



# China Renewable Energy Development

China Clean Energy Conference  
Bank of America, Merrill Lynch  
Shangri-La, Hong Kong

October 12-13, 2009  
Frank Haugwitz

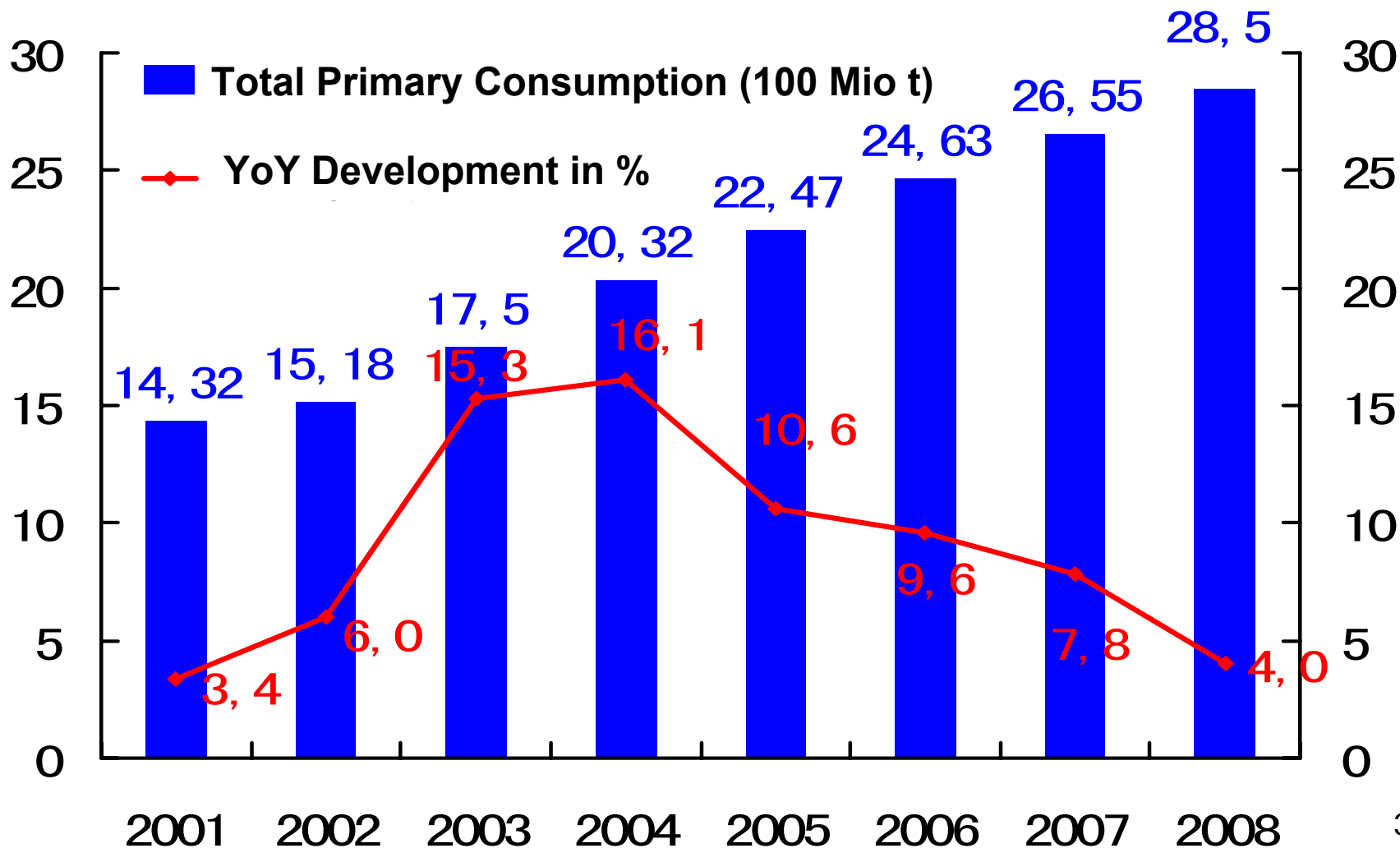


# China's Key Energy Consumption Data (2008)

Item	Consumption	Compared to 2007
Total Primary Energy Consumption	2.85 bn. t (sce)	Up 4.0%
Coal	2.74 bn. t	Up 3.0%
Crude Oil	360 Mio t	Up 5.1%
Natural Gas	80.7 bn. m <sup>3</sup>	Up 10.1%
Total Electricity Consumption	3.4502 trillion kWh	Up 5.6%

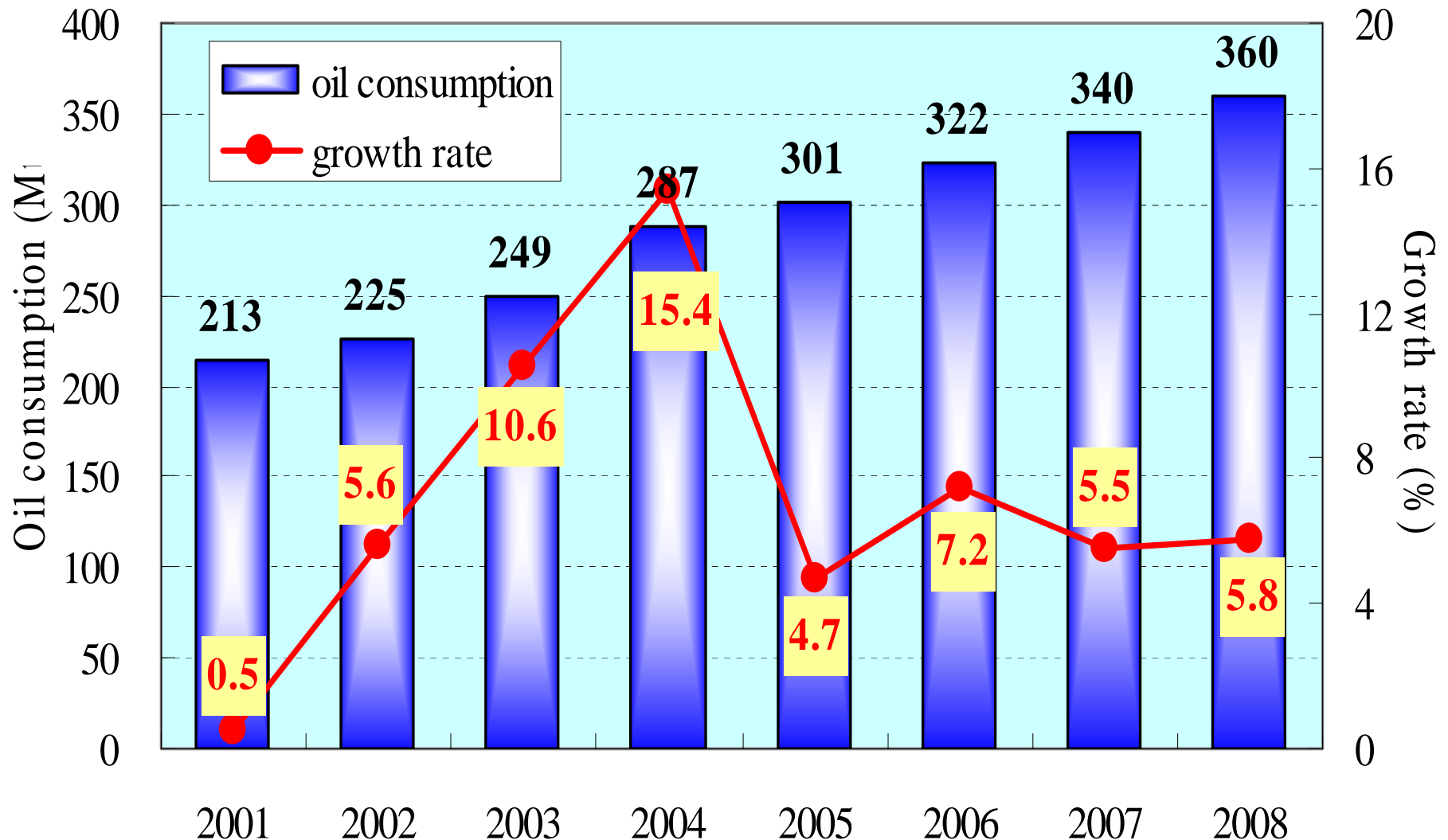


# China's Increasing Energy Consumption (2001-2008)





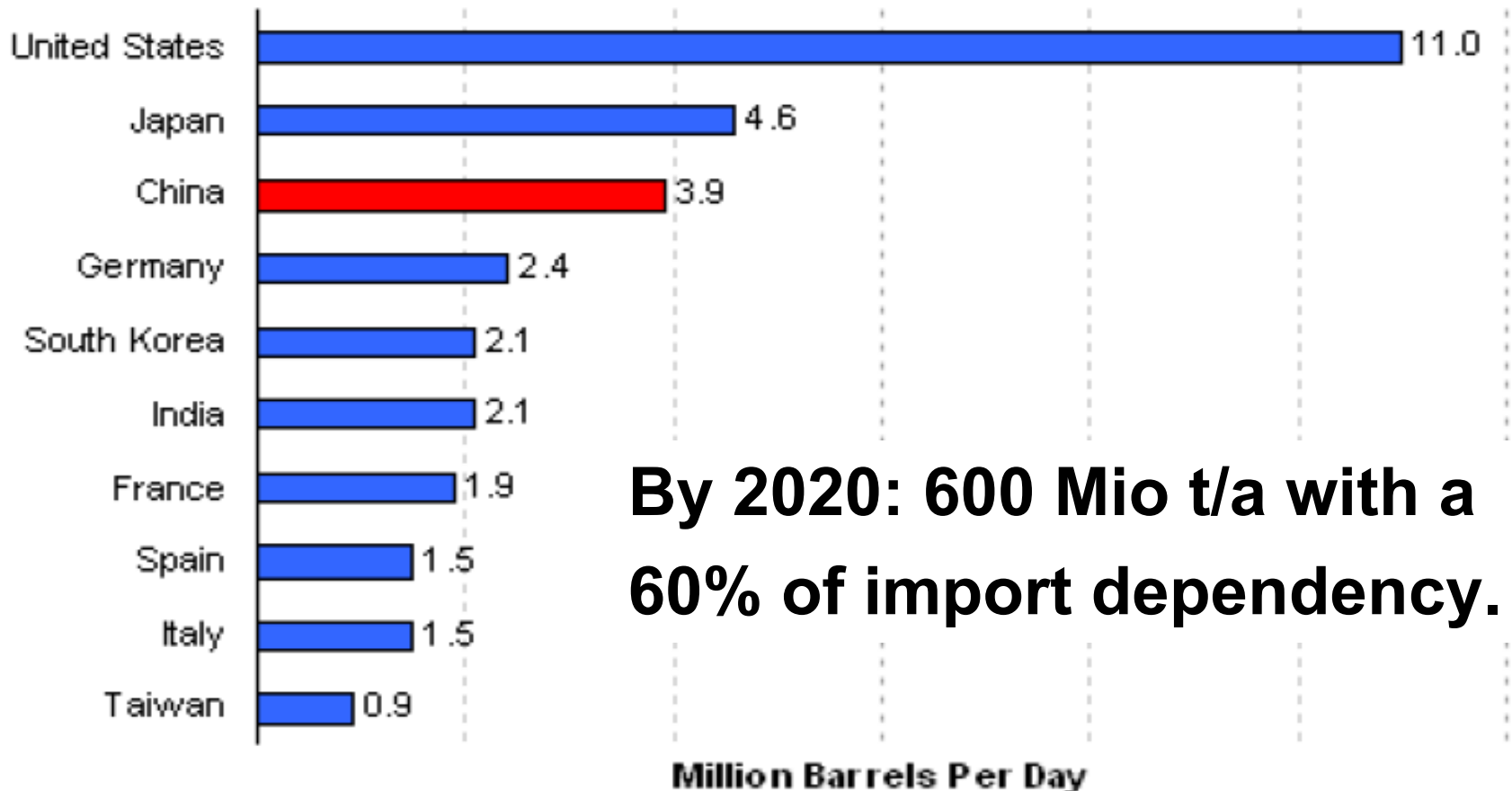
# China's Increasing Oil Consumption (2001-2008)





# China's Oil Import (2008)

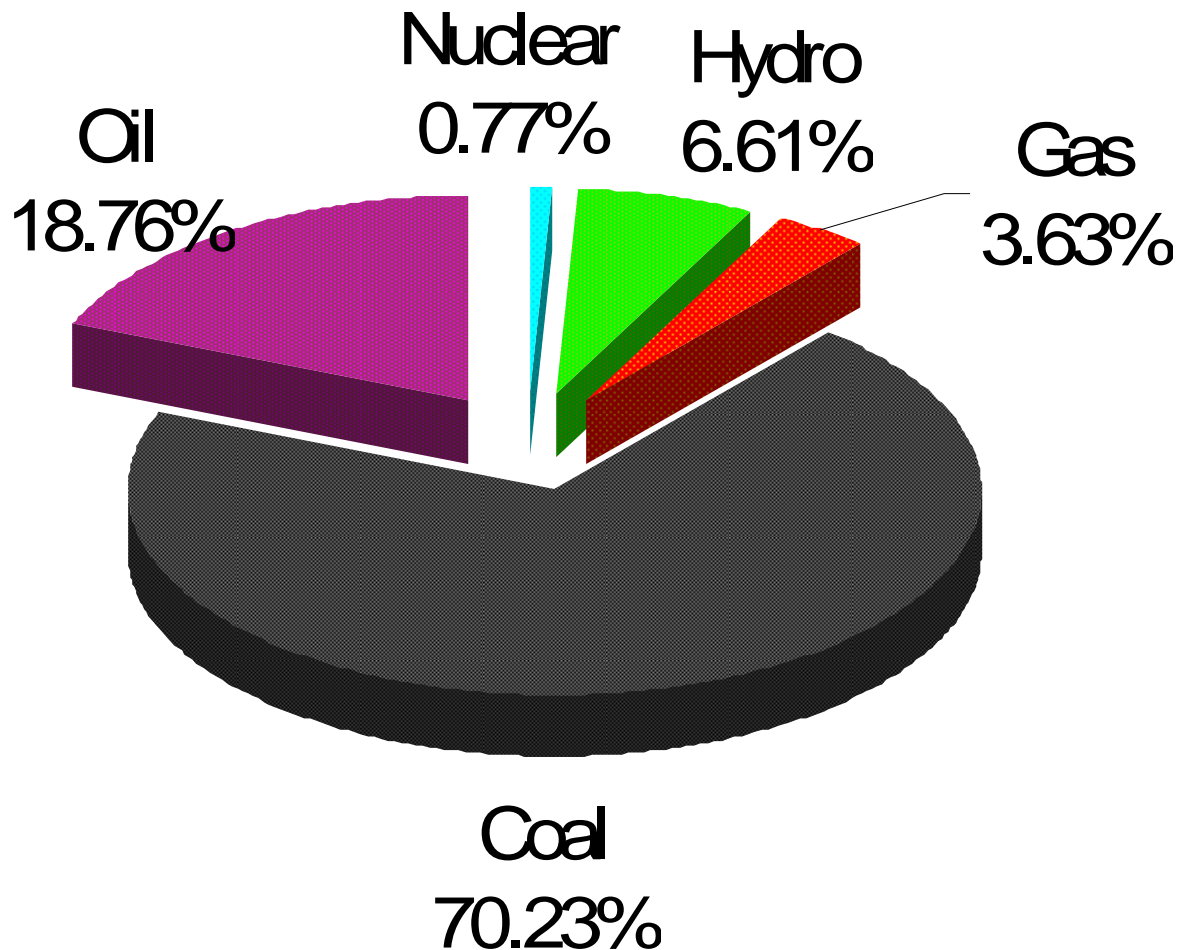
Top Ten Net Oil Importers, 2008\*



**By 2020: 600 Mio t/a with a 60% of import dependency.**

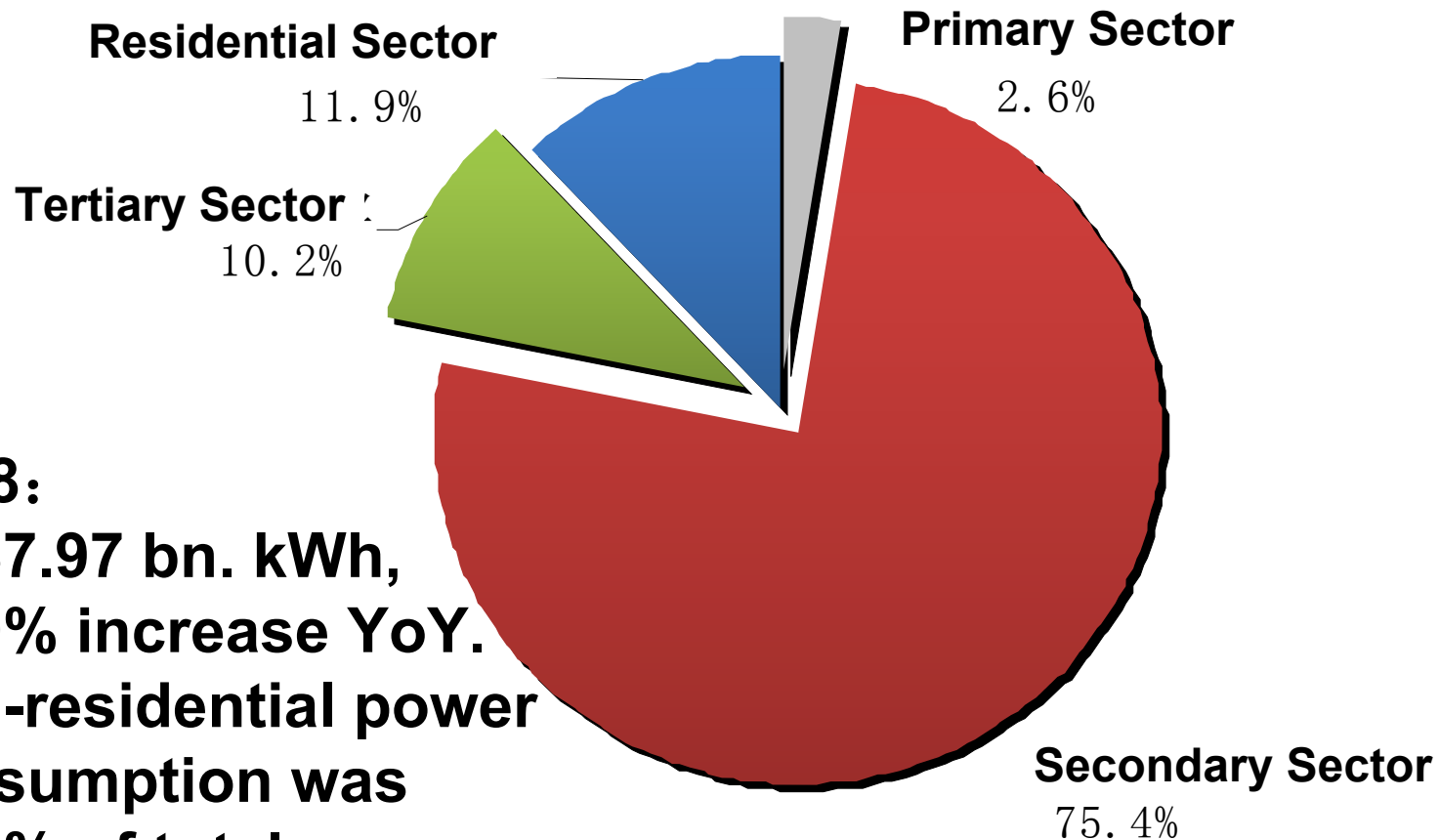


# China's Energy Consumption Structure by Fuel (2008)





# China's Power Consumption by Sector (2008)



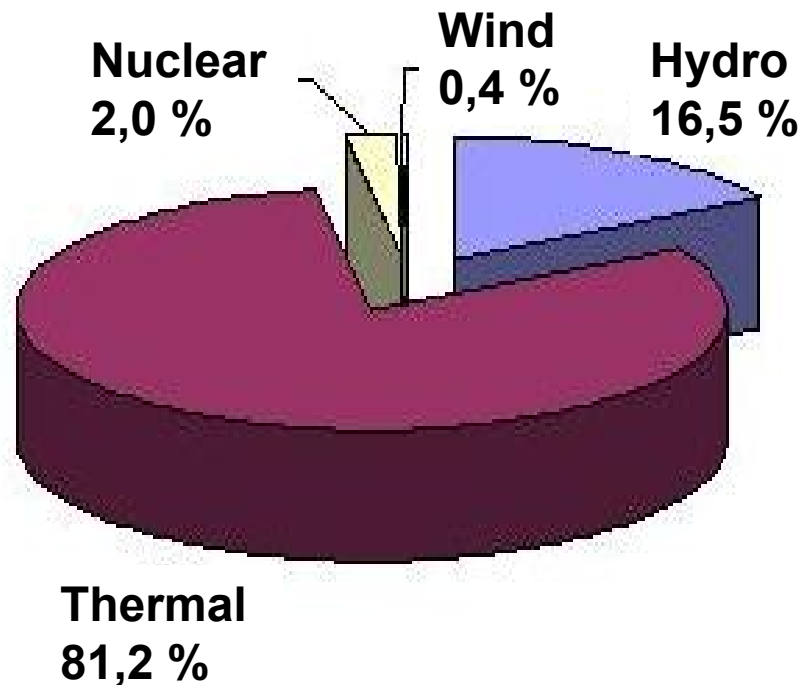
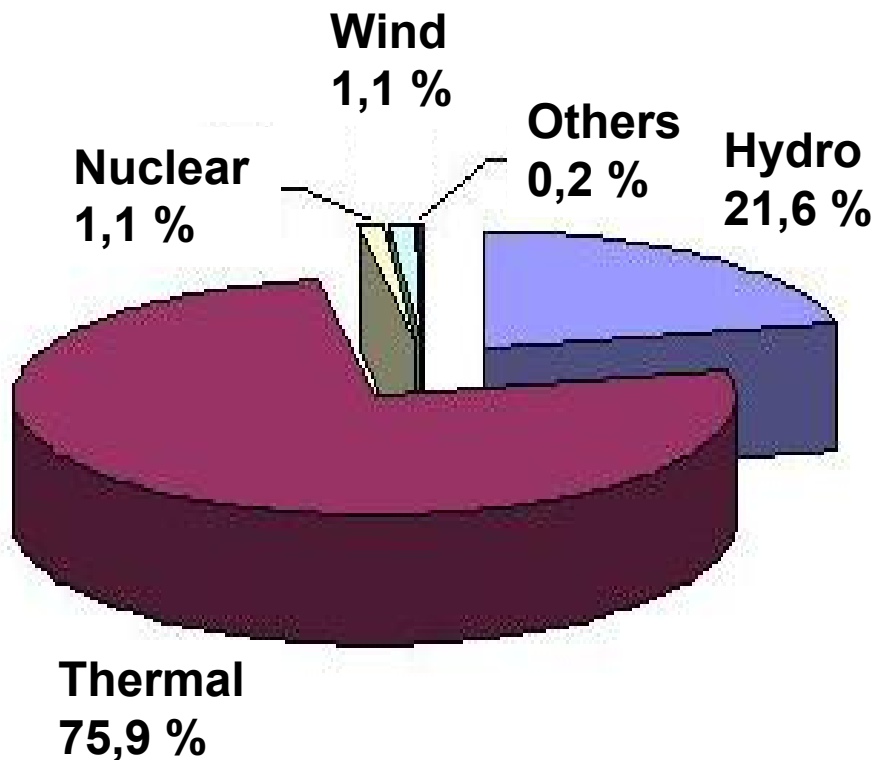
**2008:**  
**3,437.97 bn. kWh,**  
**5.49% increase YoY.**  
**Non-residential power**  
**consumption was**  
**88.1% of total.**

Source: State Grid Corporation, September 2009



# Installed Power Generation Capacity and Structure (2008)

2008: Total installed capacity 793 GW;  
10,4% increase YoY.

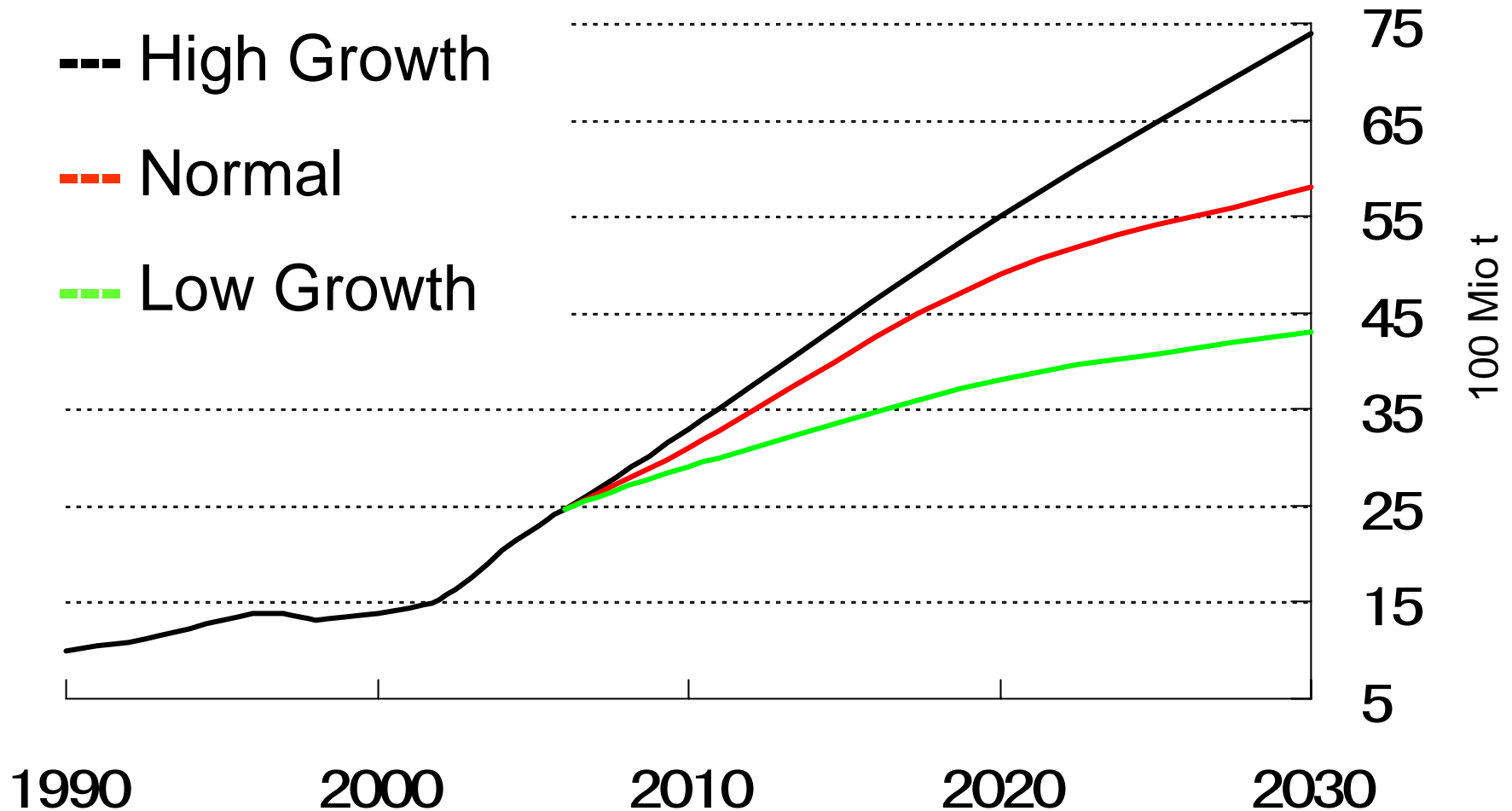


**By 2020: 1600 GW !**



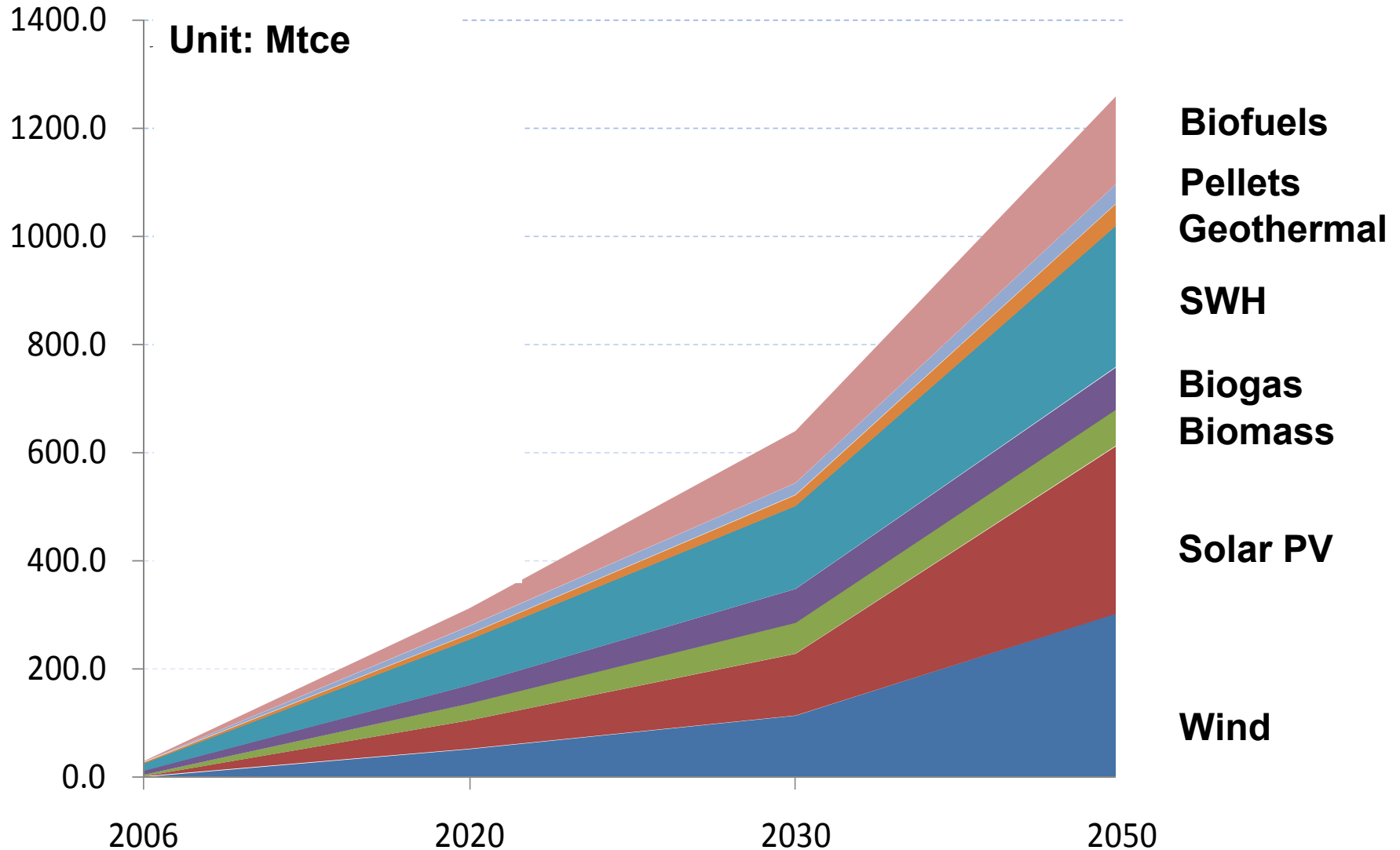


# China's Future Energy Demand Growth Trends





# China's Renewable Energy Development until 2050





# Drivers to Promote Renewable Energy

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- Meet Future Energy Demand
- Contribute to Energy Security
- Reduce Energy Import Dependency
- Image of single largest CO<sub>2</sub> Emitter worldwide
- Environmental Protection (e.g. Air, Acid Rain)
- New Growth Area for Industrial Development
  - Job creation
  - Reduce Technological Dependency
  - Meet Domestic/Intl. Market Demands



# Industrial Sector Priorities

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## **Biomass** (Conversion & Fuels)

- Pelletisation Technologies for Rural Energy Provision
- Gasification/Biogas for Power Generation Tech.
- Direct Combustion for Heat & Power Generation Tech
- Biofuels (Biodiesel, Bio-Ethanol)

## **Wind** (On- and Off-Shore)

- Localisation of large Turbine Technology incl. Design
- Off-Shore Wind Farm Development Technology
- Testing, Certification



# Industrial Sector Priorities

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## **Solar (PV & CSP)**

- Wafer, Cells, Thin-Film, Polysilicon,
- Concentrating Solar Power

## **Others**

- Geothermal
- Tidal Power

## **Software**

- Local engineers don't meet expectations e.g. design, manufacturing, operation, maintenance



# Political and Legislative Framework Conditions

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- January 2006 – RE Law came into effect
- September 2007 – Mid and Long-Term RE Development Plan until 2020 released
- March 2008 – 11<sup>th</sup> Five-Year-Plan (2006-2010) released
- Late 2008 – Stimulus Programme announced
- 12<sup>th</sup> Five-Year-Plan 2011-2015 (under preparation)



# Background of China's Renewable Energy Law?

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- High-Ranking Govt. Delegation attended “Renewables 2004” Conference, in Bonn, Germany, June 2004
- Chinese Commitment as part of the announced “International Action Plan”
  - RE Development Fund
  - RE Law plus supplementary provisions
- Annual Review of Impact Assessment



# RE Law – Proposed Amendments as of 09/2009

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- **Article 8:** Improve/streamline the work on provincial/regional/and national levels, emphasis on strategy, status of RE technology development, development of regional mid and long-term RE development plans.
- **Article 9:** RE Development Plans: More comprehensive, i.e. including targets, schedules, key projects, service systems, supporting mechanism, etc. (In the past too broad)
- **Article 14:** Regulates the obligations of grid operators: Suggests to elaborate a natl. plan for the annual purchase quota and implementation procedure for the electricity generated by RE.
- **Article 20:** Regulates the difference between on-grid electricity tariffs for conventional energy and electricity from RE. Now clearly refers to the management procedures of the RE Development Fund.
- **Article 24:** RE Development Fund: Now clearly identifies source of funding and for which purposes it shall be used.
- **Article 29:** Shall give the National Power Regulatory body the authority to order grid companies to buy the minimum quota of RE electricity within a time limit.





# Key-Features: Mid and Long-Term RE Dev. Plan 2006-2020

	2005 (Actual)	2010 (Target)	2020 (Target)	2020 (unofficial new Targets)
<b>Hydro</b>	115 GW	180 GW	300 GW	
<b>Wind</b>	1.3 GW	5 GW (35 GW *)	30 GW	100-150 GW
<b>Biomass</b>	2.0 GW	5.5 GW	30 GW	???
<b>Solar PV</b>	0.07 GW	0.3 GW (2 GW*)	1.8 GW	20 GW
<b>SWH</b>	80 Mio m <sup>2</sup>	150 Mio m <sup>2</sup>	300 Mio m <sup>2</sup>	
<b>Ethanol</b>	0.8 Mio t	2 Mio t	10 Mio t	
<b>Biodiesel</b>	50,000 t	0.2 Mio t	2 Mio t	
<b>Pellets</b>	~ 0	1 Mio t	50 Mio t	
<b>Biogas &amp; Biomass Gasification</b>	8 bn. m <sup>3</sup> /a	19 bn. m <sup>3</sup> /a	44 bn. m <sup>3</sup> /a	
<b>Nuclear</b>		12 GW	40 GW	86 GW



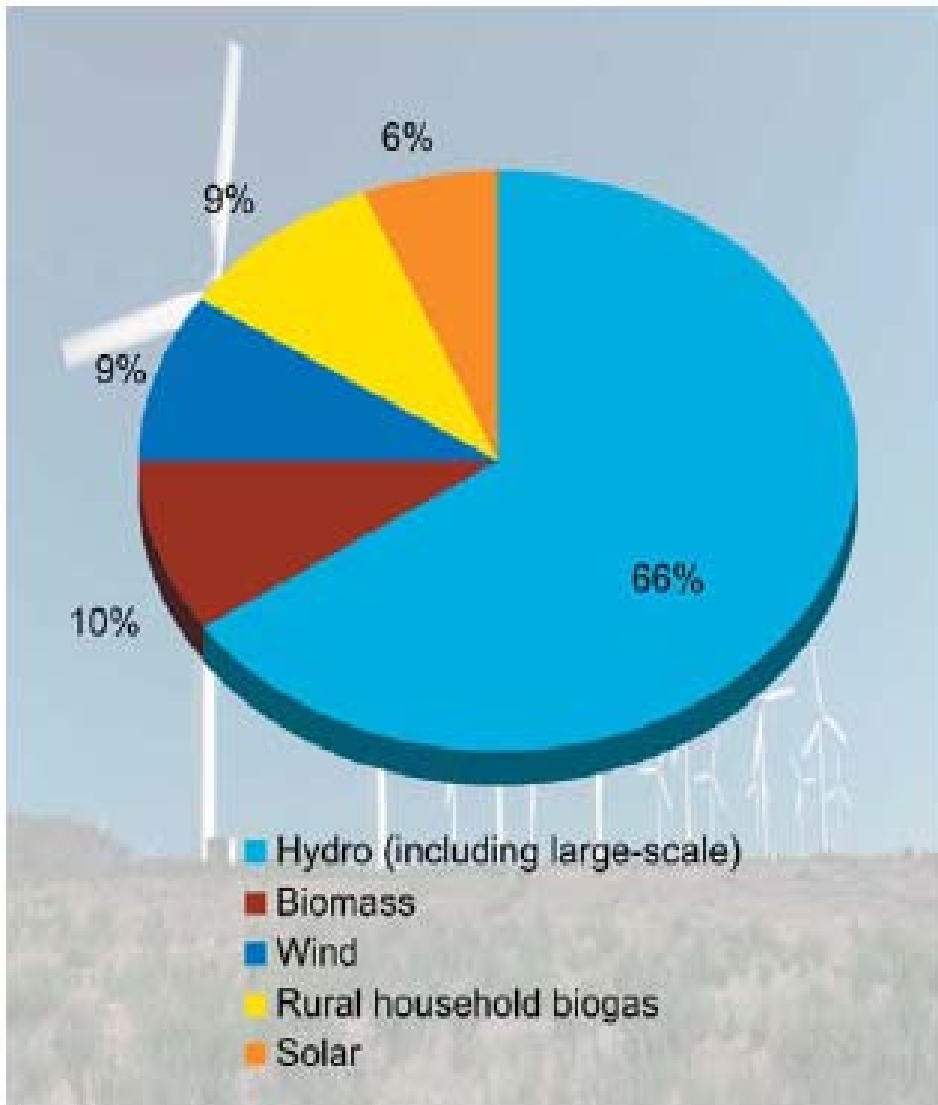
# Key-Features: Mid and Long-Term RE Dev. Plan 2006-2020

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- Power producers need to have a non-hydro renewable energy generation capacity of 3% of their total energy mix by 2010 and 8% by 2020.
- In areas covered by large grids, the non-hydro RE generation share shall be 1% by 2010 and 3% by 2020.
- Share of RE of total primary consumption will be 10% by 2010 and 15% by 2020.



# Govt. RE Investment Forecast by Sector 2006-2020

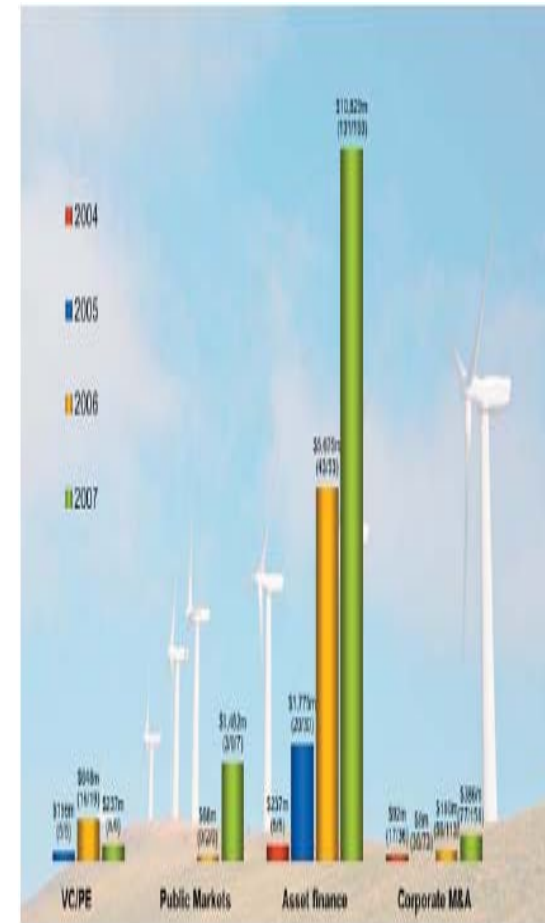


September 2007: Release of Mid-to-Long-Term RE Development Plan set out targets and includes an analysis of the investment required if the 2020 targets are to be achieved: \$251 bn. in total, or \$16.7 bn. /a.



# Investment in Renewable Energies (2008)

- Investment grew 18% to \$15.6 bn. compared to 2007 (Wind & Biomass excluding hydro). Asset finance grew 24% to reach \$14.9 bn. 3rd after the US and Spain. Over 70% was for wind.
- VC/PE investment grew 5% to \$581 Mio. with over 60% of the investment was made by VC, while in 2007 it was mostly in the form of PE.
- Chinese clean energy companies raised a total of \$2.8 billion from public markets in 2008, representing a small decrease of 3.4% from 2007.
- M&A \$1.5 bn. more than double the 2007 figure.





# China's Stimulus Plan

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- China's \$586 bn. stimulus plan is quite 'green', and includes the largest dedicated funding for energy efficiency at \$30.7 bn. The govt. plans to spend \$219 bn. on infrastructure, including upgrades to the grid, estimated at \$36.5 bn.
- NDRC/NEA submitted an "Energy Stimulus Programme" to the State Council late May 2009
  - Estimated Total Investment: € 140 – 430 bn.
  - Released expected end of 2009 but perhaps as a revised Mid- and Long-Term RE Development Plan!



# Govt. Investment Commitments until 2014

April 2009, the G-20 nations announced various fiscal stimulus packages to be spent over the next 2 to 5 years. China devoted roughly \$67 bn. including water and energy efficiency.

Figure 51: Break down of Global Stimulus allocation to Sustainable Energy, by Support Mechanism, March 2009, \$ millions

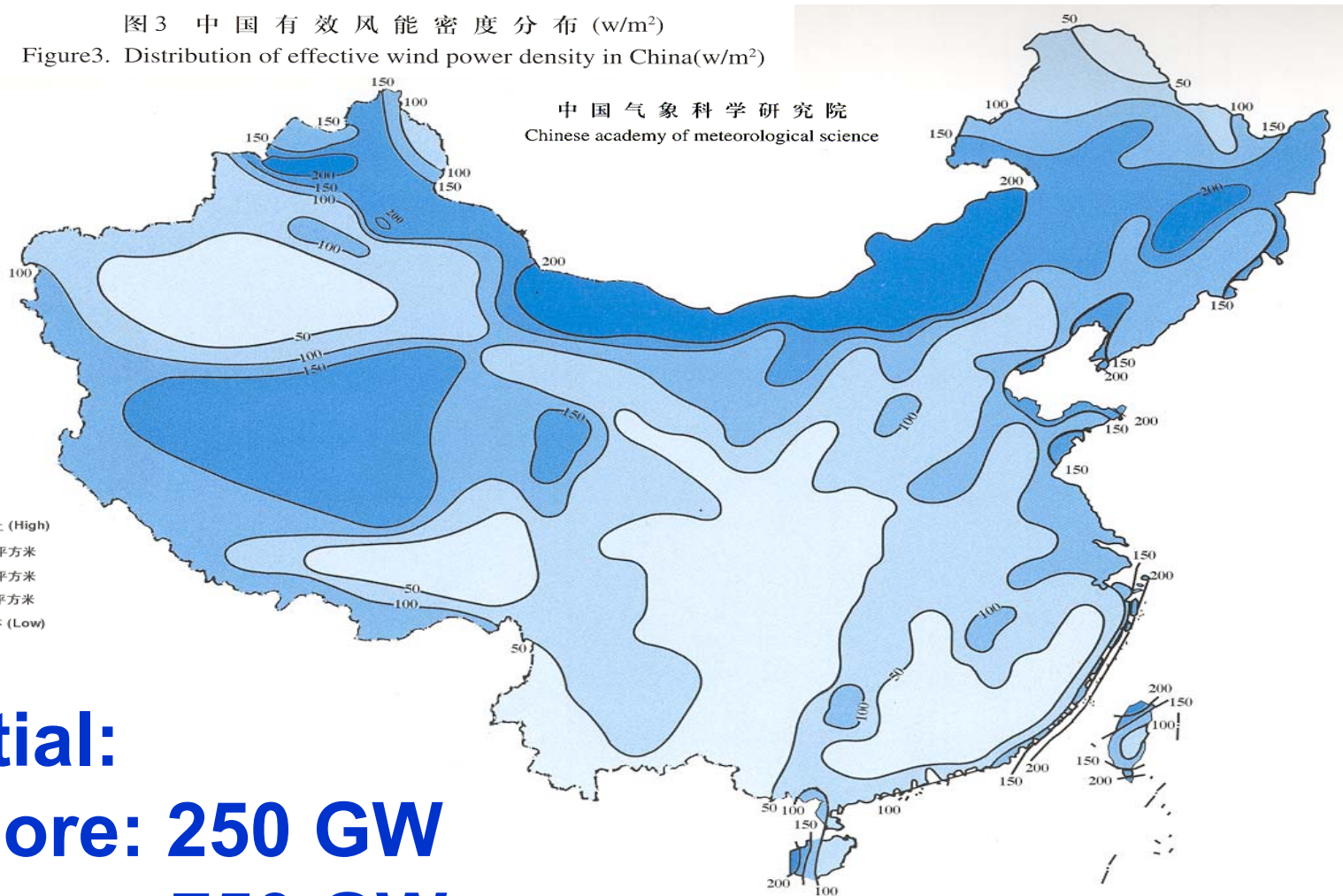
Country or Multilateral	Grant	Grant/ Loan	Loan	Loan Guarantee	ROC	Tax Credit	Tax Credit Bond	Tax Deduction	Other	Grand Total
Australia	2,887							186	303	3,376
Brazil				1,100				818		1,918
Canada	808									808
China	68,724									68,724
EU-27	3,342	7,940								11,282
France	2,157		331							2,488
Germany	1,740								1,985	3,725
India										
Italy										
Japan	1,070	2,900				4,000				7,970
South Korea	7,737									7,737
Spain	953		0						6,617	7,570
UK	441	551			771				962	2,724
US	27,568			17,000		19,739	1,381	0	872	66,560
<b>Grand Total</b>	<b>117,427</b>	<b>11,391</b>	<b>331</b>	<b>18,100</b>	<b>771</b>	<b>23,739</b>	<b>1,381</b>	<b>1,004</b>	<b>10,739</b>	<b>184,883</b>



# China's Wind Power Resource Map



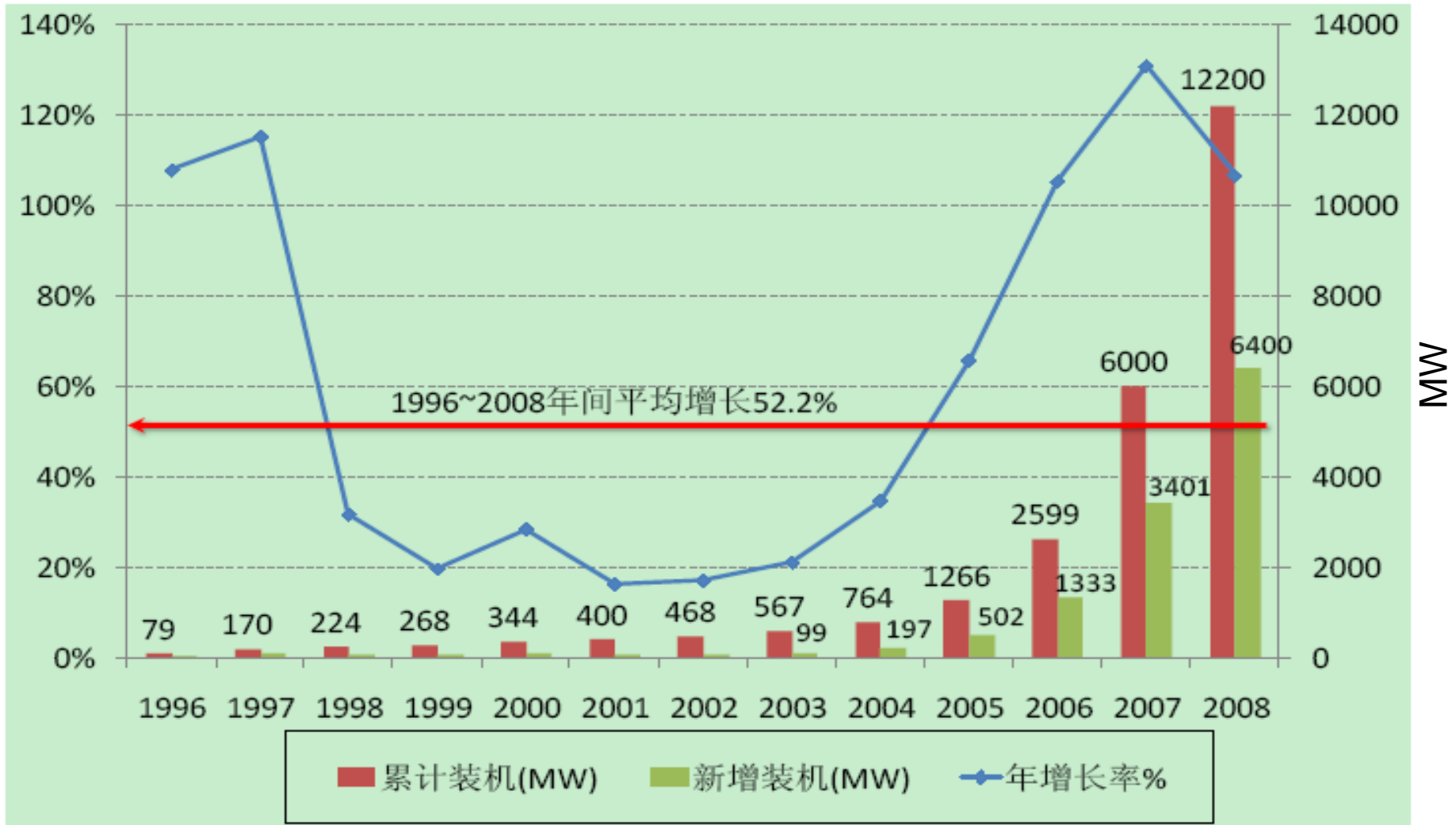
图3 中国有效风能密度分布 (w/m<sup>2</sup>)  
Figure3. Distribution of effective wind power density in China(w/m<sup>2</sup>)



**Potential:**  
**On-Shore: 250 GW**  
**Off-Shore: 750 GW**



# China's Wind Power Development (1996-2008)







# China's Wind Power Development (2008)

## Top 10 new capacity

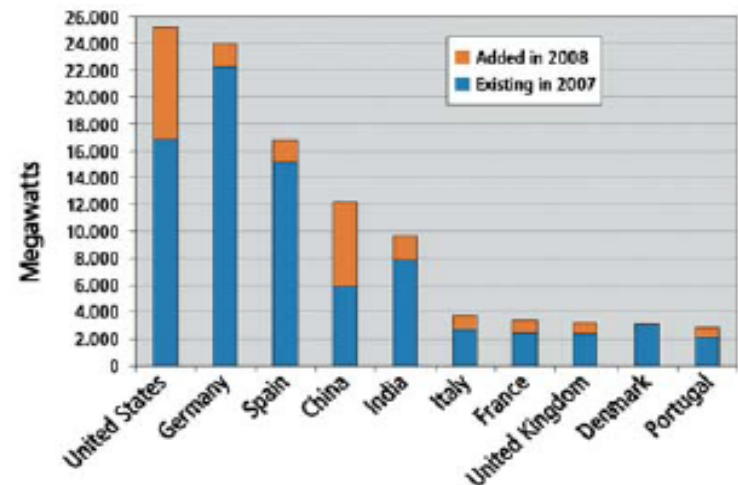
## Top 10 total installed capacity

2008: Total installed capacity doubled for the fourth year in a row. New installed capacity totaled 6.3 GW.

	MW	%
US	8,358	31
China	6,300	23
India	1,800	7
Germany	1,665	6
Spain	1,609	6
Italy	1,010	4
France	950	4
UK	836	3
Portugal	712	3
Canada	523	2
Rest of the world	3,293	12
<b>Total top 10</b>	<b>23,763</b>	<b>88</b>
<b>World total</b>	<b>27,056</b>	<b>100</b>

	MW	%
US	25,170	20.8
Germany	23,903	19.8
Spain	16,754	13.9
China	12,210	10.1
India	9,645	8.0
Italy	3,736	3.1
France	3,404	2.8
UK	3,241	2.7
Denmark	3,180	2.6
Portugal	2,862	2.4
Rest of the world	16,686	13.8
<b>Total top 10</b>	<b>104,104</b>	<b>86.2</b>
<b>World total</b>	<b>120,791</b>	<b>100.0</b>

Figure 2.  
Wind Power Capacity, Top Ten Countries, 2008





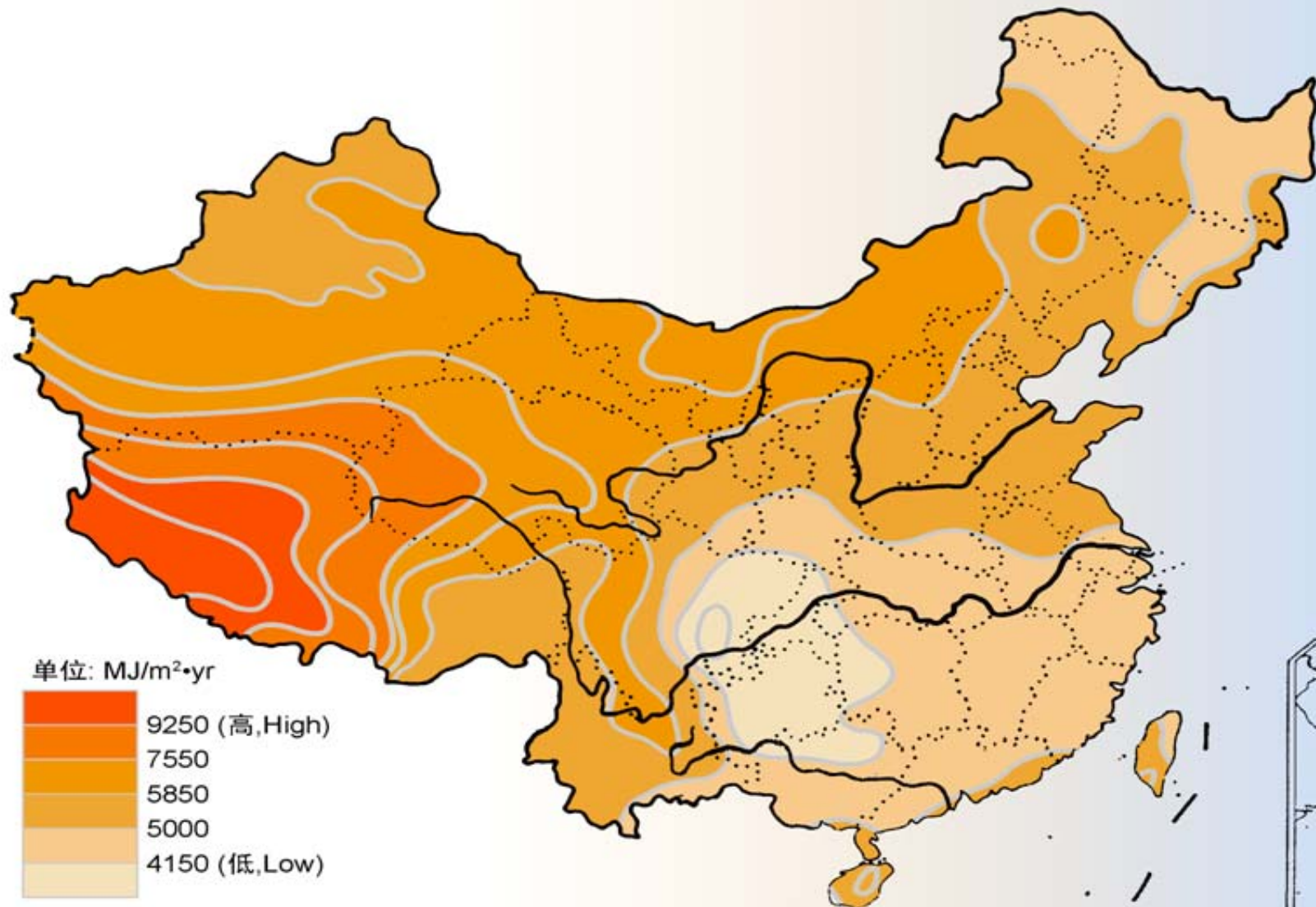
# Wind Power Development – Future Critical Issues

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- Feed-in-Tariff announced July 27, 2009
  - 4 tariffs for 4 regions range from RMB 0.51 – 0.61/kWh
- Over-Capacity of Turbine Manufacturer
  - (est. 12 GW by 2009 // est. 17 GW by 2010)
  - Shift production towards 2 MW turbines
- Grid Connection
  - 2008 approx. 30% of turbines not connected
- Off-Shore Potential
  - Shanghai, Jiangsu, Northern Shandong are focal areas

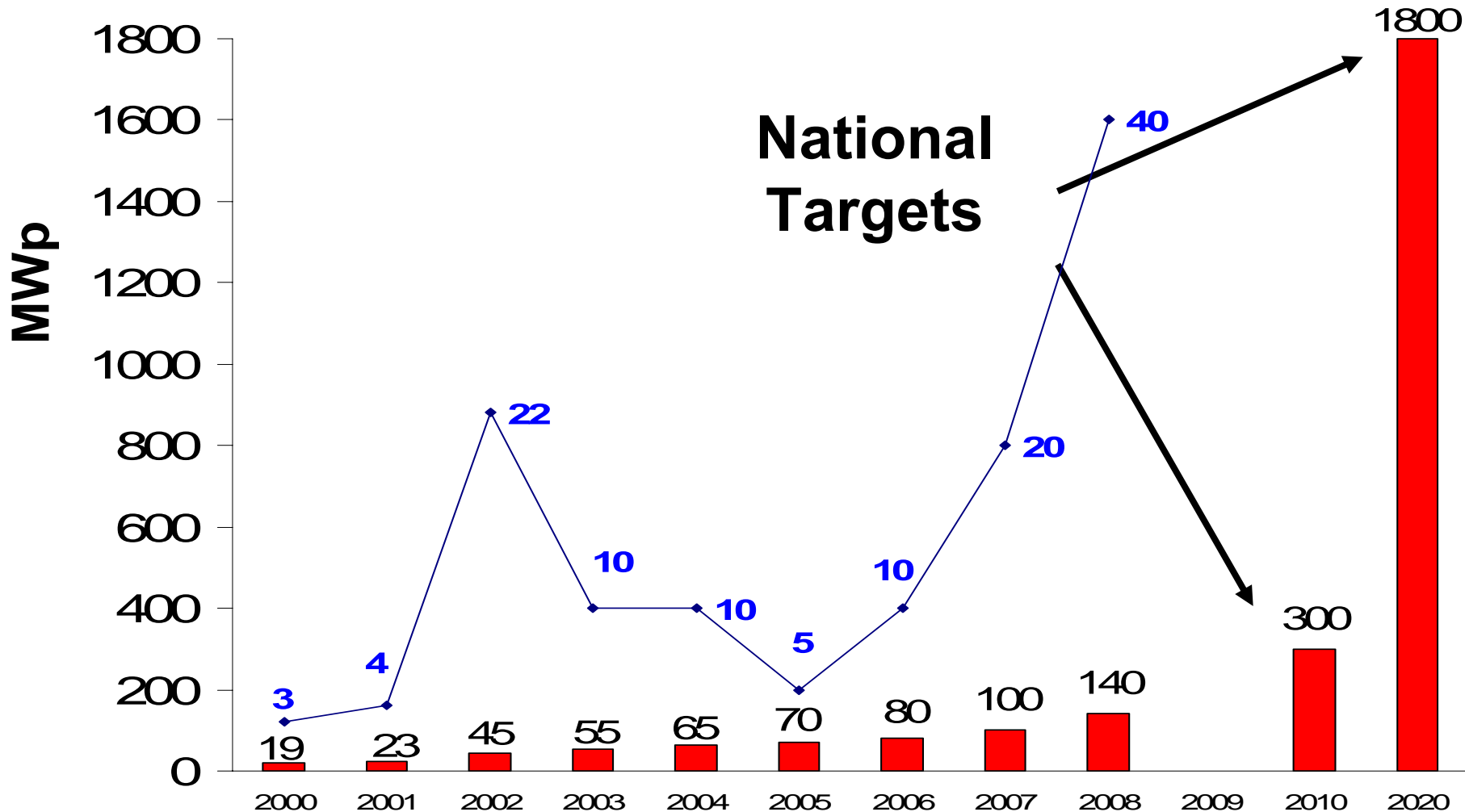


# Solar Radiation Map of China



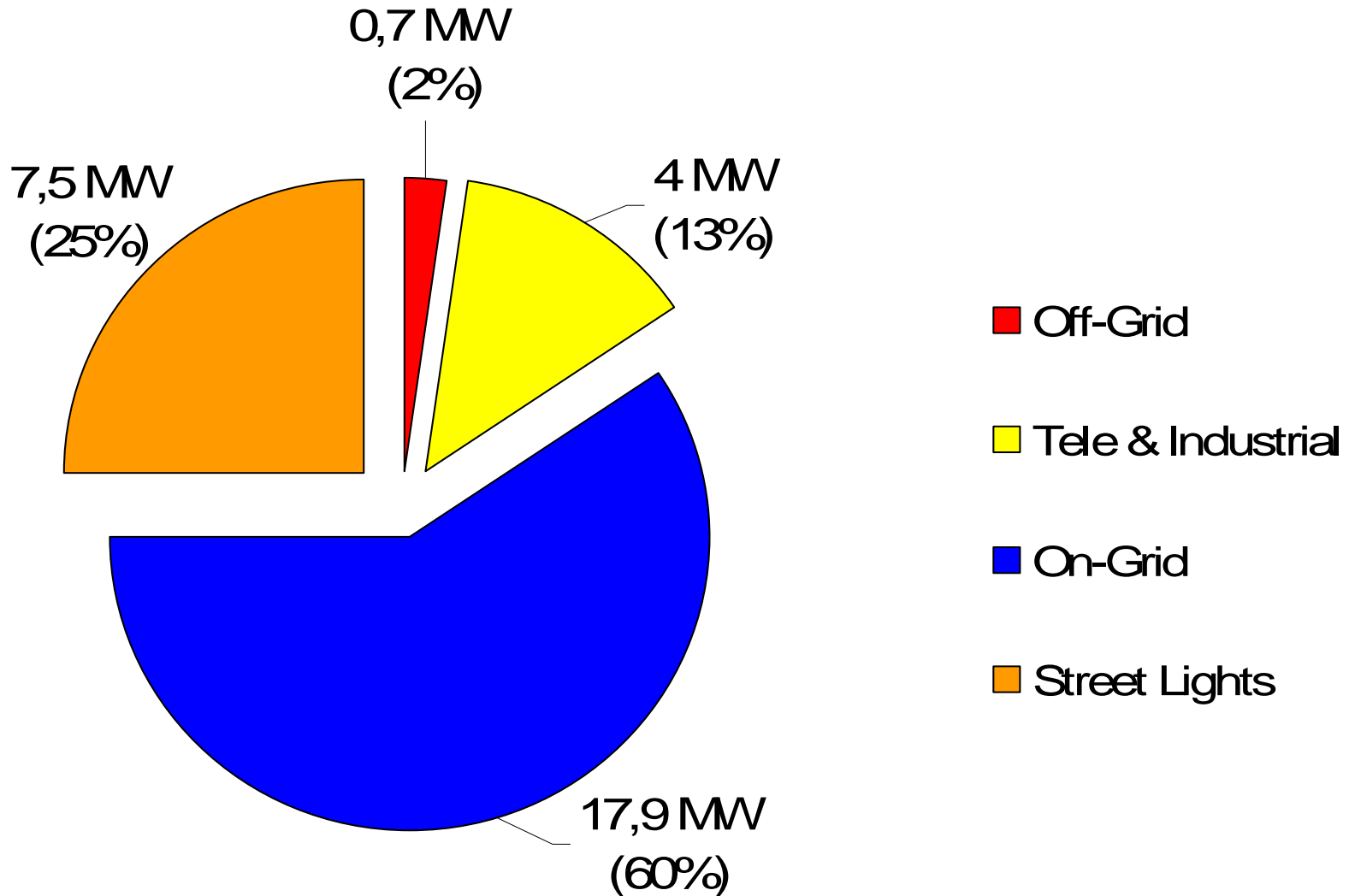


# Solar Market Development (2000-2020)





# China's Solar Market in 2008 (in total 40 MW)





# Natl. Energy Administration Feed-in-Tariff (FiT)

## 国家发展和改革委员会文件

发改价格[2008]1868号

国家发展改革委关于内蒙古鄂尔多斯、上海崇明  
太阳能光伏电站上网电价的批复

内蒙古自治区、上海市发展改革委：

报来的《关于内蒙古伊泰集团有限责任公司 205 千瓦太阳能聚光光伏电站上网电价的请示》（内发改价字[2008]422 号）和《关于核定上海崇明前卫村太阳能光伏电站上网电价的请示》（沪发改价公[2007]004 号）均悉。经研究，现批复如下：

一、核定内蒙古鄂尔多斯伊泰集团 205 千瓦太阳能聚光光伏电站和上海崇明前卫村太阳能光伏电站上网电价为每千瓦时 4 元（含税）。

二、以上电价自光伏电站投入商业运营之日起执行，高出当地脱硫燃煤机组标杆上网电价的部分纳入全国分摊。若项目运行成本高于核定的上网电价水平，当地政府可采取适当方式给予补贴，或纳入当地电网销售电价统筹解决。

国家发展改革委

二〇〇八年七月二十一日

主题词：能源 太阳能 电价 批复

August 2008:

Shanghai Chongming Island:  
1 MW Inner Mongolia: 205 kW

FiT: € 0.40 / kWh

Duration: unclear

Today: Discussed FiT

RMB 1.09-1.50 / kWh

Final Announcement: Unclear



# Ministry of Finance - Solar Subsidy-Programme



## 关于印发《太阳能光电建筑应用财政补助 资金管理暂行办法》的通知

财建[2009]129号

各省、自治区、直辖市、计划单列市财政厅(局),新疆生产建设兵团财务局:

为贯彻落实《可再生能源法》,落实国务院节能减排战略部署,加快太阳能光电技术在城乡建筑领域的应用,我们制定了《太阳能光电建筑应用财政补助资金管理暂行办法》。现予印发,请遵照执行。

财政部

二〇〇九年三月二十三日

## Key Features

- Subsidy RMB 15-20 Wp installed
- Priority BIPV / Roof-top
- Minimum capacity 50 kWp systems
- Eligibility: cell type (mono, poly, thin) must have a minimum efficiency of 16, 14, and 6% respectively
- Cap (Budget / Capacity) unknown
- Submission deadline 1) May 15 2) August 30, 2009

**By May 15 submitted applications amounted to approx. 600 MW ! By August 30 ... GW !!!**



# Ministry of Finance, Ministry of Science and Technology, Natl. Energy Admin.

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- Golden Sun Programme (July 21, 2009)
  - Duration 2-3 years
  - Support demonstration projects up to 500-600 MW or 20 MW cap per province
  - Subsidy 50% for on-grid // 70% for off-grid sys.
  - Budget – Cap unknown

Chinese Academy of Science submitted to the State Council a Long-Term Solar Dev. Plan until 2050.

Proposed Targets:

2010 (3.5 GW) 2020 (50 GW) and by 2050 (500 GW)





# China - Solar Snapshot

- Hunan Prov.: 1 GW module cap.; 30.000 t UMG-Si; 10.000 t polysilicon; 200 MW mono-si wafer, 1 GW poly-si wafer by 2012
- Jiangxi Prov.: € 400 Mio invest.: 3 GW module cap.; 3 GW cell cap.; 1 GW wafer cap.
- Zhejiang Prov.: ReneSola will construct a combined 5 MW BIPV
- Jiangsu Prov.: By 2011: Target of 10 GW prod.-cap (module and cells)
- Shandong Prov.: € 130 Mio for Cell and Module Prod.-Cap.
- Jiangsu Prov.: € 60 Mio invest.: 200 MW thin-film cell prod.
- Zhejiang Prov.: € 300 Mio invest.: 1 GW thin-film cell prod.
- Jiangsu Prov.: 1,5 MW Roof-Top project (Suntech)
- Qinghai: € 6 bln. Solar Dev. Plan until 2015
- Hubei Prov.: € 100 Mio invest.: 30 MW plant
- Jiangxi Prov.: Q-Cells & LDK Joint Venture
- Qinghai Prov.: 10 MW plant announced
- Yunnan Prov.: 200 MW Roof-Top Prog.
- Fujian Prov.: 16 MW plant
- Jiangxi Prov.: 30 MW plant

**May 14-30, 2009**

**Investment € 7 bln**

**Prod.-Capacities**

**10.000 t poly-silicon**

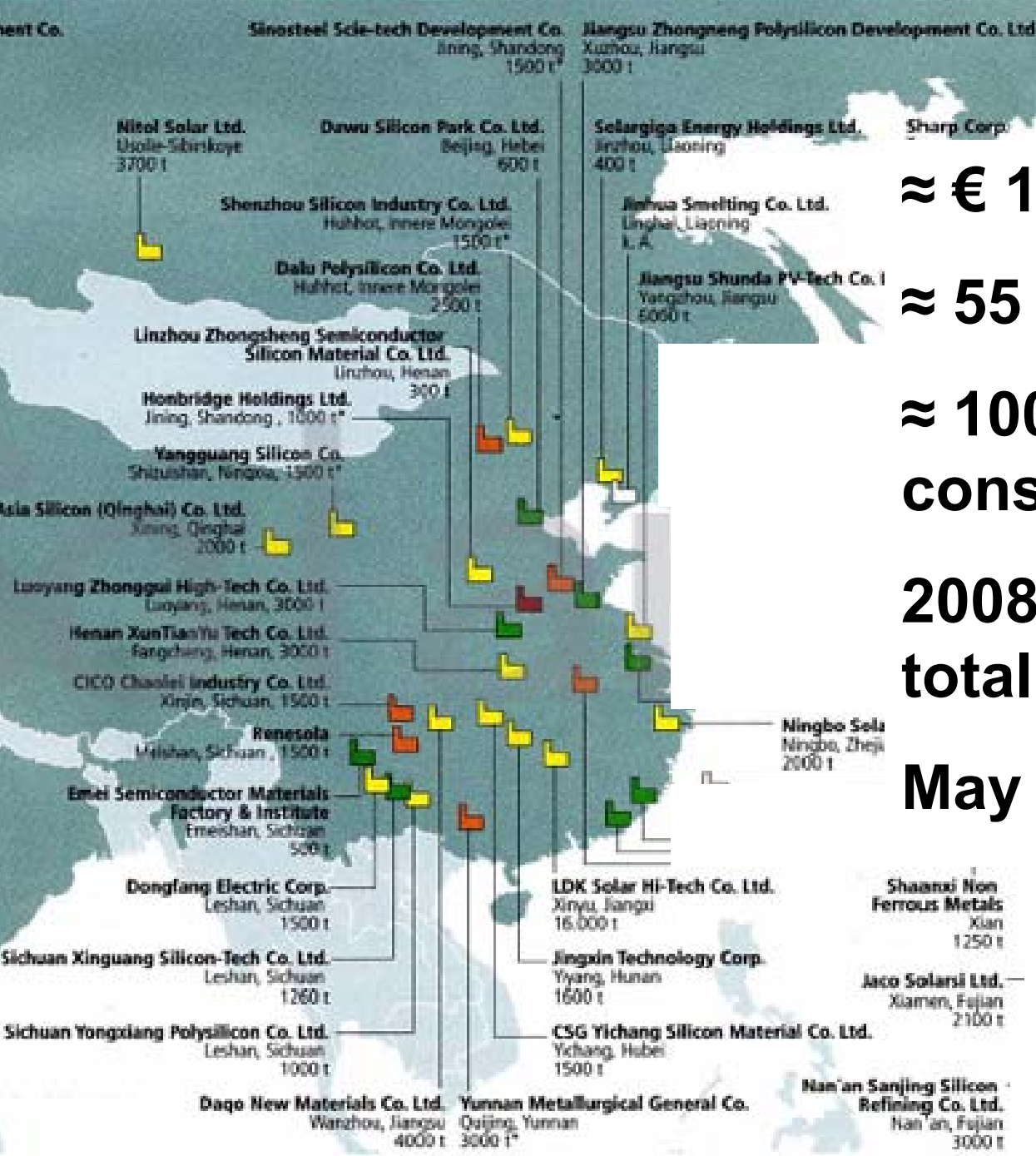
**30.000 t UMG-Si**

**4 GW Module**

**2 GW Wafer, 3 GW Cell**

**1,2 GW Thin-Film Cell**

**Installations: approx. 300 MW**



≈ € 10 bln investment

≈ 55 companies

≈ 100.000 t under construction

2008: ≈ 4500 t output;  
total demand ≈ 15000 t

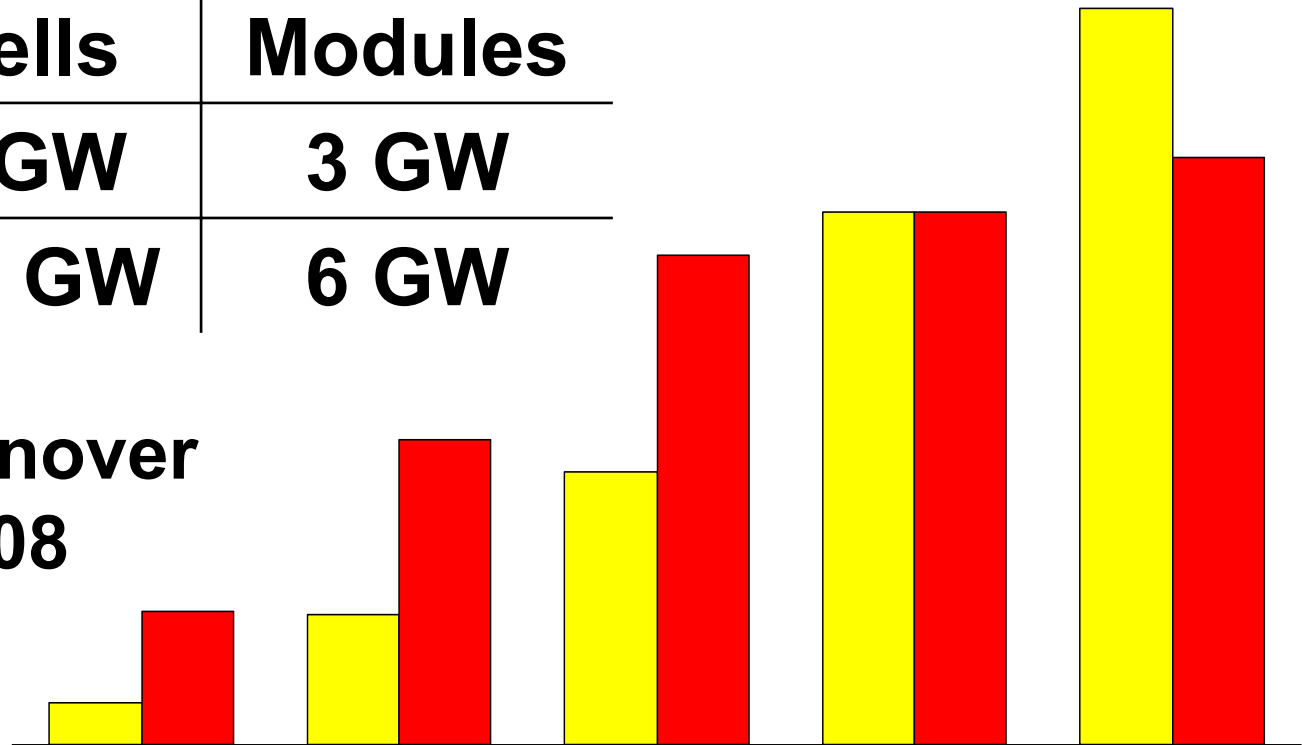
May 09: Ø US\$ 48 kg



# Cell & Module Production Capacity (2005-2009)

Output	Cells	Modules
2008	2 GW	3 GW
2009 e	4,3 GW	6 GW

Industry Turnover  
€ 2 bn. in 2008



■ Cells (MW)	388	1221	2549	5000	6900
■ Modules (MW)	1250	2850	4580	5000e	5500e



# Solar Project Announcements

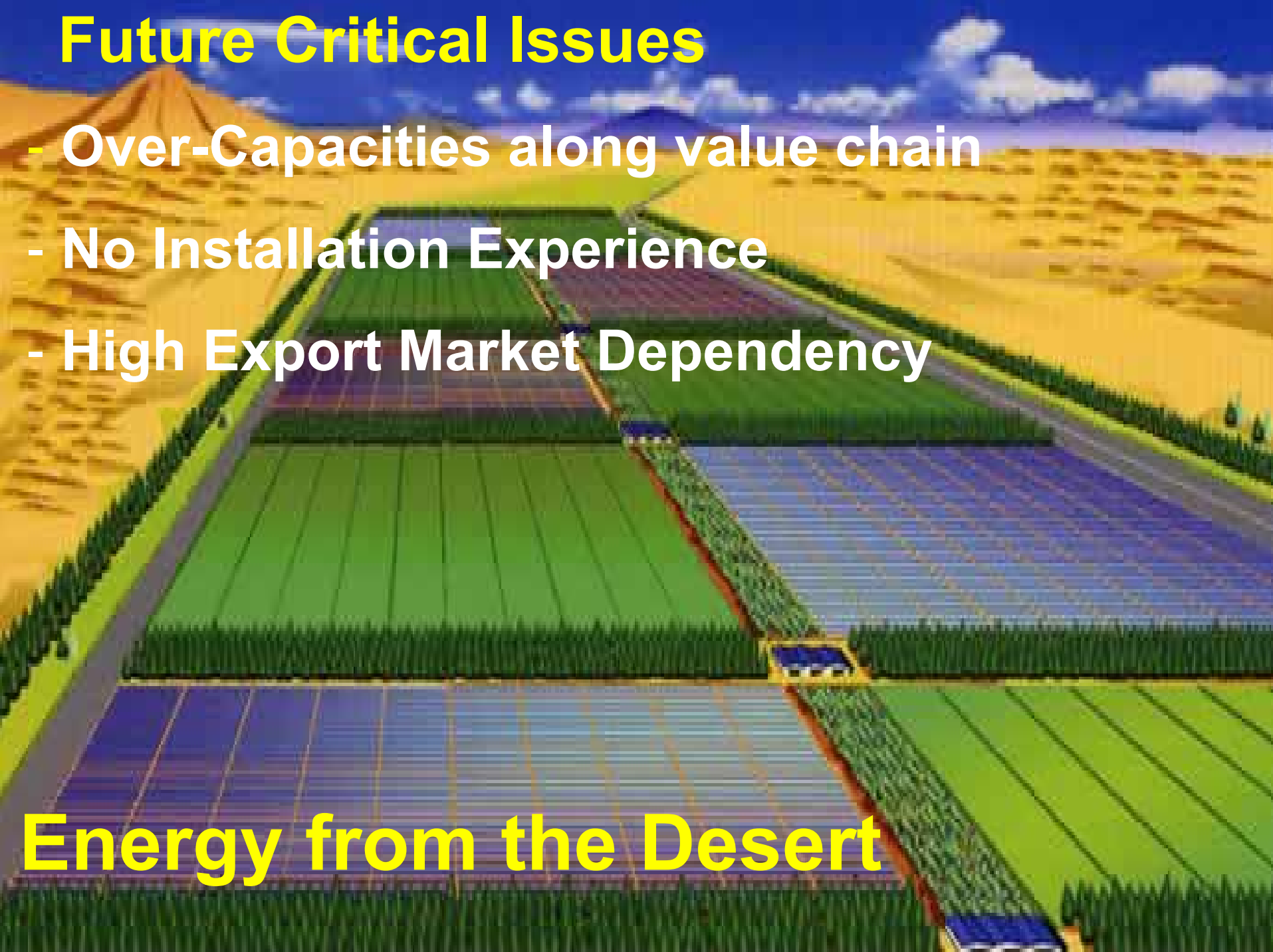
Investor	Signing location	Area	Signing date	Scale MW	Scale for primary construction(MW)
Fujian San'an Group	Qinghai	geermu		30	
Qinghai New Energy Group	Qinghai	geermu		30	
Zhonghuan Engineering Corp.	Qinghai	Geermu			
Fujian Junshi Energy Group	Qinghai	Geermu	Nov-08	10	
China Guangdong Nuclear Energy Development Co. ,Ltd	Qinghai	Da Qaidam Action Committee	2009/6/29	10	
China Guangdong Nuclear Energy Development Co. ,Ltd	Ningxia	Pingluo County, Shizuishan	2009/6/22	200	10
China Guangdong Nuclear Energy Development Co. ,Ltd	Ningxia	Managing Committee, Ningdong Energy & Heavy Chemical Industry Base,yinchuan	May-09	300	10
China Guangdong Nuclear Wind Power Generation Co. ,Ltd	Qinghai	S&T department Qinghai	May-09	10	10
China Guangdong Nuclear. Enfinity ,LDK	Gansu	Dunhuang	2009/3/20	10	
Enfinity New Energy Development, Co.,Ltd	Qinghai	Geermu		100	10
Enfinity New Energy Development, Co.,Ltd	Gansu	Dunhuang	2009/6/1	10	
Enfinity New Energy Development, Co.,Ltd	Ningxia	Shizuishan	2009/6/15	10	
Enfinity New Energy Development, Co.,Ltd	Liaoning	Jinzhou	2009/4/15	25	0.2
Enfinity New Energy Development, Co.,Ltd	Inner Mongolia	The blue banner (zheng lan qi)	2009/4/21	100	10
China Technology Development Gorp, Qinghai New Energy Group	Qinghai	Haixi	2008/12/27	1000	30
Chint Group	Ningxia	Shizuishan	2009/6/20	100	Operation started
Sun Tech	Qinghai	Wulan County, Haixi	2009/6/6	5000	500
Sun Tech	Sichuang	Panzhuhua	2009/6/26	500	
Sun Tech	Ningxia	Zhongnong District, Shizuishan	2009/6/11	10	
Sun tech, Yunnan Provincial Power Investment and other investors (Huaneng)	Yunnan	Shilin	2008/12/19	66	
China Singyes Solar Technologies Holdings	Sichuang	Xichang	2009/3/1	100	

**By Sept approx. 10 GW to be installed by 2015!**

# Future Critical Issues

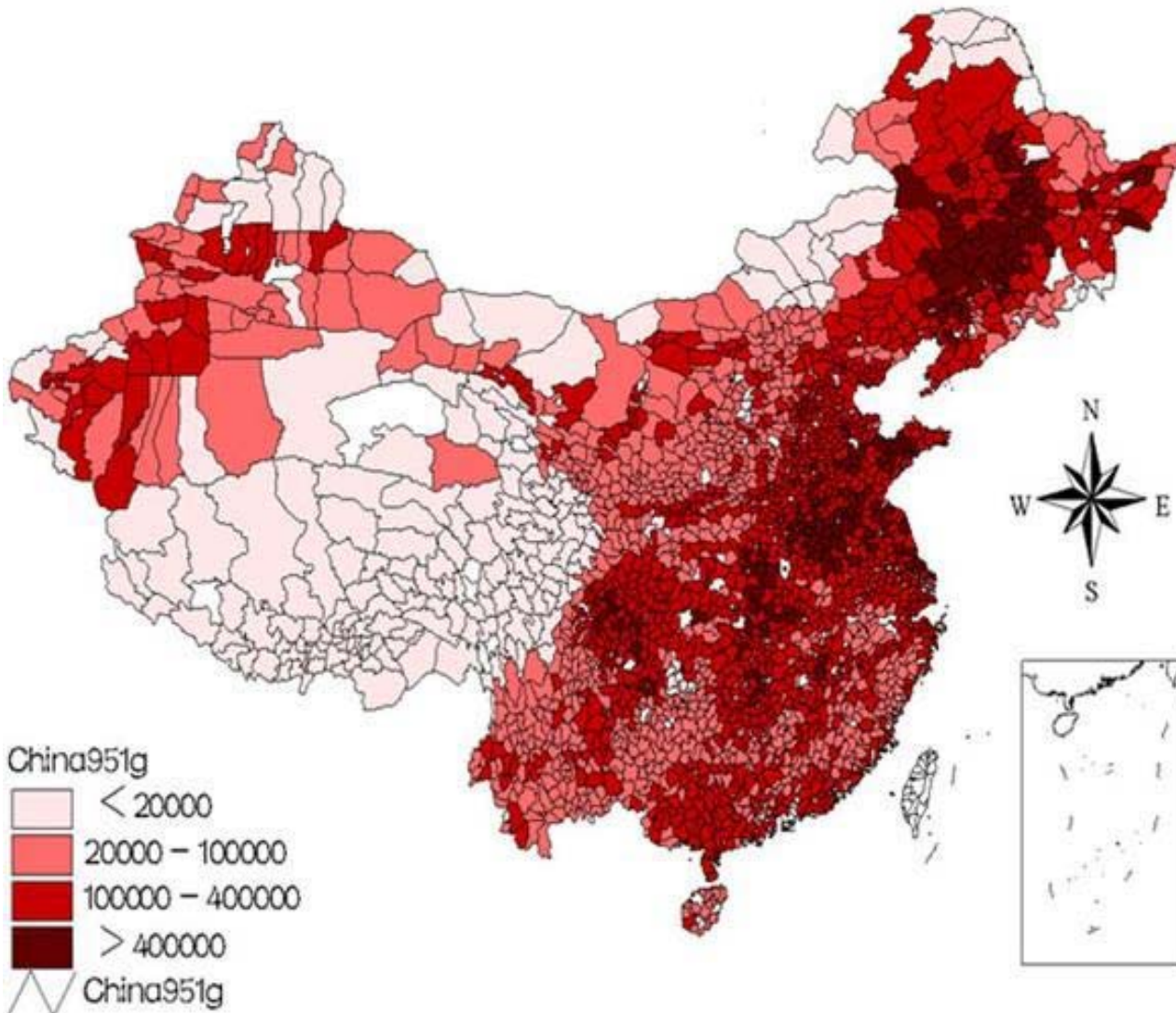
- Over-Capacities along value chain
- No Installation Experience
- High Export Market Dependency

**Energy from the Desert**





# Provinces for Construction of Biomass Power Plants



Provinces with the highest density of straw per capita are, Heilongjiang, Xinjiang, Jilin, Liaoning, Hebei, Shanxi, Henan.



# Natl. Targets for Biomass Energy Generation Capacity

Biomass	2010	2020
Power Generation	5.5 GW	30 GW
Solid Biomass Pellets	1 Mio t	50 Mio t
Biogas	19	44
No-Crop based Bio-ethanol	2 Mio t	10 Mio t
Biodiesel	0.2 Mio t	2 Mio t





# Biomass

## Future Critical Issues

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- Rumors to reduce national target
- Sector faces financial difficulties, due to high cost for purchase, collection and storage of feedstock
- Technical challenges due to nature of feedstock
- Heilongjiang – future hot spot (largest project pipeline, due to streamlined collection of feedstock due to SOE)

2008 New Installation	2008 Total	2009 Installation Forecast	2010 Govt. Target
800 MW	2880 MW	1020 MW	5000 MW





# Summary & Outlook

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## **Political Framework Conditions**

- Targets, Programmes & Investments confirms the political commitment to promote the deployment of renewable energies
- Stimulus Package for domestic economy facilitates finance / funding

## **Industrial Development**

- Potential to become the Future Global Centre of Production
- Compliance with intl. quality standards has a high priority
- Good local infrastructure will further enhance cost-competitiveness
- Increasing investment in R&D to reduce dependency on foreign know-how

## **Market Development**

- Explosive future domestic market development expected driven by new natl. targets
- Focus on EU / US Markets will remain unchanged
- Opportunities for foreign companies will remain



# Contact Details

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Xicheng District, Muxidibeili , Beijing 100038  
Tel: 0086 (10) 6390 89 88 Ext. 211  
Fax: 0086 (10) 6390 89 89  
Email: [frank@eep.org.cn](mailto:frank@eep.org.cn)  
Note: Valid only until Nov 23, 2009 !

Beyond November:  
Email: [Frank.Haugwitz@gmail.com](mailto:Frank.Haugwitz@gmail.com)  
China Renewable Energy Information  
[www.frankhaugwitz.info](http://www.frankhaugwitz.info)