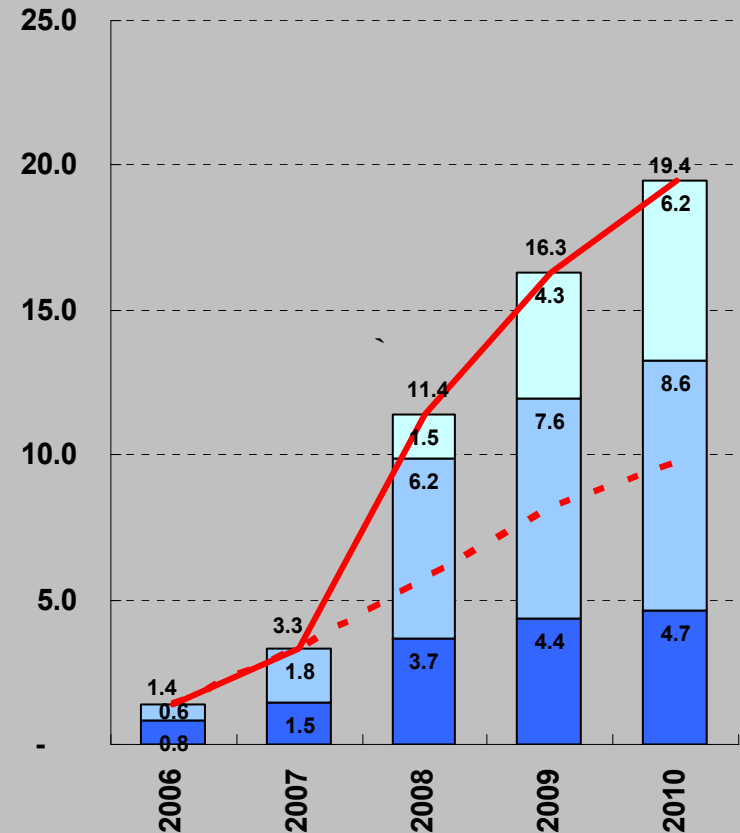
By 2009 each grouping could represent about 1/3 of the market, but “new entrants” will be challenged in acquiring market share

Expect consolidation within the next 3-years

WTG Manufacturer Company Groupings

- Established International
Gamesa, GE, NCWA, Nordex, Suzlon, Vestas
- Established Domestic
Sinovel, Dongfang, Goldwind, Windey, Changzhou, Huayi, Shanghai, Xiangdian
- New entrants
24+ companies with tech or license agreements and detailed business plans for WTG manufacturing
- Aggregate pdn plans - - - Tempered pdn

WTG Manufacturer Production Plans (GW)



Source: Azure International data

Supply - order backlog

- Retracting as production ramps-up

19 GW order backlog as at 30 June 2008



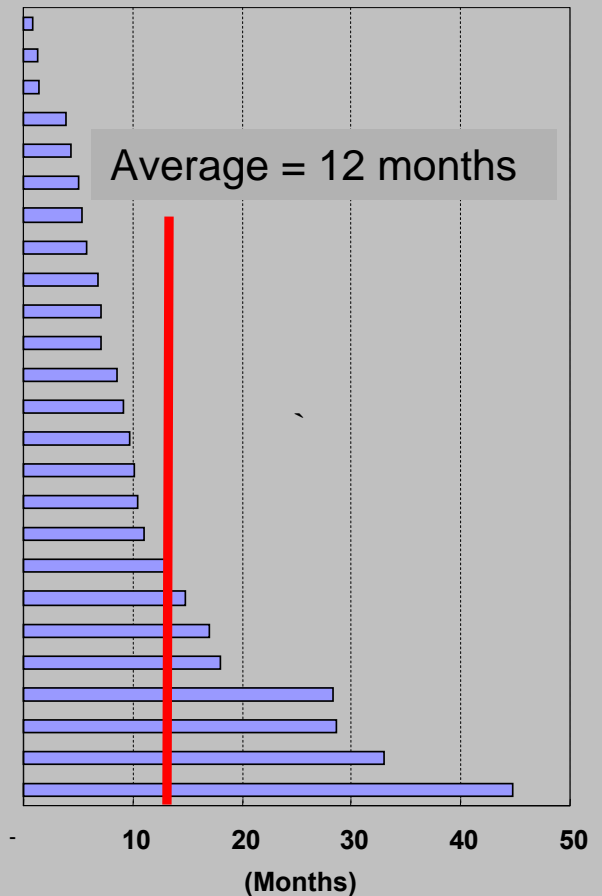
11 GW, 16GW, 19GW production rate ('08-'10)



Backlog life at end 1H08 annualized installation rate is 12-months (production plans at face value)

- Wide range of backlog times by product line

Backlog months by product line



Note: includes only production lines with existing orders
Source: Azure International

Analysis - near-term development foretold

- Pipelines of developers & ordered WTGs

A closer look at order books and pipelines:

Existing apparent pipeline = 140 GW (incl. 8GW installed)

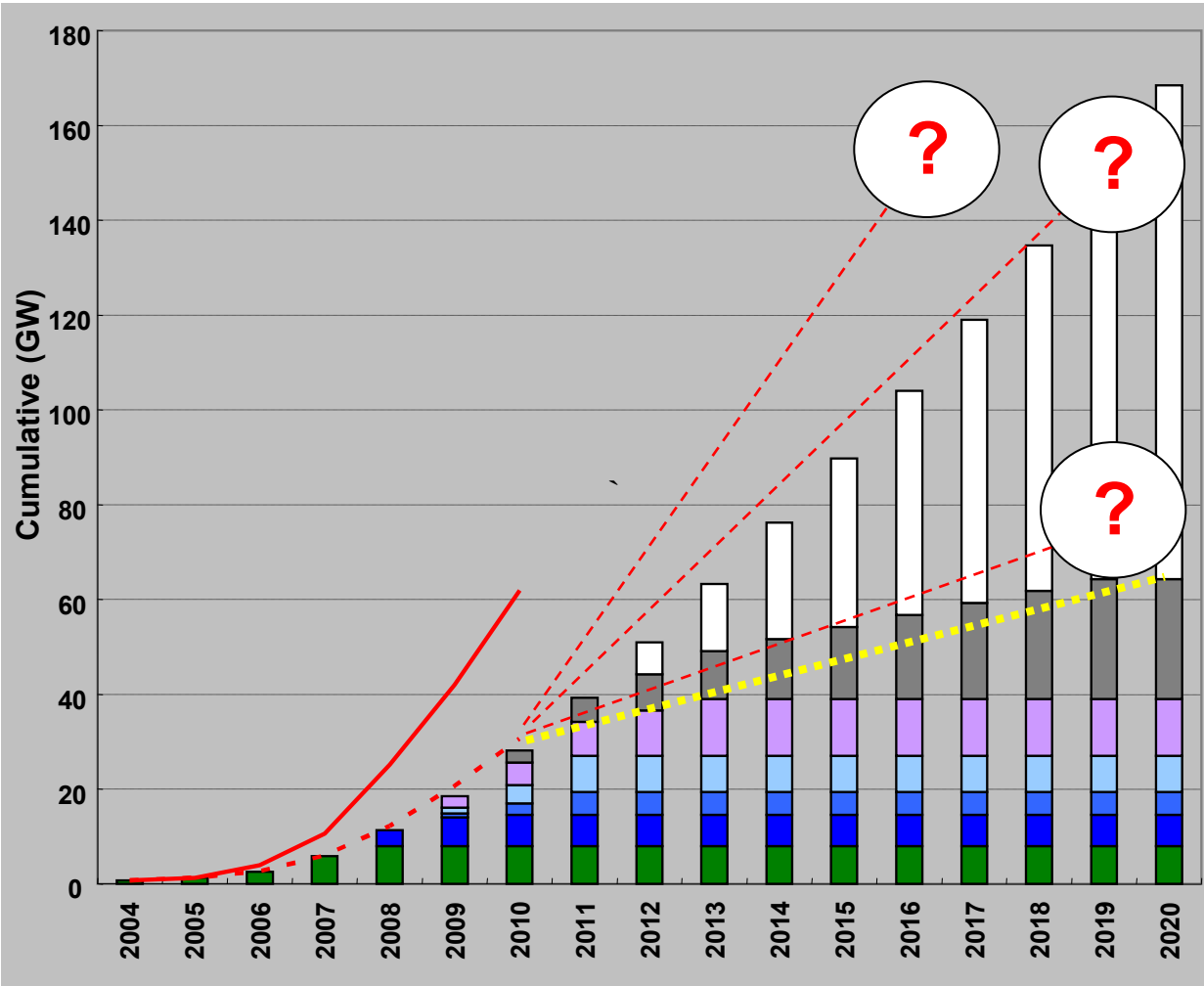
...of which “imminent development” = 35 GW

...of which order backlog = 19 GW

-  installed capacity (MW)
-  adjusted dated orders (MW)
-  un-dated small orders (<51MW) distributed over 3 years (MW)
-  un-dated large orders (>=51MW) distributed over 3 years (MW)
-  un-ordered imminent development distributed over 5 years @p75% (MW)
-  un-ordered long-term development distributed over 10 years @p25% (MW)
-  not-yet known dev. (fit to modest 5% long-term forecast curve post ID pipeline peak)
-  aggregated production plans of WTG cos.
-  tempered production plans of WTG mfr cos.(~-50%)

Analysis - cumulative installations to 2020

- National targets already met by existing pipeline



Source: Azure International

10 GW in 2008

60+ GW 2020 target in existing prob. weighted pipeline

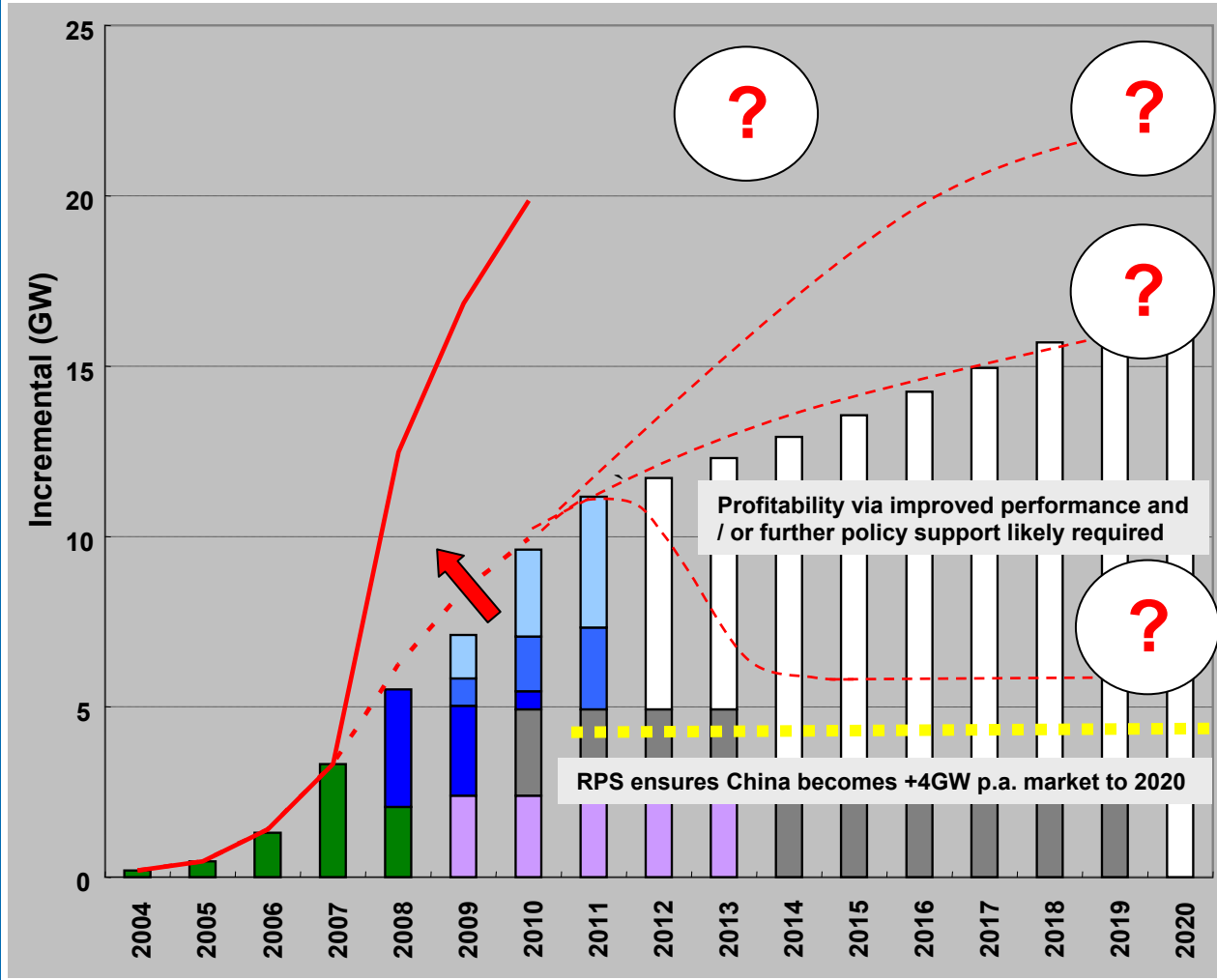
140 GW sum of existing identified pipeline

After near-term identified peak 2010 apply conservative 5% CAGR = 160+ GW 2020

- Installed cap.
- Adjusted dated orders
- Un-dated small orders
- Un-dated large orders
- Un-ordered imm dev
- Weighted inc LT dev
- RPS cap requirement

Analysis - annual installations to 2020

- Year on year future still undetermined



Source: Azure International data

Beyond RPS, further policy support still desirable to ensure additional growth

Min 60% and growing of planned production cap can theoretically export

Healthy market fundamentals and successful wind generation industry necessary for meaningful export success

- Installed cap.
- Adjusted dated orders
- Un-dated small orders
- Un-dated large orders
- Un-ordered imm dev
- Weighted inc LT dev
- RPS implied min ave

Some conclusions

- China Domestic wind market to affect global market?

- **Near-term domestic demand is secured by aggressive RPS, but development beyond required levels remains uncertain; focus on kW (not kWh) may challenge industry health**
- **Near-term capacity overhang suggests increasing focus to export markets & perceived limitation of licenses may not be the real limiting factor**
- **It will be difficult for new WTG manufacturers make inroads in established markets like Europe & US with un-proven product and not-well understood financial status (among other things); Emerging markets new to wind will be a receptive market for cheaper turbines (SE Asia, Africa, Middle East & Latin America) (Canada, USA, Cuba, Chile, Poland, Korea, Pakistan, Turkey)**
- **International established companies may be the first to export meaningful production**
- **In the long run, a healthy, successful and profitable domestic wind industry experience remains key to international export success**

Azure International

- Contact information



Sebastian Meyer

Director, Research & Advisory

Sebastian.Meyer@azure-international.com

Tel: +86 10 8447 7053

Fax: +86 10 8447 7058

Welcome to visit us at our office:

Oriental Kenzo

Suite H, Office Tower, 6th Floor
48, Dongzhimen Wai Street
100027 Dong Cheng District, Beijing
PR China

www.azure-international.com