

Climate Change and Energy - Opportunities in China

Jerry Li

Asia Pacific Regional Vice President - Hitachi Metals

Industrial Advisor - AGTAA



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Socioeconomic development and energy consumption

Macro	Build a well-off society by 2020 → annual GDP growth to be 7.2%
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- Local governments compete for GDP growth
- Accelerated industrialization and urbanization
- Rapid increase in fixed assets investment (27.7% up in 2003, 25.8% in 2004)
- Secondary industry growing faster than others, reaching a proportion of 53% in 2004
Heavy industry (61.0% in 2002 to 64.3% in 2003, and to 67.6% in 2004)
- Domination of products with high energy consumption
Ferrous metallurgy grew by 26.8% in 2004, non-ferrous by 22.4%, chemical industry by 18.2%, non-metallic minerals by 19.9%, cement by 12.5%

Energy Demand and Supply – A snapshot

China's energy consumption in 2004: **1.97 billion tce**

Coal: 1.87 billion tons, up 14.4%
Crude oil: 290 million tons, up 16.8%
Natural gas: 41.5 billion m³, up 18.5%

Ave. growth (01-04): 9.89%
2003: 13%
2004: 15.2%

Electric power output in 2004: **2,187 billion kWh**, up **14.5%**

Newly installed capacity was 50.5GW in 2004
may exceed 70GW in 2005 (breaking world's record!)

Current installed capacity is 430GW, world's 2nd largest.

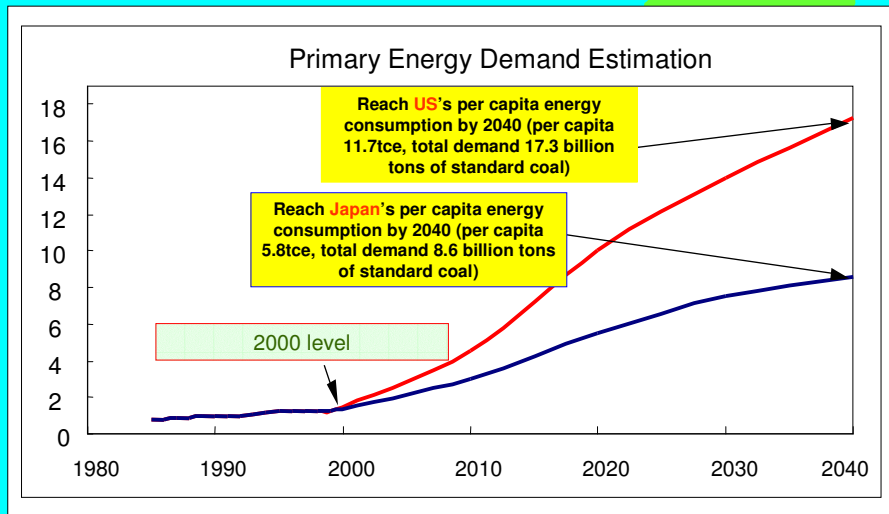
Coal output in 2004: **1.956 billion tons** in last year, up **17.3%**

Abnormally fast growth – was 1.38 billion tons in 2002

Crude oil output: **175 million tons**, up **2.9%**

Energy Consumption Elasticity Coefficient :
Before 2000: approx. 0.5
2003: 1.39
2004: 1.60

Future Energy Requirement





Economy and Energy

The Economy	<p>Big size but low level in per capita terms</p> <ul style="list-style-type: none"> - World's 6th largest economy - 2004 Per capita GDP = US\$1250, which is about 5% of developed countries - Low urbanization, rural population = 770 million - Energy consumption ranking 2nd in the world (10% of world's total) - Per capita primary energy consumption: 0.79 tons of standard coal - Per capita installed capacity < 0.4KW, which is about 25% of developed countries - Per capita power consumption < 2,000KWh in urban areas, 200KWh in rural areas <p>Fast growth at poor quality</p> <ul style="list-style-type: none"> - Repetitive construction - High energy-consuming industries <p style="text-align: center;"><i>e.g. 2004 Output - Steel & Iron 273 million tons, Cement output 970 million tons</i></p>
Energy Structure	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;"> <p>World</p> </div> <div style="text-align: center;"> <p>China</p> </div> </div> <p>In 2004, China's primary energy consumption was 1.97 billion tons of standard coal. Of which crude coal was 1.87 billion tons, accounting for 67.7%; crude oil was 290 million tons, accounting for 21.1%, natural gas was 41.5 billion m³, accounting for 3.0%; hydro and nuclear power was 3,781kwh, accounting for 8.2%.</p>

Resources Availability

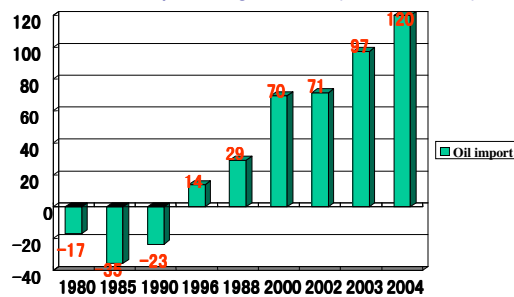
China's fossil energy output in 2002 and exploitable reserve verified by the year end

		2002						
		Consumption		Output		Year end exploitable reserve		Reserve/ exploitation ratio
		Int'l Ranking		Int'l Ranking		Int'l Ranking		
Coal	billion tons	1.37	1	1.38	1	114.5	3	82
Oil	billion tons	0.2457	2	0.167	5	2.5	11	14.8
Natural gas	billion m ³	30.1	18	32.66	16	1510	21	46.3

Per capita reserve of fossil resources only 55% of world level, oil 10%, natural gas only 5%

For renewable energy, hydropower resources have a technically exploitable capacity of 378.5GW and an economically exploitable capacity of 294GW. Wind energy: on-land technically exploitable capacity: 250GW

China's oil net import during 1985-2004 (unit: million tons)



What are the Targets?

China's mid-and long-term economic targets

By 2020, quadruple GDP on the basis of 2000 (annual growth rate 7.2%)

- Build a well-off society in an all-round way

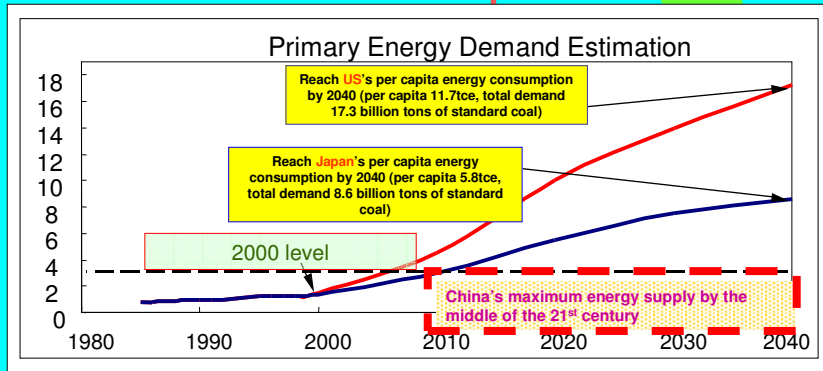
Basically complete industrialization by 2030

- Urbanization comes of age; basically complete infrastructures
- High energy-consuming industries gradually decrease

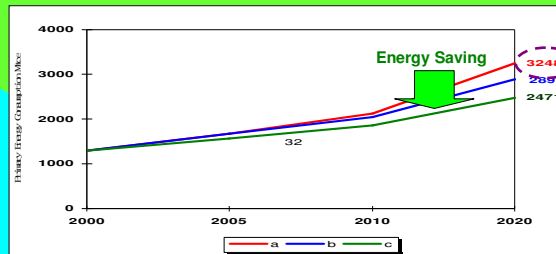
Socioeconomic development: a moderately developed country by 2050

- Comfortable life
- Convenient traffic
- Clean water and blue sky

A REAL Gap Exists

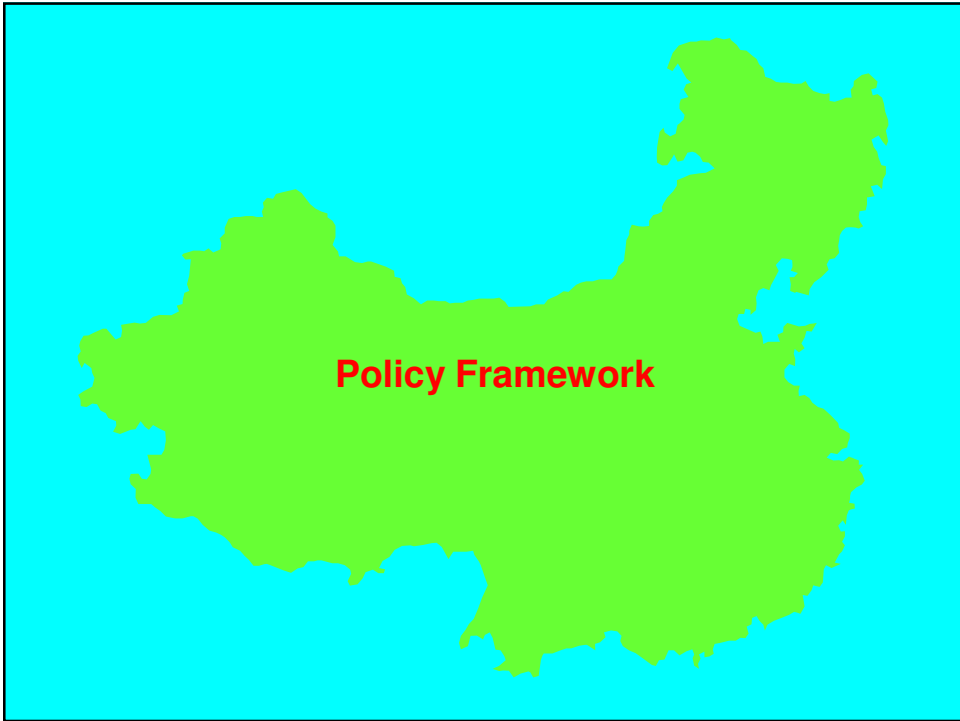


Made in 2001 under the assumption that elasticity coefficient is 0.5. Recent studies are showing far higher coefficients (1.39 for 2003 and 1.60 for 2004)



Challenges

Supply	<p>Long-term and stable coal supply is uncertain Over-investment, abnormally fast growth Safety and effective production, frequent fatal accidents</p> <p>Oil import dependence level is increasing and oil supply safety is becoming more important</p> <p>Energy structural improvement is facing challenges</p> <ul style="list-style-type: none"> ▪ Oil price, difficulties in utilizing foreign resources ▪ Coal-dominated energy structure will continue
Utilization	<p>Low efficiency in energy utilization</p> <ul style="list-style-type: none"> ▪ Low GDP per unit energy consumption ▪ Domination of high energy-consuming industries ▪ Efficiency improvement initiatives such as shut down small, inefficient coal-fire generators are difficult under power shortage
Environmental	<p>Coal consumption has put severe challenges to eco-environmental protection</p> <ul style="list-style-type: none"> ▪ CO₂ emission – over 3 billion tons ▪ SO₂ emission – over 20 million tons ▪ CMM emission – 9-12 billion m³ ▪ 73.7% of the population in sub-standard environment



Policy Framework	
Ensure Supply	<p>Enhance domestic energy supply capacity building</p> <p>Modernize coal industry</p> <p>Strategic oil reserve</p> <p>Participate in international market</p> <ul style="list-style-type: none"> -Cooperation with overseas oil companies -Spot / future trades -Diversify import sources and regions
Save Energy	<p>Rationalize Demand</p> <ul style="list-style-type: none"> -Transform economic growth pattern -Use technology to improve energy efficiency -Max. consumption quota & min. efficiency criteria -Energy efficient coal mines and power plants <p>Conceptualize “energy saving” as “the fifth conventional energy”</p> <ul style="list-style-type: none"> -Energy saving as basic national policy
Diversify Energy Structure	<p>Promote hydro, nuclear and renewable power</p> <ul style="list-style-type: none"> -20 million KW wind power planned for 2020, 1 billion KW exploitable -10 million KW biomass power planned for 2020, 1 billion tons of standard coal -36 million KW Nuclear power planned by 2020 (4% in China vs 16% world average) <p>Supporting policies</p>



Commercial Perspective – Business Opportunities

Renewable Energy	<ul style="list-style-type: none"> •RE Law comes into force in Jan 2006 •Wind: 0.57GW in 2003, potentially 20GW in 2020 •Small Hydro: 30GW in 2003, potentially 70-80GW in 2020 •Biomass / Biogas / Biofuels: 1.9GW in 2003, potentially 20GW in 2020 •Solar / PV / SWH: 0.05GW PV in 2003, potentially 1GW in 2020
Energy Efficiency	<ul style="list-style-type: none"> •GDP / tce is remarkably low. Current per million USD energy consumption is 3.1 times of world average •Sector specific consumption (per unit product) as compared to world levels: thermal power – 22% higher, steel industry – 21% higher, cement industry – 45% higher, buildings – 2 to 3 times higher •A 10% efficiency improvement = 100GW by 2020
CMM	<ul style="list-style-type: none"> •China's CMM emission = world's 40%. Methane is far more damaging than CO₂ •If 50% could be utilized, the equivalent generation capacity would be 400-800MW
CDM / CER	<ul style="list-style-type: none"> •China could deliver 1.8 Billion tonnes of equivalent CO₂ emission reductions up to end 2012 – current market value would be Euro 36 billion •Supporting RE, EE, CMM
Rural Energy - PV, Wind, Hydro	<ul style="list-style-type: none"> •At the end of 2001, 30 million people still had no access to electricity •Township electrification program – 24,000 villages from 2005-2010
Transport	<ul style="list-style-type: none"> •Biofuels / Hydrogen fuel cells / CNG are all being developed/deployed •Emission standards are aligning themselves with EU standards
Consumer Goods & Buildings	<ul style="list-style-type: none"> •Greenlights program •Appliance certification & labelling programs •Largest market for Solar Water Heaters in the World

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Amorphous Metals



Amorphous Metals – an energy efficient material for transformer application

Reduce transformer core loss by 70-80%
Can potentially save 15-20 billion KWh and reduce 10-16 million tons of CO₂ emission per year in China



Activities in China

- JV Manufacturing
- Technology Licensing / Transfer



Over 15,000 high efficiency amorphous metal transformers are installed

Estimated saving and CO₂ reduction: 66M KWh and 55K tons CO₂ of per year for 25 years

Sizable grid level project on going

 西安中扬电气股份有限公司
XI'AN ZHONGYANG ELECTRIC CORPORATION



Semi-core Reactor – energy efficient option for reactive power compensation

Typically reduce power loss by 30-50%
20-45% size advantage
A 35KV / 20000KVAR semi-core shunt reactor will save 10-15M KWh in its service life of 20 years.



Applications

Transmission & Distribution Grid
High Power Consumption Industrial Users

Case Example

User: Xian High Voltage Power Supply Bureau
Additional Investment Required: RMB 120,000
Energy saving / CO₂ reduction: 145K KWh / 149.94 ton per year
Payback Period: 1.7 years

More examples at <http://www.zvelec.com/cqal.asp>



Inventor and Advocator of Efficient & Low Pollution Combustion Technologies
Beijing Shenwu Thermal Energy Technology Co., Ltd

Advanced combustion technologies – efficient furnace & boiler for heavy industry

Heavy industry is a key driver of dramatic increase in energy demand

Huge number of industrial furnaces and boilers in heavy industries would require efficiency upgrade

Shenwu's technology can typically improve efficiency by 20-50%



Applicable Sectors

- Metallurgy, Mechanism and Nonferrous Metal Industry
- Petroleum and Chemical Industry
- Fuel Power Industry
- Ceramics and Glass Industry
- Civil Water, Vapour and Heating Industry

150 advanced furnaces are installed in major Chinese steel manufacturers

Re-fabricated furnaces have saved 74 million GJ, or 2 million tons of oil / eqv. natural gas per year, and reduced 10 million tons of CO₂ emission

More examples at http://www.shenwu.com.cn/achievement_qyl6.htm



Integrate Together for Results
Liaoning Nengfa Weiye Group

China's largest energy saving & design institute

Owns 7 proprietary technologies in combustion, heating, water processing, coal processing, etc.

Project Management

Financing

Manufacturing



Sector Focus

- Electric Power
- Metallurgy
- Petroleum & Chemicals
- Coal
- Automobile
- Basic Infrastructure

Accomplished over 500 energy-saving projects in more than 200 domestic enterprises. Resulting a saving of 100 million tons of coal and a reduction of 70 million tons of CO₂ emission

Accomplished 14 co-generation power plants design

More examples at <http://www.lnemic.com/htmy.htm>

