



ENERGY AND NATURAL RESOURCES

Think BRIC!

Key considerations for investors targeting the power sectors of the world's largest emerging economies

CHINA

ADVISORY





Contents

Contents	3
Foreword	4
Introduction & Methodology	5
Executive Summary	6
1. China – The Country in Figures	9
2. Population	10
3. Economy	12
4. Electricity Market	18
4.1. Electricity demand	20
4.2. Electricity supply	27
4.3. Current ownership structure of the power industry of China	32
4.4. Main determining factors in the development of the electricity industry	36
5. Investment Opportunities	43
Acronyms	44
KPMG's ENR Practice Overview	45
KPMG's <i>"Think BRIC! Key considerations for investors targeting the power sectors of the world's largest emerging economies"</i> publication series	49
Other KPMG Thought Leadership	50

Foreword



Péter Kiss
Partner, KPMG Global Head
of Power and Utilities

Energy is a global industry, vital to economic development and as such has strong political and social implications. The world's largest emerging economies, known in shorthand as the BRIC countries – Brazil, Russia, India and China – are in the top 10 global energy consumers and are home to 40 percent of the world's population.

The strong correlation between economic growth, welfare and energy use means that future demand levels, security of supply, energy mixes, production levels and general market dynamics will increasingly move to the fore as key issues.

Electricity is by nature a unique product. It is indispensable and it has no substitute. It is something we realize the importance of only when we experience a shortage. It is just enough to recall the biggest blackout in U.S. history in 2003 which struck parts of the Northeast, Midwest and even Canada, knocking out power to millions of Americans.

This publication is a part of a series of reports titled "*Think BRIC! Key considerations for investors targeting the power sectors of the world's largest emerging economies: Brazil, Russia, India and China*" – aiming to highlight major trends and challenges shaping the evolution of these countries' power sectors over the course of the next decade in light of the global economic crisis.

In this publication we have attempted to turn market data into meaningful information and include top-level executives' perspectives on the evolution of the Chinese power sector from political, socio-economical, technical, environmental and legal aspects. They offer scenarios they consider adequate to meet the supply-demand balance challenge in the short, mid, and long term.

Major questions raised during this research included how necessary investments in generation, transmission and distribution will be financed in terms of state support, privatization and foreign direct investment, how regulation will support the emerging trends and how global financial turmoil will affect the pace of development.

I trust that the contents of this report will offer you deep insight into these unique, emerging energy industry markets.

A handwritten signature in black ink, appearing to read 'Peter Kiss', written in a cursive style.

Introduction & Methodology

This publication has been compiled by KPMG's Global Power & Utilities Knowledge & Resource Center, based in Budapest, Hungary as the Chinese country report of the "**Think BRIC! Key considerations for investors targeting the power sectors of the world's largest emerging economies**" publication series.

KPMG conducted comprehensive research both on- and off-site in China and our in-depth analysis characterizes the development of the electricity industry.

This report is partly based on a survey conducted by Ipsos, an independent international market research company, assigned by KPMG to interview key decision makers of the Chinese power sector. Based on these interviews, professional databases, evaluations and KPMG forecasts, KPMG's Global Power & Utilities Knowledge and Resource Center compiled predictions for the development of the Chinese power sector up to 2020.

During the survey period of March-May 2009, Ipsos' senior qualitative researchers conducted semi-structured

personal interviews (based on a questionnaire prepared by KPMG) with top-level executives considered to be key stakeholders in the country's power sector. The target groups of the interviews comprised:

1. **Major market participants:** key players in the electricity industry bearing a dominant market position (both state-owned and privately-held integrated electricity companies, TSOs, electricity traders)
2. **Regulatory authorities:** competent ministries, regulatory bodies
3. **Financial institutions:** domestic and international investment banks with dominant market share
4. **WEC** – World Energy Council
5. **Technology suppliers, equipment manufacturers**

The sample consisted of 15 prominent experts working throughout the power sector, and whom KPMG would like to thank again for the wealth of valuable information they shared for this report.

In China, the following listed companies and their representatives contributed to our survey:

Segment	Company
Major Market Participants	1. Guodian Longyuan Electric Power
	2. Huaneng Power Int I- Beijing No.2 thermal power plant
	3. Datang Intl Power
	4. AES
Regulatory Authorities	5. National Energy Administration
Financial Institutions	6. CCB-China Construction Bank
	7. Calyon Bank
Technology Suppliers	8. ICBC
	9. ING Bank
	10. Bank of China
	11. Schneider Electric SA
	12. Siemens
	13. ABB
	14. WEG
	15. GE

Executive Summary

Question: Which country is mixing half the world's concrete and smelting a third of global steel production to support its development projects?

A sobering thought; but it is perhaps facts such as these, rather than citing the oft-quoted population figure – 1.3 billion souls – that help to bring home something of the vastness and vitality of China.

Consider, too, the country's economy, which expanded – nay exploded – at an average rate of 13.4 percent each year between 2000-2008. After faltering in the global downturn, it is fully expected to resume the high growth path of 11 percent annually from 2014 to 2020.

If realized, this will triple GDP per capita, currently at around USD 6,200 (only 18 percent of the European level) to USD 18,865 by 2020.

China's electricity sector – certainly its growth in recent years – is similarly impressive, and its potential similarly awesome. Consumption, a 'mere' 1,200 TWh in 2000, has roughly tripled to around 3,300 TWh today, and is set to roughly double again by 2020.

Such breath-taking expansion naturally brings many challenges, not least of which are concerns over the environment, both locally and on a global scale. Coal-fired generation currently produces 80 percent of

China's electricity, and the vast local deposits mean coal will still account for 70 percent of China's electricity production at the end of the next decade.

In 2008, China invested some USD 83 billion in the electricity sector. Longer term, the International Energy Agency (IEA) estimates China will need to invest USD 2,765 billion into the industry by 2030 to cope with demand – an estimated one quarter of the total global energy sector investment within that period.

How will such a gigantic sum be spent, and what opportunities will it offer investors and suppliers?

The IEA estimates that just under half the total investment will be allocated to generation, and while retrofitting older plants will take significant amounts, total capacity is expected to rise to 1,418 GW by 2020, roughly double that of today.

Indeed, there is a need for new capacity to meet demand, one estimate putting the national shortage at 40 GW in the peaks, a deficit that resulted in power cuts and power rationing in 2008.

As noted, a large proportion of this new capacity will be comprised of modern, coal-fired plants. As one survey respondent put it; *"Coal will still dominate the total power generation mix; the other forms of power are just*

supplementary for the adjustment of the power generation mix."

And while China will be open to any modern developments that enhance efficiency and more environmentally-friendly plants, it otherwise largely has the resources, both physical and human, to carry out this expansion.

The nuclear industry, by comparison, is underdeveloped and lacks both know-how and the latest technology. China, which sees nuclear as a clean alternative to coal, is determined to make radical advances in the nuclear field, aiming to triple its share of production from about 2 percent currently to 6 percent by 2020. While such developments may depend to some degree on the politically sensitive issue of technology transfer, China is also seeking to develop its home-grown nuclear expertise to meet future needs.

Hydro is another potential resource far from fully exploited in China, despite currently supplying about 15 percent of production. This figure is expected to climb to 18 percent within the next decade, but respondents noted that the public concerns over the Three Gorges project on the Yangtze River has *"dampened enthusiasm"* for large hydro schemes, and prospects for new mega projects appear limited.

With oil and natural gas resources limited, many observers believe the next decade will bring huge growth in

renewables. Opinions as to actual numbers vary within the industry, but hopes are high based on one government target of generating at least 15 percent of electricity from wind, solar, small hydro and other renewable sources by 2020.

“Renewable power will have rapid development in the next 5 years as it not only meets the environmental requirements with little pollution, but also enjoys substantial support from the government,” one major financial institution replied in this study.

Estimates of the current capacity of wind generation in China vary somewhat (one puts it at 1.5 percent of the total, i.e., roughly 12 GW) but it certainly does offer huge possibilities.

A study by the Climate Centre of China puts potential onshore capacity at between 700-1,200 GW (i.e., more than the nation’s current total installed capacity of all types) with an additional 250 GW offshore.

Solar energy also has vast potential, most particularly for serving smaller, isolated communities. The National Development and Reform Commission (NDRC) is most optimistic about solar, its energy research unit insisting that the 2020 target for solar generation should be 10,000 MW or more.

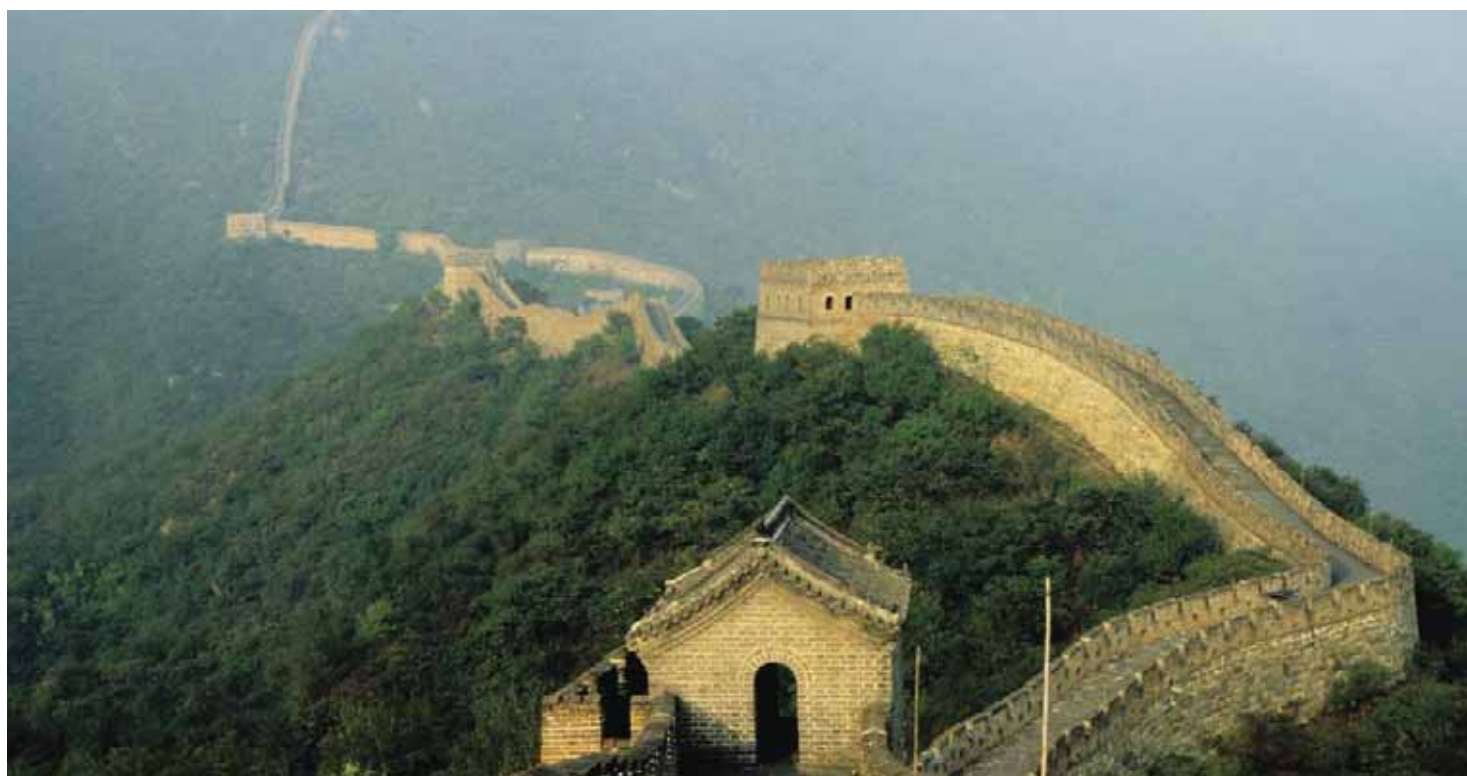
There have already been some notable developments. As one respondent noted; *“In many places in Yunnan Province the roofs have installed solar energy [panels]; the street lights in many parts of the*

Baoding development zone use solar energy; the bird’s nest for the Olympics adopted energy saving technology.”

However, not all observers are so positive, and the viability of most schemes will probably depend very much on the availability of subsidies and cheaper solar panels.

But if electricity is forthcoming, what of the transmission and distribution systems?

The IEA estimates that the networks will account for just over half of all investment in the next two decades. However, opportunities for foreign investors are expected to be limited to supplying equipment, rather than management (and certainly not ownership) of assets. China sees



transmission and distribution as of strategic importance, and despite restructuring its electricity industry in 2002, the concept of opening the networks to even partial foreign ownership is anathema, at least in the current time horizon.

Nonetheless, the grid is considered something of a bottleneck to expanding the power supply, and despite boasting technical losses in the region of only 8 percent (below the world average), the networks must be improved if power cuts are to be reduced. Respondents noted that transmission and distribution grids need more advanced technologies, and stricter management *“is a must”* when dealing with electricity distribution issues, including theft.

In terms of private sector investment, this leaves the generating sector as the most promising. But, even here, the possibilities appear limited. The restructuring in 2002 created five large power companies, competing but all state-owned. These currently manage about 80 percent of all capacity, and their size allows them *“to compete on the domestic and international markets due to their accumulated gigantic assets and influence,”* as this study puts it.

In addition, the regulatory environment is new-born, still undergoing development, and subsidies and cross-subsidies continue to exist. It is not at all clear how successful attempts to eliminate such subsidies will prove.

As one major market participant noted for this study; *“In my opinion the pricing reform in 2009 is critical for the development of both domestic and international companies; the price of electricity is essentially determining the development direction of enterprises.”*

Such factors mean that independent power producers face an uncertain time. Despite this, it is clear that China needs investment and know-how, particularly in the nuclear and wind segments, and the government appears to be willing to provide support and favorable conditions, e.g., on price policy, to achieve this.

Yet there are clearly serious concerns, and a majority of respondents were *“highly cautious”* about entering the generation business since the possible return on investment may even seem to be less favorable than that of past projects.

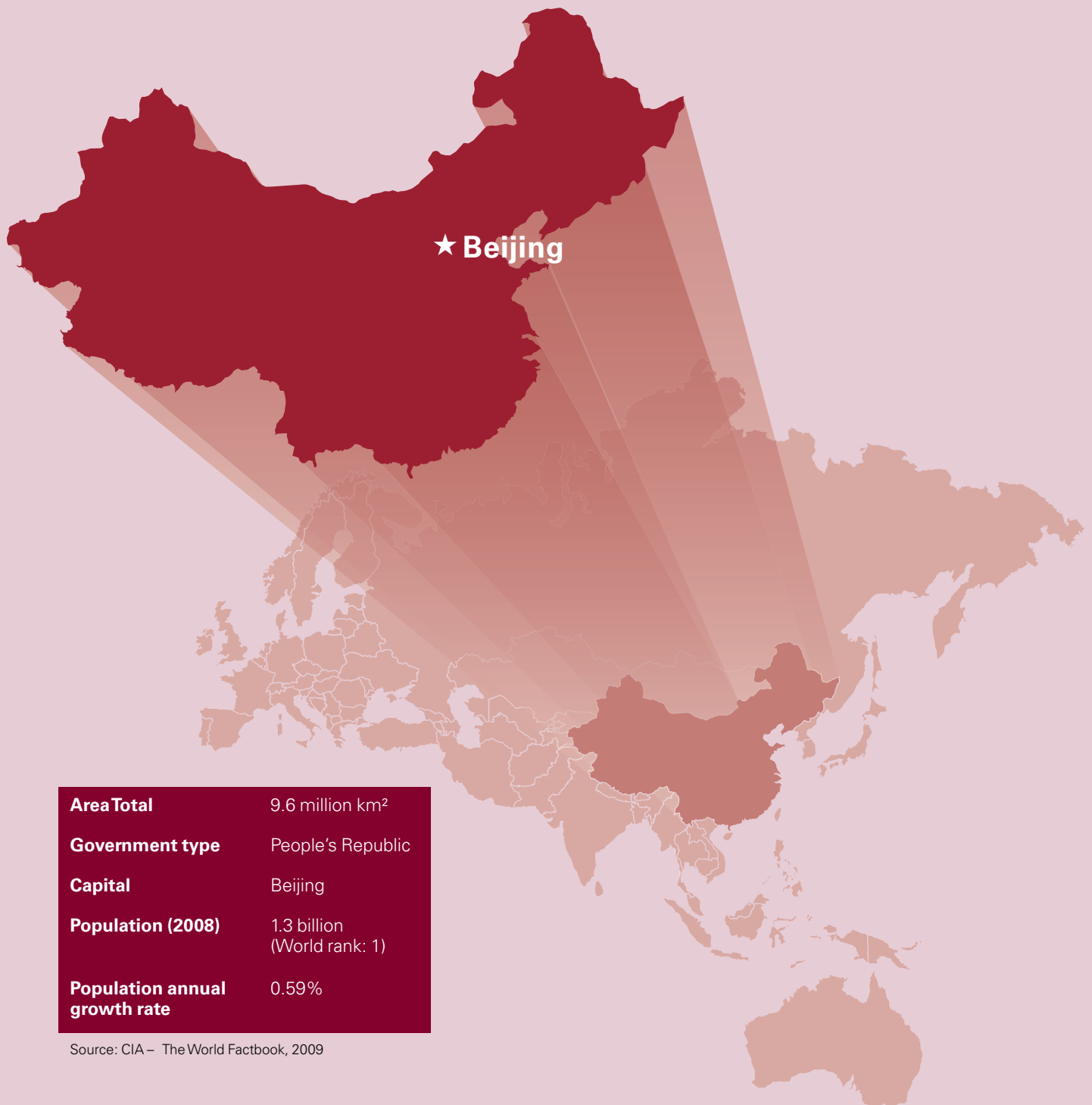
Those experienced in the business world of the resurgent China in the past few decades stress the importance of understanding local conditions. As one major market participant noted; *“There are many non-market factors which can have a deep impact on the whole investment opportunity, so foreign investors must be cautious when entering China’s electricity market. Examples include how to deal with relationships and to learn and understand cultural differences.”*

There is little doubt that for foreign companies with the right know-how, technology or equipment,

opportunities exist to help China in its huge efforts to modernize the infrastructure and deliver electricity to its population – both urban and rural – to make energy savings, and to feed its expanding commercial services and voracious heavy industry.

Success in realizing these goals will take time, skill and patience. As this report notes; *“for foreign investors, service localization is the key to winning more business; for example, having a specialized local service team to serve local clients, and translating international service value into local management.”*

1. China – Country in Figures



Source: CIA – The World Factbook, 2009

2. Population

„The most prominent phenomenon in China in the future would be the urbanization process.“

- Major market participant -



Population growth is one of the main determining factors of energy use in China. Although the share of the residential sector in electricity consumption is only approximately 12 percent, population growth is decisive in respect to domestic demand for goods and products. Furthermore, population growth is also crucial to industrial output and domestic gross production. In the first section of the research, the main trends and expectations of the Chinese demography are presented to frame the future potentials in economy and energy use of the country.

The Chinese population growth rate with regard to the number of inhabitants is approximately 0.59 percent annually, which is lower than the global average (1.07 percent).

The reason behind this is the so-called One Child Policy – in effect since 1979 – which resulted in the slowdown of population growth.

The current growth rate is expected to be constant in the next 12 years and the population of China is forecast to be approximately 1.424 billion in 2020. Figure 1 shows the trend of the population in China in contrast to the population in India.

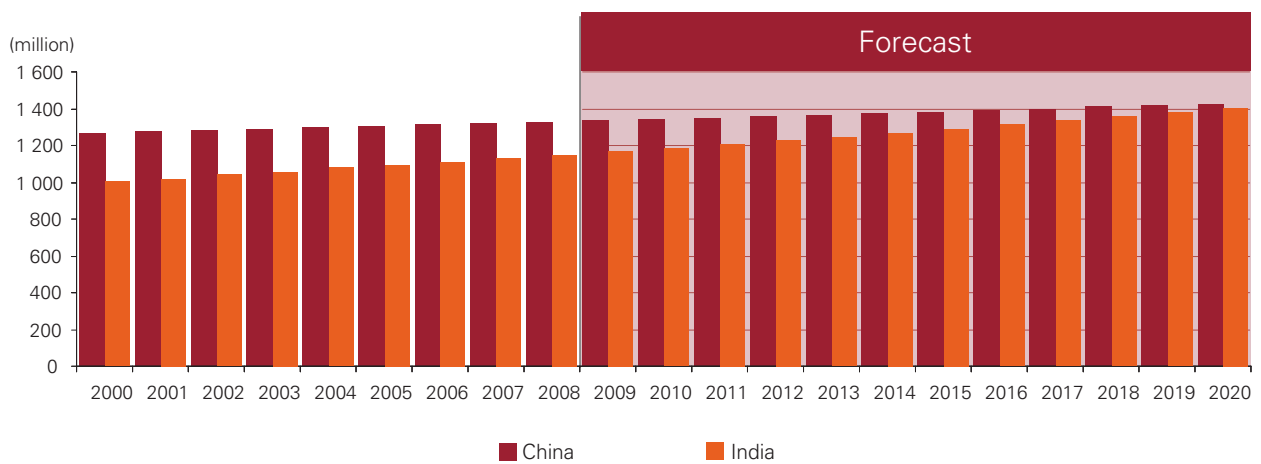
China, as a country developing fast shows unique trends such as extensive urbanization and an aging population. It is expected that in the future, up to 0.4 billion people from rural areas could resettle in cities and towns. At the same time, China is now one of the most rapidly aging countries in the world.

1 Source: Economist Intelligence Unit

2 Source: Economist Intelligence Unit



Figure 1: Population of China (2000–2020)



Source: KPMG, EIU

3. Economy



There is important relationship between the economy and electricity use. The urge to study the relationship between electricity consumption and economic growth arises from the need to understand the complex links between the two. Electricity use depends on technical and economic factors, while it also supports technology advance and stimulates economic growth. Gross domestic product, as one of the most important economic indicators, and electricity use correlate and presumably will continue to do so. Ferguson et al. (2000)¹ find correlation between electricity use and welfare and most studies reveal this relationship between the two. In this part of the research the main factors affecting economic growth are studied to describe its implications and future prospects for the electricity industry in China.

China's economic growth is founded predominantly on an insatiable hunger for energy. In fact, the country is second only to the United States in terms of energy consumption.²

In 2008, 49.2 percent of the Chinese GDP was produced by industrial activities.³ Industry in China is very diverse and includes mining and ore processing; iron, steel and other metals production; machine building; armaments; textiles and apparel; petroleum; cement; chemicals; consumer products, (footwear, toys, and electronics); transportation equipment, (automobiles, rail cars, ships, and aircraft); telecommunications equipment, commercial space launch vehicles, and satellite production among others. According to China's National Bureau of Statistics the industrial output of the country is producing

double digit growth rates⁴ annually, and will continue to do so in the future.

One of the most prominent industrial sectors in China is construction. Many countries have started a wealth of major construction projects recently, but none can compete with magnitude of the Chinese. China is using half the world's concrete and a third of its steel for its numerous construction projects.

Just for the purpose of demonstrating the unimaginable scale, the government has set a plan to upgrade the trade and transportation networks of the country, which means the construction of around 85,000 km of express roads. It is expected that the length of highways in the country will reach the level of the United States before 2030.⁵

1 Source: Ferguson, R., Wilkinson, W., Hill, R., 2000. Electricity use and economic development. Energy Policy. 28, 923-934

2 Source: OECD/IEA

3 Source: CIA – The World Factbook, 2009

4 Source: <http://www.stats.gov.cn/enGliSH/>

5 Source: www.chinaorbit.com



Figure 2: Forbes Global 2000 ranking of Chinese companies (2009)

World Rank	Company	Industry	Revenue (billion USD)	Profits (billion USD)	Assets (billion USD)	Market Value (billion USD)
12	ICBC	Banking	53.60	11.16	1,188.08	170.83
14	Petro China	Oil & Gas Operations	114.32	19.94	145.14	270.56
23	CCB - China Construction Bank	Banking	42.98	9.45	903.35	119.03
30	Bank of China	Banking	40.10	7.70	817.84	105.04
33	Sinopec-China Petroleum	Oil & Gas Operations	154.28	7.43	100.41	93.50
72	China Life Insurance	Insurance	26.20	5.32	127.83	83.26
139	China Telecom	Telecommunications Services	24.46	3.25	54.59	27.66
141	Ping An Insurance Group	Insurance	18.76	2.56	94.63	35.33
143	Bank of Communications	Banking	13.69	2.78	288.59	34.38
221	China Merchants Bank	Banking	8.15	2.09	179.13	30.68

Source: Forbes

Despite the serious effects of the global financial meltdown, China remains the third largest exporter of goods in the world, a fact that contributes greatly to the unprecedented growth rates of its industry.⁶ Over the past 18 years, exports have increased more than tenfold, far exceeding the expansion rate of world trade that was experienced over the same period.

In the last decade, China has become the most important trade partner of the European Union as China has become specialized and sophisticated in export-focused production.

In the past, the economy of China was a communist centrally planned system which was mainly closed to foreign investments.

As a result of the reforms dating back to the 1970s, China is currently fairly market-oriented, and with a fast developing private sector, the country is a major player of the global economy.

Since the territory of China is nearly 9.6 million km², the economic development in the country varies depending on numerous factors. In general, the coastal provinces are more advanced than continental areas.

With relatively stable financial and social conditions, China is regarded as one of the most favorable locations for investment. The opening of the country's economy resulted in a large inflow of capital in 2008, with the volume of foreign direct investment at USD 92.4 billion⁷.

However, there are still sectors that are somewhat protected by the government. These areas are important from an "economic security" point of view. Therefore, the leading state-owned market players of these areas are supported through different actions in order to preserve their position locally and become competitive on the global market. For example, only public investment goes into power transmission and distribution, private and foreign investments are not allowed.

The main economy related challenges China faces are the following:

- sustaining adequate job growth,
- reducing corruption and other economic crime,
- keeping environmental damage and social strife under control as the economy rapidly transforms.

30 years after the launch of the economic reforms resulting in constant development, foreign demand for Chinese exports decreased for the first time in 2008 due to the global financial crisis. In order to facilitate recovery and further growth, the government is committed to the persistent reform of economy as well as intending to take the necessary actions to increase domestic consumption and ease export dependence.

Nominal GDP

With the second-largest economy in the world, the nominal GDP of China was USD 8,148 billion in 2008, which is roughly 52 percent of the corresponding value of North America at purchasing power parity (PPP). China contributed to the World's total GDP with 11.9 percent in 2008.

The Compound Annual Growth Rate (CAGR) of the Chinese nominal GDP was 13.4 percent between 2000 and 2008, which is the most significant growth rate out of the observed BRIC countries. As a result of the financial crisis, the stable growth trend of the Chinese economy is expected to slow down to approximately 8 percent for two years. However, China is expected to recover from the turmoil and the

Figure 3: Main economic indicators

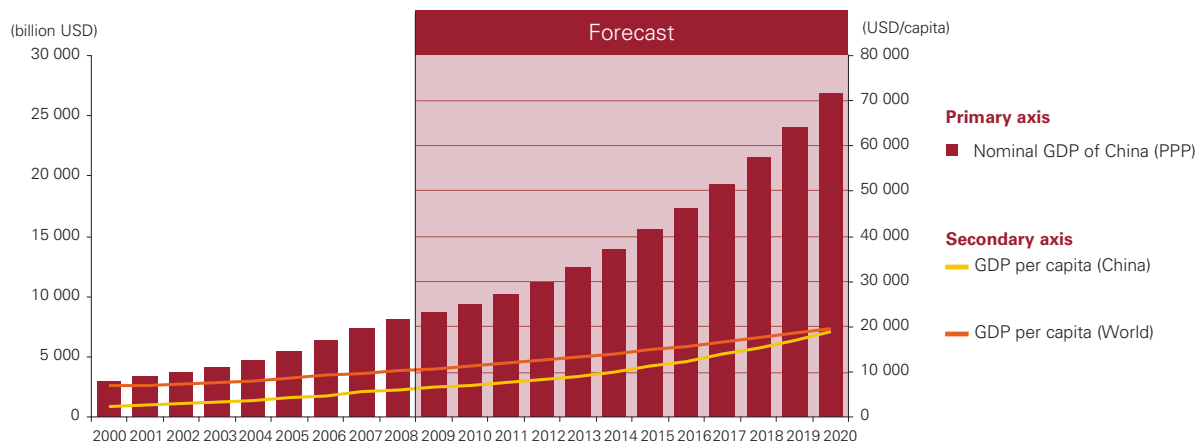
GDP (PPP)	USD 8 148.1 billion (2008)
GDP real growth rate	9.8 % (2008 est.)
GDP/capita (PPP)	USD 6 135.6 (2008 est.)
GDP composition by sector	agriculture: 10.6% industry: 49.2% services: 40.2% (2008 est.)
Labor force	807.7 million (2008 est.)
Labor force by occupation	agriculture: 43% industry: 25% services: 32% (2006 est.)
Unemployment rate	4% (2008 est.)
Level of electricity provision to households:	Total 98% (2009)
Industrial production growth rate	10.7% (2008 est.)

Source: KPMG, Economist Intelligence Unit

- strengthening the social safety net,

⁶ Source: www.imf.org

⁷ Source: PRC Ministry of Commerce (MOFCOM)

Figure 4: China: Nominal GDP (PPP), GDP per capita

Source: KPMG, EIU

nominal GDP is predicted to grow by more than 9 percent annually from 2011. Based on the expectations, between 2014 and 2020 the CAGR of the Chinese nominal GDP will follow the average growth rate of the period of 2000-2013, which is above 11 percent annually. By the year 2020, the nominal GDP of China will represent ca. 18 percent of the world's total GDP at purchasing power parity (PPP).

GDP per capita

GDP per capita in China was approximately USD 6,135 in 2008, which is 18 percent of the Western European level (USD 34,420) and roughly 60 percent of the global average.⁸ As a result of the reduced population growth rate and the significant growth of the Chinese economy, the value of GDP per capita will increase in the examined period (2000-2020) by approximately 11 percent annually, which is roughly

two times higher than the average global growth rate. By the year 2020, the GDP per capita of China is predicted to reach USD 18,865 which would be slightly under the global average.

Foreign investment

China will retain strong state control, leaving little or no room for private investors to enter the energy sector. Strategic assets like the grid network (power transmission and distribution) are considered to be critical for economic and social development, thus the state will maintain control.

How do you see the attractiveness of China for foreign capital investment during the course of the next five years?

As a fast developing economy, China is considered to be a hot spot for foreign investment. Circumstances have greatly changed compared to the 1980s, when focus was on directly absorbing the FDI, without an obvious priority. Now, with abundant capital reserves, more detailed constraints and criteria are being set for foreign investments.

„Affected by the global economic crisis, the economy in China has to undergo some adjustment.“

- Major market participant -

8 Source: Economist Intelligence Unit



"In the past, China was in urgent need of FDI. Now, there is plenty of capital here and the appeal of foreign investors is no longer their capital; their advanced technology and services will be much more valuable instead."

- Major market participant -

Positive factors:

- China's investment environment is relatively stable, and lacks powerful external influences, so risks associated with investments are less volatile.
- China offers favorable conditions to attract foreign investors (e.g. foreign exchange controls and bank credit).
- The financial environment in China remains stable, its currency (RMB) continues to appreciate
- Government policies are clearer, more fair and democratic.

"Our company headquarters regards China as an investment area, but now they have changed their mind to regard China as a base of production. They invest additional money and have a long-term plan in China."

- Survey participant -

Shortcomings:

- China still limits foreign investments in many ways, such as designating which specific regions and industries are open to investment. In addition, the approval procedure is so complicated that foreign investors often have great difficulty in dealing with it.

"Although the whole investment environment is attractive, there are still some disappointing aspects for foreign investors, for example, the procedure is too complex and it takes great effort to deal with."

- Major financial institution -

- In certain industries affected by the global financial crisis, the amount of absorbed foreign capital is showing a clear downward trend. A few projects funded by foreign investors will likely be postponed. The main reason for this is that the parent company is facing severe financial difficulties.
- Many believe that the Chinese government exerts too much control over marketing activities, resulting in a lack of economic competition which is unfavorable for private and foreign investors.

Energy economy

The global economy has been deeply affected by the unprecedented rate of growth of the Chinese energy sector due to the effort to try to keep pace

Figure 5: Key energy indicators for China, 2006 (million TOE)

Production	1749.29
Import-Export	135.88
Dependency (Net Import/TPES)	7%
Total Primary Energy Supply (TPES)	1878.74
Total Final Consumption (TFC)	1213.4
Conversion Rate (TFC/TPES)	65%
CO₂ emission (million tons)	5606.54

Source: OECD/IEA Energy Balances of Non-OECD Countries, EIA, UNESCAP

Figure 6: Fossil resources of China (2008)

	Proved Reserves	Production	Consumption
Oil	15.5 billion barrels	3.8 million barrels per day	8.28 million barrels per day
Natural gas	2,445 billion cubic meters	76.08 billion cubic meters	83.3 billion cubic meters
Coal	114.5 billion tons	2,782 million tons	2,800 million tons

Source: BP Statistical Review of World Energy, 2009

with the huge demands required for both industrial production and private consumption during the last decade. The primary energy production mix is dominated by coal, the source of nearly 70 percent of the total primary supply. Though 14 percent of the world's proven reserves is at China's disposal, industrial needs, including the power and heating sectors that are responsible for more than 55 percent of the consumption, make China the sixth biggest importer as well as the seventh biggest exporter of coal. Parallel with this, China has become the single largest global producer of CO₂ emissions since 2006, notwithstanding the still average per capita emission.

The rest of the primary energy supply portfolio comes mainly from oil (20 percent), of which a daily 5.5 million barrel import supplements domestic production. Large hydro and developing nuclear power production adds some 7 percent further to the TPES. The largest user of the total supply is industry with a 75 percent share, including the energy sector itself (15 percent).

Industry and transportation cover about 44 percent and 10 percent of the final consumption of energy, respectively. The residential share decreased from 44 percent in 1990 to the recent level below 30 percent.



4. Electricity Market

“Electricity is not just a commercial product, it takes responsibility – to promise people it will all be on the rails.”

- Survey participant -



Before the 1960s, China with a mainly rural population and an underdeveloped industrial sector, relied solely on biomass and coal as a minor and basically self-sufficient energy consumer. However, due to accelerated economic growth, the country became the world's fastest-growing energy consumer within one generation as well as major player on the energy market.

For comparison, China's commercial energy production was twenty times higher by the end of the 1970's than at the time when the People's Republic was established in 1949. Even so, about 40 percent of rural households had no access to electricity. Furthermore, during winter heating related difficulties occurred frequently in the Northern Districts.⁹

Through the major economic reforms started in the late 1970s, the level of

infrastructure investment increased significantly. As a result, the power-generation capacity was expanded; and the electrification of almost all communities and households was realized.

As a part of the government's poverty alleviation program, which defined electrification as one of the main goals, the development of basic infrastructure and the creation of local enterprises was particularly well supported in the mid 80s. Several local networks were established based on hydropower and integrated into the regional grids all around China.

The Chinese Electricity Law which is an important milestone in the development of the power industry was implemented in 1994. With the Law, the rights of investors, managers and consumers were defined and protected; and generation,

distribution and consumption were also regulated. As a result of the rapid development of the power industry in the 1990s, China became the second-largest electricity consumer in the world.

Coal is still considered to be the backbone of the Chinese energy system as about 70 percent of the primary energy supply and 80 percent of electricity generation is based on this source. Oil demand has also been growing quickly since the country began exploiting its first large domestic oilfields. Consequently, as a result of substantial fossil fuel use, environmental related issues have arisen in China both locally (acute pollution) and on a global level (greenhouse-gas emissions). In order to maintain the sustainable development of the country's economy, the environmental issues have to be resolved in the near future.

⁹ Source: International Energy Agency



The state continues to control the energy sector directly, although due to ownership and economic regulatory reforms smaller utilities are now managed by local governments in several cases. Furthermore, corporations outside of the government administration are allowed to enter into certain segments of the industry. The Chinese energy sector is still dominated by numerous state-owned, vertically integrated companies.

The 11th Five-Year Plan¹⁰ proposed by the government and approved by the National People's Congress (NPC) contains several energy related goals for the period 2006-2010. Besides specifying certain infrastructure projects, which have key importance, the following are the main targets:

- reducing energy intensity by 20 percent in 2010 compared to 2005,
- diversifying energy resources,
- protecting the environment,
- enhancing international co-operation, and
- ensuring a stable supply of affordable and clean energy.

The above medium term guideline also identifies necessary actions that should be taken in order to realize these goals, such as proposed institutional and legislative changes, including pricing reforms. Several market players and other stakeholders eagerly anticipate the disclosure of the electricity pricing reform policy in 2009.

„Pricing reform in 2009 is critical for the development for both domestic and international companies...“

- Major market participant -

¹⁰ Source: www.china.org.cn

4.1. Electricity demand

As already mentioned above, China is the second-largest electricity consumer in the world, after the United States. Although the total amount of Chinese electricity consumption currently exceeds 3 million GWh annually, the country's per capita consumption is only about 20 percent of the OECD average.

Demand forecast

The Chinese economy is growing at the fastest rate in the world. GDP per capita rose by about 13 percent between 2000 and 2008 in average¹¹ and is expected to grow by 11 percent on average until 2020.

In addition, China is the most populous country in the world, therefore, the potential for electricity demand growth is particularly high. Figure 7 shows the growth trend of Chinese electricity consumption and per capita consumption compared to the Western European and world average indicators.

Electricity consumption

Electricity consumption in China grew by 12.5 percent annually between 2000 and 2008¹². The high growth rate is expected to continue until 2020 and is based on the predictions that the total annual consumption of the country will reach approximately 6,500 TWh in 2020.

Due to the lack of 40 GW peak capacity, China has been hit by power shortages, culminating in 2008, resulting in power rationing, blackouts and rolling blackouts.

Electricity consumption per capita

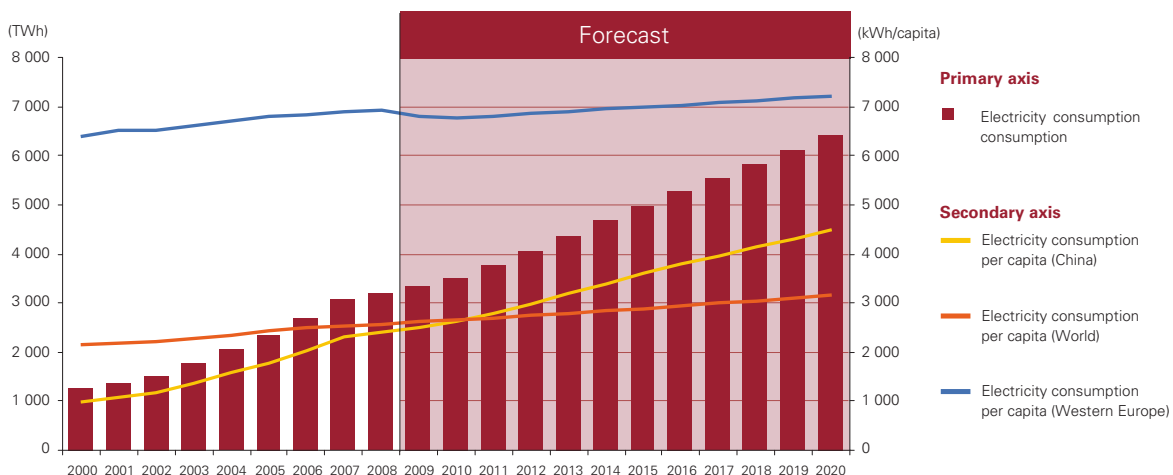
China experienced the highest growth rate of electricity consumption per capita¹³, with nearly 12 percent annually, between 2000 and 2008¹⁴. From the level of 990 kWh/capita in 2000, which was only 46 percent of the global average, Chinese consumption had risen to 2,416

kWh/capita by 2008, which represented 94 percent of the world average. This tendency is not expected to change in the forecast period, and, as a result, Chinese per capita consumption will exceed the global average by approximately 42 percent by the year 2020. The per capita electricity consumption of China is expected to be approximately 4,500 kWh in 2020.

Electricity consumption per sector

The total electricity consumption of China is determined by five main sectors besides residential consumption. Figure 8 shows the share of the six sectors in the total consumption based on the International Energy Agency's database and KPMG's forecast. It provides a summary of Chinese electricity consumption between 2000 and 2020. The total demand of the country has been divided into six major sectors and the rest of the consumption is shown

Figure 7: Electricity consumption, electricity consumption per capita



Source: KPMG, EIU

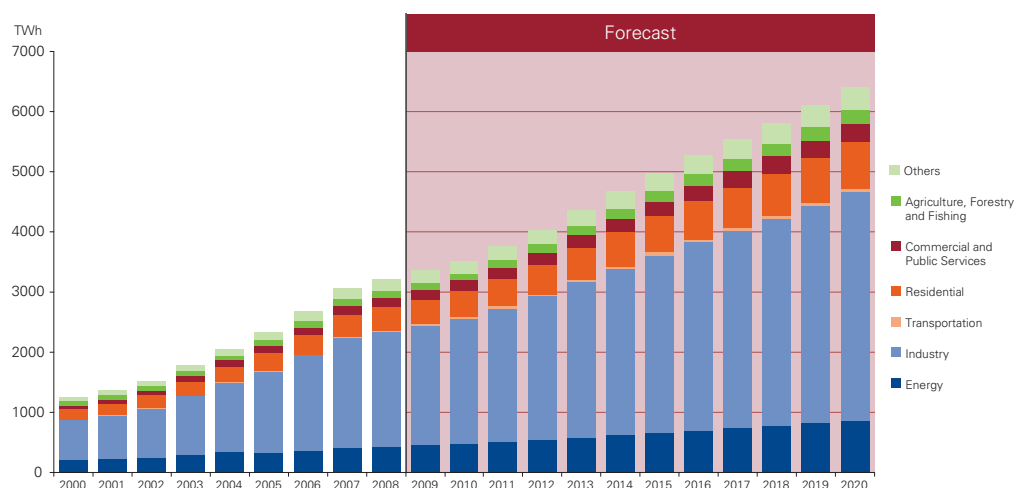
11 Source: Economist Intelligence Unit

12 Source: International Energy Agency

13 Source: Electricity consumption per capita is calculated from the total electricity

consumption of the country which is divided by the total population.

14 Source: International Energy Agency

Figure 8: Electricity consumption by sector

Source: IEA, KPMG

in the “others” category. The growth of the different sectors follows the average growth of the total electricity consumption of the country.

Household electricity consumption

The total consumption of the residential sector increased from 167 TWh in 2000 to 325 TWh in 2006, however the share of the sector decreased from 13 percent to 12 percent in the examined period.

Household electricity consumption is expected to increase in the medium term, however, the opinions of different experts vary significantly regarding the level of growth. Per capita electricity demand in China is still very low compared to the world average, thus, there might be some

space to expand residential electricity consumption. Furthermore, the urbanization process gives momentum to accelerate this process.

How do you see the dynamics of electricity consumption of households during the course of the next five years?

Household electricity consumption accounts for only about 10 percent of the total electricity consumption in China.

The household electricity market is anticipated to experience stable growth of approximately 50 percent during the next 5 years. Average electricity consumption per capita in China has increased as much as two to three-fold in the past decade but still lags significantly behind the world average.

“I have 20 years of experience in this field. In my opinion, in the past 10 years the consumption of electricity doubled. I think it will continue to increase in the future.”

- Survey participant -

Household electricity consumption can be categorized into urban and rural residents’ electricity usage, which exhibit different demand trends.

Urbanization is the main driver of the sharp rise in household electricity demand. It is expected that in the future up to 0.4 billion rural inhabitants will resettle in cities and towns. This will result in an additional sharp increase on the demand side.

Rural power consumption volumes may also see a significant rise due to the recent government scheme “Home

“...when people from rural areas resettle in cities and towns, the amount of electricity consumption will increase...”

- Major market participant -

Appliances to the Countryside”, which aims to kick start sales in rural areas by offering television sets, washing machines, computers, refrigerators and mobile phones at controlled prices (with an additional 13 percent rebate). This type of change in the rural areas should boost the development of rural electricity consumption and grid transformation.

“Household electricity consumption will certainly rise. With an increasingly higher living standard and the development of city construction, the amount of electricity consumption will definitely go up. However, the development of grid enterprises is comparatively lagging behind and this is a barrier for the development of the electricity sector”

- Major market participant -

On the other hand, the adoption and application of energy-saving technologies may lead to a slight decline in the power consumption of households. In reaction to the government’s encouragement of energy-saving and environmentally-friendly policies, compact fluorescent lamps have been heavily promoted, resulting in a drop of 5.5 percent in household electricity consumption.

Rural electrification program

The rural electrification program is believed to offer significant opportunities in the near future as it is a priority in China and therefore will have support in the future.

How would you evaluate the progress of the rural electrification program from political/ institutional/ financial perspectives?

Rural electrification will be a priority for the government within its efforts to improve economic development and poverty alleviation in rural China. The concept of sustainable rural energy and economic development is increasingly being incorporated into the rural development plans of the government such as the National Development and Reform Commission (NDRC) and the Poverty Alleviation Office (PAO) of the State Council.

China Village Electrification Program (Song Dian Dao Cun, SDCC)

The SDCC’s goal is to provide renewable electricity (either solar or small-scale hydro power) to 3.5 million households in 10,000 villages by 2010. This is to be followed by full rural electrification using renewable energy by 2015¹⁵. The program pursues the initiative of the

smaller China Township Electrification Program which ended in 2005.

Brightness Program

Through China’s Brightness Program, electricity will be provided for 23 million people in remote areas using renewable energy technologies by 2010. The goal is to eventually provide 100 watts of capacity per person.

China is focusing its efforts in the western provinces including Inner Mongolia, Tibet, Qunghai, Gansu, and Xinjiang¹⁶.

The order of priority depends on the level of development in the different regions.

- In some remotely located rural areas, the economic development is lagging behind the country’s average. These areas may be rich in labor force and manpower resources, but they cannot afford expensive electrical equipment.
- In some rural areas with advanced economic development, there may be a lack of human labor due to urbanization. Therefore, the demand for electrical equipment in these regions will be higher.

The transformation of the rural electrical grids is considered to be a key factor for success in the rural electrification program.

Development of power-intensive industrial activities

Electricity consumption of the energy sector represented 13.5 percent of total demand in the country in 2006.

¹⁵ Source: <http://www.nrel.gov/international/publications.html>

¹⁶ Source: <http://projects.wri.org/sd-pams-database/china/brightness-program>



In spite of the fact that the overall consumption of the sector increased from 209 TWh to 359 TWh between 2000 and 2006, the share of the sector decreased by roughly 3 percentage points in this period.

The most significant consumer of electricity is the industrial sector in China, which accounted for about 59 percent of the total consumption in 2006. In addition, the industrial sector showed significant growth between 2000 and 2006 from 662 TWh to 1,585 TWh.

The transportation sector accounted for 0.8 percent of the total electricity consumption of the country in 2006.

Power-intensive industrial activities, particularly steel, nonferrous metals,

chemicals and construction materials, play a critical role in the total scope of industrial activities and have a strong influence on GDP.

Accordingly, the electricity consumption characteristics of these kinds of activities have a great impact on the whole electricity demand of China (for example, the above-mentioned four sectors represented 42 percent of the annual volume in 2007). As the financial turmoil has significantly influenced the performance of some of the large market players (mainly certain export companies), the government is now looking for means to enhance the economy and make the necessary structural adjustments.

How do you see the development of power-intensive industrial activities and its expected effect on the electricity consumption over the next five years?

In 2007, the electricity consumption of the power intensive industrial activities was 42.3 percent of the total electricity consumption.

„The government is making an obvious effort to reduce the number of enterprises with poor efficiency and promote clean power.“

- Major market participant -

„It is a good time for China to institute industrial reform. I think it is a good initiative to carry out the policy of ‘Replacing Small Generation Units with Large Ones’.”

- Major market participant -

To make the necessary structural adjustments, China has adopted a series of policies and measures within the framework of its Medium and Long-Term Energy Conservation Plan establishing macro level controls over high energy-consuming, power-intensive, industrial activities.

Guided by the policy of the “Replacement of Small Generation Units with Large Ones”¹⁷, a large number of small and inefficient coal-fired power plants have been shut down to reduce polluting emissions and energy consumption.

Meanwhile, many new high efficiency power plants (applying supercritical or ultra-supercritical technologies) using environmentally-friendly fuels are under construction.

“The government is making an obvious effort to reduce the number of enterprises with poor efficiency and promote clean power. In recent years, many SMEs have been closed down, and a number of high efficiency projects have been approved.”

- Major financial institution -

“The volume of electricity consumption is going through an obvious decline due to the current global financial crisis, especially in the case of certain export enterprises. However, power-intensive enterprises producing for the domestic market will still have a great demand for electricity, as they will continue to provide materials for infrastructural construction projects in the domestic market.”

- Major financial institution -

“Affected by the global economic crisis, the economy in China has to undergo some adjustment. In the coastal regions, like Guangdong province, many

enterprises were forced to shut down, and the government accepted this kind of change. It is believed that the products manufactured by certain enterprises have already lost value. There will be new enterprises with new products to enter the market and contribute to economic development”

- Major market participant -

“In my opinion, high energy efficiency is different from environmental protection through energy. Energy efficiency makes use of traditional resources to reduce energy costs.”

- Survey participant -

Agricultural electricity consumption

The share of the agriculture, forestry and fishing sector decreased in the examined period from 5.5 percent to 3.5 percent. Agricultural development in China varies from place to place.



17 Source: Replacement of Small Generation Units with Large Ones (RSWL) aims to develop 600 MW or above supercritical (ultra-supercritical) units and large combined-cycle units; improve thermal power generating units that are under

operation with high efficient and clean power generating technologies, so as to increase the efficiency of these units. Replace small unit with large ones; construct large units and restrict small ones; eliminate small units, so as

to increase single-unit capacity. Source: China Medium and Long-term Energy Conservation Plan, November 25, 2004, National Development and Reform Commission

How do you see the development of agricultural electricity consumption in China over the next five years?

In the southern parts and coastal areas of the country where agriculture is comparatively developed, agriculture may be further expanded mainly through industrial farming and agricultural mechanization. In certain western regions, agriculture is still in its initial development stages.

"In the East of China, the rural regions are richer than the capital city in the west. Electricity depends on the rural regions in China."

- Survey participant -

Agricultural development may see steady growth in the near future. With the modernization of agriculture, township enterprises will play a key role in agricultural development. Largely supported by financial institutions, these township enterprises are making good use of the abundant natural resources in developing businesses like wood products manufacturing, mineral exploitation, livestock breeding, irrigation, etc.

Electricity consumption of the SME and commercial sectors

In spite of the fact that the commercial and public services sector experienced an annual growth rate of 11 percent – the electricity consumption was 68



TWh and 129 TWh in 2000 and 2006 respectively – their share also slightly decreased in the period. The sector accounted for 4.8 percent of the total consumption of the country in 2006.

The role of SMEs (small and medium-sized enterprise) and the commercial sector is similar to that of the household sector, with the level of demand not expected to change significantly in the future, but it will have little influence on electricity consumption as a whole.

What are the expectations on the development of SMEs (small and medium-sized enterprise) and the commercial sector and its expected effect on electricity consumption in the next five years?

The SME and commercial sectors account for a small portion (roughly

10 percent) of the total electricity consumption and so have no major impact on the overall electricity consumption.

With the current financial crisis, the SME sector has been heavily impacted, and many SMEs are being closed down. For the next 5 years electricity consumption will depend on the ability of the SMEs to survive the crisis.

The influence of the commercial sector is not as strong as that of the industrial sector in terms of electricity consumption. A significant increase in its electricity consumption is not expected as the increasing application of energy saving technologies and rising electricity prices have pushed enterprises to be even more cost-sensitive and maintain strict control of energy consumption. They are becoming more conscious and



implementing all kinds of energy saving measures.

“The electricity consumption capacity of commercial sector including retail, real estate, etc. will not increase substantially, as commercial enterprises are more cost sensitive and control electricity consumption strictly. Furthermore, energy-saving technology is widely adopted...”

- Major financial institution -

The government tends to limit the

use of electricity in office buildings. In contrast, shopping malls will boom in the future and shopping space per person is increasing so the total electricity consumption will be higher under high efficiency.

Power pricing

During the ongoing industry and regulatory reforms since 2002, the State Electricity Regulatory Commission was setup for licensing and monitoring purposes, though the

National Development and Reform Commission remains the authority as far as prices are concerned. Tariffs vary to a large extent due to territorial differences, so in 2006 the average retail prices in Guangdong province of USD 0.085 were almost three times higher than those in Qinghai. The funds for promoting renewables built in the tariffs also helped to raise average prices to around 0.07 USD/kWh by 2009. As a pilot scheme, some industrial consumers become eligible to conclude bilateral market contracts with suppliers.

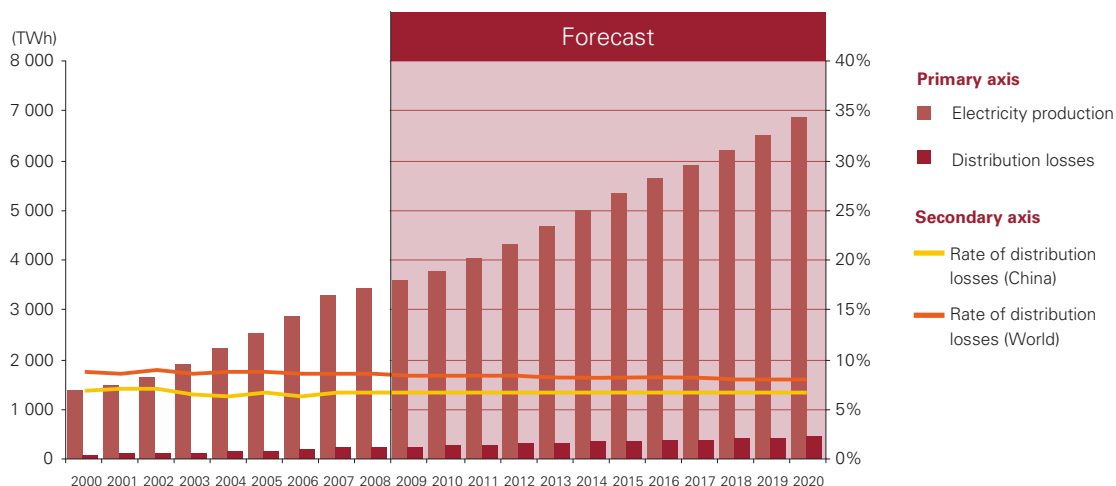
The administratively limited low electricity end-user prices experienced in China 10 years ago are gradually turning into more cost and market based tariffs. In 1996 the residential prices around USD 0.036 were subsidized by higher industrial prices in the range of USD 0.04 – 0.043 and commercial users’ charges almost 0.07 USD/kWh. While cross-subsidies were not only eliminated, but even increased, considerable effort has been put into modernizing the price setting mechanism and tariffs. Under pressures of hiking fuel prices since 2005, and more and more critical power shortages, the government cannot sustain continuous losses on grid prices and transmission tariffs.

Figure 9: Electricity average prices in China

	2005		2006		2007	
	RUB*/kWh	USD/kWh	RUB/kWh	USD/kWh	RUB/kWh	USD/kWh
Residential (incl. VAT)	0.45	0.055	0.47	0.059	0.49	0.064
Industrial (> 750 kW)	0.5	0.061	0.53	0.067	0.55	0.072
Total average	0.47	0.058	0.51	0.063	0.52	0.068

Source: National Bureau of Statistics, NDRC, Deutsche Bank Research, KPMG calculations and estimate

*Note: CNY Chinese Yuan, currency of China

Figure 10: Electricity production and distribution losses

Source: KPMG, IEA

4.2. Electricity supply

Electricity production in China has seen substantial growth in the last 8 years in order to meet the increasing demand of the country.

The amount of generated electricity grew by roughly 12 percent annually between 2000 and 2008.

Figure 10 shows the growing electricity production of China compared to the distribution losses of the electricity network.

In your opinion what kind of network developments, including metering, need to be made over the next five years to reduce power outages and electricity losses during transmission and distribution?

To reduce power outages and electricity losses during transmission and distribution, more advanced technologies should be adopted, such as the High Voltage Direct Current (HVDC) technology; in

addition, strict management is a must in dealing with electricity distribution issues i.e. theft.

According to the respondents, the following developments are necessary to address the issue of technical losses.

- *Adjusting the distance of transmission. Long and improper distances for transportation increase electricity losses.*
- *Identifying the most suitable place for transformation. Under the current circumstances, a central location would be the most suitable place to reduce losses. The best transformation method would be the circle.*
- *Adjusting each sector from generation to electricity transmission, transformation, and distribution and especially selecting the most suitable network for services. Small size and multicast are the trend. There will be more and more small*

power plants and big density stations to supply the electricity in each place.

In terms of commercial losses:

- *More campaigns are needed to raise public awareness of the legitimate use of electricity*

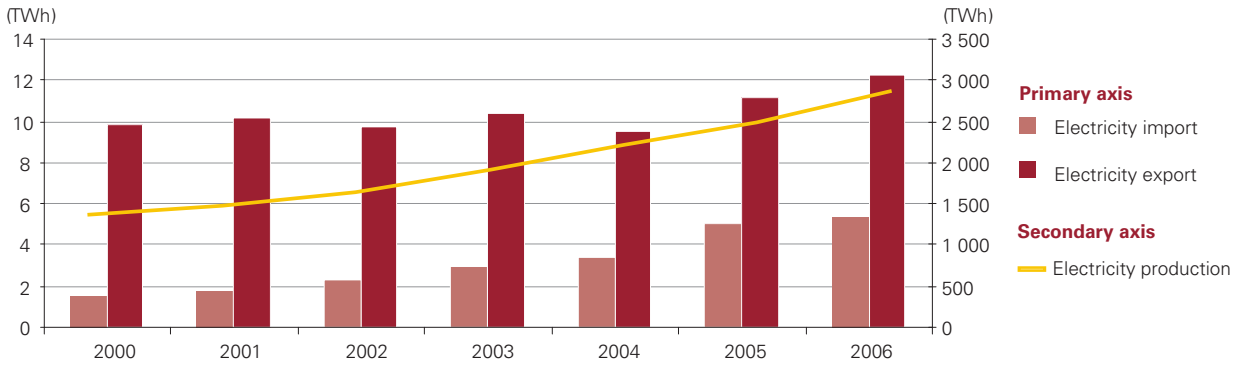
Supply forecast

Chinese electricity production is expected to grow by ca. 8.5 percent annually until 2020 and, as a result, the total generation of the country is anticipated to reach approximately 6,857 TWh. This amount will represent nearly 25 percent of global production by the end of the forecast period.

The level of distribution losses in China, as a share of total electricity generation, is among the lowest in the world¹⁸. Based on expectations, the current ratio will stabilize in the following period, staying under the world average.

18 Source: International Energy Agency

Figure 11: Electricity import, export and total electricity production



Source: KPMG, IEA

Figure 11 shows the trends of imports and exports of the country compared to total production between 2000 and 2006.

Electricity import, export

As can be seen on Figure 11, total electricity import and export accounted for only 0.18 percent and 0.4 percent respectively of total domestic

production in 2006.

Installed capacity

Figure 12 shows the total installed capacity of China which is expected to grow significantly in the following period reaching almost 475 percent of the level of 2000 by the year 2020. This rapid development is due to the anticipated further increase of

domestic demand and the ambitious goals of the government in line with that.

Breakdown of electricity production

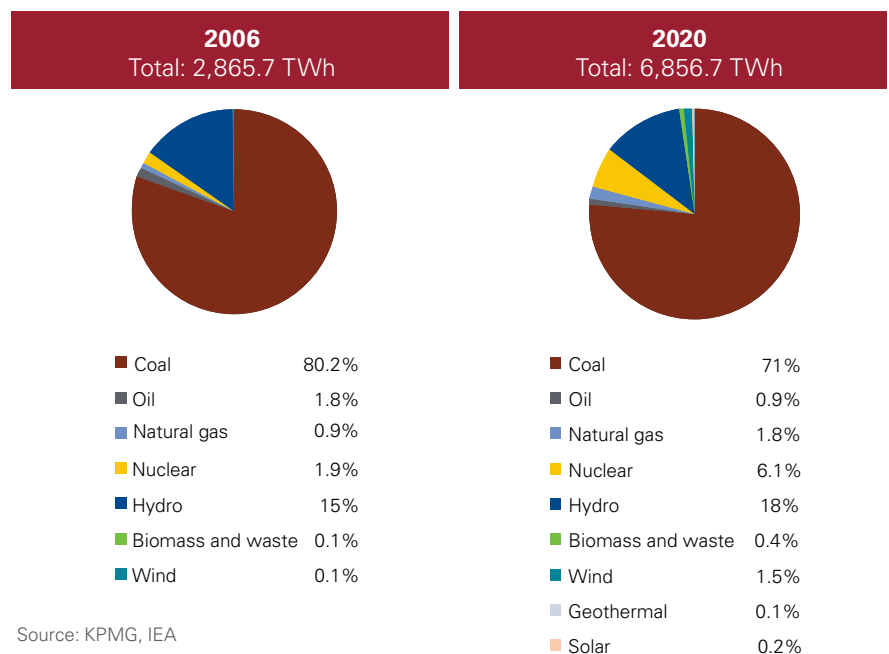
A breakdown of electricity production by fuel types is presented in Figure 13 for 2006 as well as the corresponding expected indicators for the year

Figure 12: Installed capacity (GW)

2000	298.6
2001	319.1
2002	338.3
2003	380
2004	442
2005	517
2006	622
2015	1189
2020	1418
CAGR (2000–2006)	13.01 %
CAGR (2000–2020)	8.10 %

Source: KPMG, IEA, EIU

Figure 13: Breakdown of electricity production



Source: KPMG, IEA

19 Source: KPMG estimation based on the data of the International Energy Agency and the Economist Intelligence Unit

2020.¹⁹ Total electricity generation exceeded 2,865 TWh in 2006 and installed capacity of the country was 622 GW.

China is rich in coal and short of oil and gas, which represents a constraint to the country's energy sector. China's generation mix is heavily dependent on coal-fired generation, which represented 80 percent of the total production.

Hydro-electric power was the second most important, providing 15 percent of the total electricity production in 2006.

Other sources, like nuclear and renewables, accounted for only a minor share in the generation mix in 2006, however, considering the total amount of power produced in China, these might represent enormous volumes.

Beyond that, it must be noted that due to the various levels of development, there are significant differences regarding the amount of generated electricity among certain areas of China: the ten largest electricity-producing provinces contributed with 62 percent to the total generation of the country.

Coal

China has enormous coal reserves and at the same time runs out of oil and natural gas reserves. As a result, more than 80 percent of the generated electricity in China was produced from coal in 2006.²⁰ In addition, the Chinese coal-based power generation accounted for nearly 30 percent of the global amount in 2006.

„The main change will take place in the nuclear sector. The government will invest a lot in this area in the next 10 years.“

- Major regulatory agency -

Based on the expectations, coal will remain the most important resource of electricity generation in 2020.

However, due to environmental considerations and the rapid spread of the use of other energy sources, the share of coal in the generation mix will fall to 71 percent by 2020.

Nuclear

Nuclear energy facilities represent only about 2 percent of the total installed capacity in China, although nuclear power has huge potential for energy saving and emission reduction due to its high efficiency.

A policy called "Active Development of Nuclear Power Plants" – setting a goal of 6 percent of the total installed capacity by 2020 – is hoped to enhance the market's potential in China for the use of nuclear-based electricity in the future.

What are the expectations on the development of nuclear generation during the course of the next decades?

In response to China's energy saving and emission reduction targets, nuclear power as a clean source of electricity with high efficiency is expected to see unprecedented opportunities. According to the respondents, the current

percentage (1.13 percent) of nuclear power in the total power generation mix will go up sharply in line with the policy "Active Development of Nuclear Power Plants".

The status of nuclear power will be further consolidated in the future as it is being considered as an effective supplement in future power generation mixes, offering a viable option for replacing coal-fired power on a large scale.

The government is considering nuclear power development as a top priority. However, safety concerns remain a large barrier, and there are only two or three plants that meet the extremely strict approval criteria for operation.

"Nuclear power is currently being discussed due to the State providing support in promoting its development.

"...there are plenty of water, wind and solar resources, which indicate that new power will appear in the future."

- Major market participant -

²⁰ Source: European Intelligence Unit



“China has learned its lessons from large hydro, I think the government will maintain the current status of large hydro and will not invest in any additional new large hydro projects.”

- Survey participant -

But until now, only a few power plants met the criteria and this is really harmful for nuclear development”

- Major market participant -

“China must keep an eye on nuclear investments. Nuclear energy is considered highly technological and there are many problems remaining to be solved, such as how to deal with nuclear waste, radiation problems, etc.”

- Major financial institution -

It is possible that there will be additional power plants which meet the required criteria in the future and can get on the path to accomplish the target of 2020.

Technology transfer would be an efficient and easy way for China to raise the level of development. However, the country cannot rely solely on this because cutting edge technology transfer is usually politically charged and very sensitive. Thus,

technology localization is another key step for China to take in order to develop nuclear power on a large scale.

Large hydro

China is comparatively rich in water resources, accordingly the ratio of large hydro in the total power generation mix is rather high, roughly 10 percent. This industry is in a mature development stage and might not have much further potential.

What are the expectations on the development of large hydro capacity expected to be during the next decades?

China has comparatively rich water resources. The installed capacity of large hydro accounts for roughly 20 percent of the total installed capacity. Large hydro power is fairly mature in the development process, so the future potential to expand may not be

as alluring as that of nuclear power and wind power.

The main reason for this is that development of large hydro power is becoming more and more difficult. Usually a large hydro project needs comprehensive cooperation and enormous investment, including immigration and ecology conservation. China gained the experience with the environmental and evacuation issues on the Three Gorges Project on the Yangtze River, and this has dampened the enthusiasm for further development of large hydro projects.

“China is currently not likely to see great development in large hydro. The Three Gorges Project has already exhibited potential impact on climate change, furthermore, large hydro projects involve a wide range of problems, such as population immigration, enormous initial investment, changes to water resources, etc.”

- Major financial institution -

Renewables

Renewable power generation might see rapid progress in the following years in China due to governmental support.

National Development and Reform Commission (NDRC) has issued an ambitious plan which is aiming renewable energy to account for 10 percent of the country's energy resources by 2010 and 15 percent by 2020.²¹

To what extent do you see further development of the renewable power generation segment (taking into account the related incentive schemes) in the next five years?

The government will ensure substantial support and favorable policies for the

renewable power generation sector. Increasingly, the concept of sustainable rural energy and economic development is being incorporated into the government's rural development plans such as the NDRC and the Poverty Alleviation Office (PAO) of the State Council.

"Renewable power would have rapid development during the next 5 years, as it not only meets the environmental requirements with little pollution but also enjoys great support from the government level."

- Major financial institution -

Developed countries are also expected to provide technology and supplies to support the development of renewable power generation in China.

However, largely limited by natural conditions, renewable power (wind, solar, small scale hydro, waste, biomass) can only play a supplemental role in China's future power generation mix.

Wind power

The installed capacity of wind power in the country accounted for roughly 0.1 percent of the total amount in 2006. The Chinese onshore wind power potential is estimated to be 700 GW to 1,200 GW and the country might have another additional 250 GW of offshore wind power capacity²²,

There is still room for further development. Accordingly, plans are being considered to develop mega wind power farms with the potential to each generate more than 10 GW.²³

Solar power

At the end of 2008, solar-based electricity production facilities connected to the grid totaled nearly 100 MW in China, representing a minority share, about 0.01 percent of the installed capacity of the country. As the NDRC's Energy Research Institute reported, the 2020 target of installed solar capacity would be expanded to 10,000 MW or more from the recent level of 1,800 MW. However, solar energy may not play a major role in the generation mix of the country in the future.²⁴

The total electricity generation of China is expected to exceed 6,857 TWh by



21 Source: <http://www.ccchina.gov.cn/en/NewsInfo.asp?NewsId=1821>

22 Source: Climate Center of China

23 Source: www.ccchina.gov.cn/en

24 Source: www.ccchina.gov.cn/en

2020 and the total installed capacity of the country may reach to about 1,420 GW.

How do you foresee the future balance of power plant fuel consumption? What changes do you expect in the generation mix?

Determined by its natural conditions, which means being rich in coal and short of oil, China's future power generation mix is expected to depend heavily on coal at approximately 60–70 percent, followed by large-hydro at 20 percent though becoming increasingly less significant, and the remaining approximately 10 percent would primarily be nuclear and wind power.

Nuclear power will actively gain a larger position in the generation mix. In line with NDRC promoting energy-saving technologies and emission deduction, nuclear power will account for 5 percent in the total power generation mix by 2020.

Renewable power will actively gain a larger share of the country's generation mix. The share of wind energy is expected to reach approximately 1.5 percent, up from 0.1 percent in 2006.

"Coal-fired power will still dominate the total power generation mix; the other forms of power are just supplementary for the adjustment of the power generation mix"

- Major market participant -



"The future power generation mix will largely depend on the availability of natural resources. I think there is no absolute formula for the future generation mix. Coal-fired power will still dominate. Nuclear power and renewable power have a bright future, but can only be regarded as an effective supplement in the total generation mix."

- Major market participant -

"The main change will take place in the nuclear sector. The government will invest a lot in this area in the next 10 years."

- Survey participant -

The share of nuclear power is predicted to be about 6 percent of the power generation in 2020 in line with the NDRC promoting energy-saving technologies and emissions reductions.

Large hydro power generation will account for 18 percent, and is becoming less significant due to

environmental concerns and the negative perception of the Three Gorges Project on the Yangtze River.

Renewable power will actively gain a larger share of the country's generation mix. The share of wind energy is expected to reach approximately 2 percent, up from 0.2 percent in 2006.

4.3. Current ownership structure of the power industry of China

The energy sector in China is dominated by numerous fully integrated conglomerates that control the entire value chain. As the industry is considered to have strategic importance in the country, these companies are controlled centrally and are owned by the state.

In order to increase the efficiency of the centrally planned business model,

some minority stakes of certain conglomerates were sold in foreign exchanges, thus, these companies are more likely operating in a way similar to the Western type of vertically integrated company.

The electricity sector is only partially open to foreign investors and opportunities are limited so far. Investors are required to comply with the restriction on shareholding interest based on the latest version of the Guidance Catalogue for Foreign Investment Industries (the Catalogue). The main aim of this publication is to support China in developing its industrial structure while ensuring the social security of the population at the same time.²⁵

Most of the above-mentioned conglomerates were established in 2002, as part of the reform process. At that time the Chinese government decided to set up separated business units responsible for generation, transmission and services by separating the former State Power Corporation (SPC) which previously operated as a monopoly.

In addition, the State Electricity Regulatory Commission (SERC) was founded in 2002, which is responsible for the overall regulation of the electricity sector.

Reorganization of generation companies

As a result of dismantling the SPC, the country's generation sector is now controlled by the so-called "Big

Five." These state-owned holding companies – namely China Huaneng Group, China Datang Group, China Huandian, China Guodian Power, and China Power Investment – manage more than 80 percent²⁶ of China's generating capacities. They are also able to compete with global giants on the domestic and international markets due to their accumulated gigantic assets and influence. The remaining share of the generation sector is operated by independent power producers (IPPs) and provincial level investor arms. These businesses usually generate electricity in partnership with the state-owned companies.

Organization and future of the transmission, distribution and trade sectors

At the time of the previously mentioned reforms, the SPC transferred all of its electricity transmission and distribution assets into two new companies, the China Southern Power Company and the State Power Grid Company. As a long-term goal, the government intends to integrate the former 12 regional grids of China into three large power grid networks operated by the two above-mentioned companies. Finally, the fully integrated national electricity grid is expected to be realized by 2020.²⁷

How is the privatization process expected to unfold in the Chinese electricity sector?

The electricity sector is considered to have strategic importance for China's economic and social development, and as a result, a significant impact on China's economic and social security.

Therefore, the privatization process of the electricity industry is less likely to happen in China and strong government control will continue to be present in the sector in the long term. The current global financial crisis compels the government to be more prudent in controlling the sector to provide people with economic and social security.

"On the power generation side, the Big Five make up a majority of the whole power generation capacity; private and foreign investment only account for a small portion."

- Major financial institution -

"China as a developing country will be reluctant to open its... electricity industry, for it must protect the development of its local enterprises to enable them to compete with the international companies. For international enterprises in China, this is unfavorable."

- Major market participant -

Competition is very fierce in the power plant sector. Currently, there are several

"I think privatization is impossible."

- Survey participant -

²⁵ Source: <http://www.mondaq.com/article.asp?articleid=58282>

²⁶ Source: eia.doe.gov

²⁷ Source: www.mondaq.com

private and foreign-invested power plants involved in the competition. With the further development of the electricity sector, more competitors can be expected to enter the market.

Investment needs

Based on the forecast of the IEA, a total investment of USD 2,765 billion is necessary for the development of the power sector in China by 2030.

This amount represents 25 percent of the investment needs of the energy sector on a global basis up to 2030.

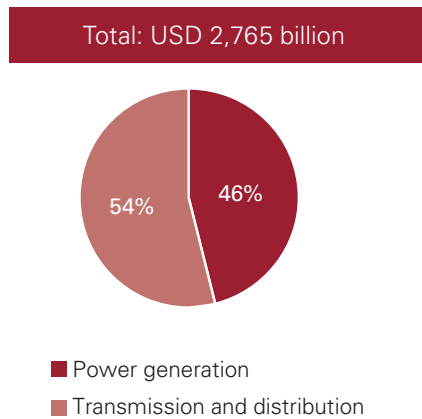
In 2008 China invested approximately USD 82.7 billion in the power sector, a Year-Over-Year increase of 1.52 percent²⁸.

In general, more investment is needed in the development of the transmission and distribution sectors than in power generation. Although the level of distribution losses is particularly low in China, the development of the transformation and distribution system still requires significant investment in the future to allow further development of the industries in the central regions relatively far from the developed coastal regions.

What are the top investment priorities in the electricity sector over the next five years?

The most attractive investment direction will likely change in the coming years. Today, neither the grid, nor transmission and distribution are open to private and foreign investment

Figure 14: Investment needs of the electricity sector up to 2030



Source: IEA

in China. Only power plants are potential targets for investment.

Power generation

There are significant opportunities on the generation side, e.g. investing in nuclear power, wind power, solar power and other kinds of renewable power. In these areas, the government will provide considerable support and favorable conditions (e.g., pricing policy) to boost development. Related policies are to be carried out in 2009, which is considered as a key step for the electricity industry.

However, a majority of respondents hold the opinion that being highly cautious is best when entering the generation business as the ROI on power plant investments considered to be less favorable based on previous experience.

- China is reluctant to open up on-grid price competition in the wholesale market, and private power plants must sign an agreement on the pricing of electricity. As a result, the agreed upon price usually does not reflect the actual cost, leading to a mismatch between the cost and the benefit.
- There should be more consideration when entering China’s power plant market. Generally the electricity sector requires a systematic project which in turn requires long-term investment. In addition to significant capital investment, considerable effort must go into establishing an integrated industry chain and management system. Domestic power plants have strong advantages in these areas compared to private investors.

“There are many non-market factors which can have a deep impact on an investment opportunity, so foreign investors must be cautious when entering China’s electricity market. Examples of non-market factors include how to deal with relationships and to learn and understand cultural differences.”

- Major market participant -

Grid

Both the state and local government have invested enormously in the transformation of the grid, especially in rural areas. Yet it is believed that the grid has become a “bottleneck” for power plant development. Therefore, the need for transformation

28 Source: China Electricity Council

of the grid is considered to be urgent and will require significant capital investment. Thus, there may be a great opportunity for electrical equipment providers to serve the demands of the grid enterprise. This area is going to be a future investment hotspot.

Technology

The nuclear power and wind power sectors are, in a large part, reliant on foreign electrical equipment and technology. Foreign technology transfer is highly efficient; however, it is susceptible to politics characterized by concern for national interests. According to technology suppliers, the nuclear and wind power sectors are often reliant on foreign electrical equipment and technology.

Will the state be able to finance the investments in the electricity sector over the next five years?

In the next five years, China will certainly be able to invest in the electricity sector, and it will increase the level of investment.

Priority areas include:

- transformation of grid network,
- energy saving,
- emissions reduction (nuclear power and wind power).

Competition is increasing among the state companies in the electricity sector, so all of the investment tends to be market-oriented. The role of the

“The state enterprises are all becoming profit-oriented and the government will not give them large financial support any more”

- Major market participant -

government is gradually shifting toward that of a “judge” to monitor the developments of the sector.

“The state enterprises are all becoming profit-oriented and the government will not give them large financial support any more”.

- Survey participant -

What are the expectations on the level of public and private sector investments going into the electricity sector in the course of the next five years?

Public investment will primarily go into areas where private and foreign investments are not allowed, such as transmission and distribution, ensuring that strategic assets remain under State control. In these two areas, there will be no opportunities for foreign investment in at least the next 10 years. However, when investment becomes possible in the power generation segment, the private sector will be likely to invest in smaller scale units. Still, the government will maintain significant control over these investments as well.

Private investors will be encouraged to invest in non-critical sectors, such as



technology advancement and equipment manufacturing, especially in areas like nuclear power and renewable power.

4.4. Main determining factors in the development of the electricity industry

Regulatory climate

Worldwide experiences and best practices support the idea that decentralization and privatization lead to market liberalization and sustainable development.

To let these happen, a supporting legislative background is required, which is one of the essential constraints on the development of a country's electricity system.

As the state is usually unable to maintain the country's electricity system in satisfactory condition through its investments, especially on the scale required in China, the involvement of private capital is a necessary step to keeping the technology stream coming into the country. This requires full, but controlled support from the state.

In this process of electricity market development, free competition on the market should be the desired goal, which requires precise legislative paving and careful organization.

China already shows willingness to bring in more experienced know-how through international market players

and increases in private ownership in the generation sector.

One of the most urgent priorities of China as a rapidly developing country is to set a standard rule for the market players to better serve their interests. This is also the real reason for the difficulties faced by foreign enterprises when they enter China's market.

What are the top priorities of the Regulatory Agency over the next five years?

- The most important task for the regulatory agency is to draw up policies and have macro-control of the electricity industry.
- Conducting macro planning on the structure of the whole electricity industry, including further analysis of the areas that open up for private and foreign investment, the adjustment of electricity prices, the further development of the grid in rural areas, etc.

- Diagnosing the effects of the global financial crisis on the electricity sector, objectively based on analyses and estimates of the dynamics of electricity supply and demand.
- Concentrating on process improvement, e.g. streamlining the approval procedure, making policies more transparent.
- Several parties are eagerly anticipating disclosure of the electricity pricing reform policy in 2009, which is believed to indicate the action direction for the market players.

"In my personal opinion, the pricing reform in 2009 is critical for the development of both domestic and international companies; the electricity price is essentially determining the development direction of the enterprises."

- Major market participant -

- Kickbacks are too high for the



suppliers and differ from usual standard. The rules of regulation should be enforced.

How is the end-user electricity tariff structure expected to be during the course of the next five years?

Will the regulator be able and committed to reduce subsidies and cross-subsidies in the existing end-user tariffs and gradually move towards a cost-reflective tariff regime in the next five years?

The adjustment of end-user electricity tariffs is a very sensitive subject in China. The differentiated pricing policy reflects the government's intention to protect certain consumer groups and to ensure their basic living/operating conditions. In China, this is considered to be reasonable and understandable because it concerns the nation's interests and the people's livelihood. These kinds of policies, especially those related to electricity prices for households and agriculture, are less likely to change until the living standard of these people has improved significantly.

"The differentiated pricing policy could be considered to be the result of China's planned economy. However, it is good for the benefits of ordinary people. It is reasonable and reflects the government's macro control method."

- Major market participant -

"I really wish that the residential electricity price could be more cost reflective, but in China, it is not likely to happen. China, as a developing country, has a great number of people with a low standard of living, the government must support these people, and they cannot afford high electricity prices. Maybe in the long term, things could change slightly."

- Major financial institution -

Environmental concerns

Concerns over climate change, sustainable development and atmospheric pollution have directed the attention of the international community toward potential measures to overcome these threats. One of the most important international treaties was the Kyoto Protocol²⁹ which came into force in 2005. Industrial nations (Annex I countries of the Protocol) have set limits on green house gas emission (GHG), meanwhile developing countries have agreed on efforts for the reduction of GHGs but did not set emission reduction targets.

China is among the main beneficiaries of the project based emission reduction mechanism, or Clean Development Mechanism (CDM) of the Protocol.

CDM projects are investments executed in developing countries, partly or entirely



financed by developed countries which are parties to the Protocol.

The majority of these projects seem to be directed at emission reductions in the energy sector, naturally being one of the main GHG emitters of the globe.

What are the effects of health, climate change and environmental issues/ concerns on the current and planned power generation portfolio?

Health, climate change and

29 The Kyoto Protocol is a set of rules to the United Nations Framework Convention on Climate Change (UNFCCC or FCCC), an international environmental treaty which was produced with the goal of achieving "stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system". The Kyoto Protocol establishes legally binding commitments for the reduction of four greenhouse gases (carbon dioxide, methane, nitrous oxide, sulphur hexafluoride), and two groups of gases (hydrofluorocarbons

and perfluorocarbons) produced by "Annex I" (industrialized) nations, as well as general commitments for all member countries. As of January 2009, 183 parties have ratified the protocol, which was initially to have been adopted for use on 11 December 1997 in Kyoto, Japan and which entered into force on 16 February 2005. Under Kyoto, industrialized countries agreed to reduce their collective GHG emissions by 5.2 percent compared to the year 1990. National limitations range from 8 percent reductions for the European Union and some others to 7 percent for the United States, 6

percent for Japan, and 0 percent for Russia. In the non-binding "Washington Declaration" agreed on 16 February 2007, Heads of governments from Canada, France, Germany, Italy, Japan, Russia, United Kingdom, the United States, Brazil, China, India, Mexico and South Africa agreed in principle on the outline of a successor to the Kyoto Protocol. They envisage a global cap-and-trade system that would apply to both industrialized nations and developing countries, and hoped that this would be in place by 2009.



environmental issues/concerns are receiving increasing attention. China is proactively involved in activities to achieve its target of energy-saving and emission reduction under the CDM, a component of the 1997 Kyoto Protocol.

The following steps are being taken in an ongoing effort to reduce greenhouse gas emissions:

- A large number of small and medium coal-fired power plants (<600MW) have been shut down because of low efficiency ("Replacement of Small Generation Units with Large Ones" policy).
- Energy-saving technologies have been implemented and the development of clean power, including nuclear power and renewable power, has become top priority for the government.
- China widely applies the Flue Gas Desulfurization (FGD) and Denitration

technology to decrease the emissions of SO₂ and nitrogen oxides.

- To make the best use of water resources in power generation, all the water should be fresh water; for seaside power plants, they must use desalinated sea water.
- More strict approval criteria are in place regarding environmental requirements.
- Merger and Acquisition activities are executed to raise power efficiency.
- Green materials for plants and end-consumers are more popular in the field of electricity.

How strong is China's commitment towards fostering a carbon sensitive economy over the next five years?

Due to China's clear target of energy-saving and emission reduction by 20 percent, many activities are ongoing within the confines of the China Medium and Long-Term Energy Conservation Plan. The most significant initiatives are highlighted.

- RSWL is aiming to eliminate small units (<600 MW), so as to increase single-unit capacity, by closing down inefficient plants and implementing supercritical (ultra-supercritical) units and large combined-cycle units.
- Power plants have made heavy investments in decreasing their carbon emissions, like FGD and Denitration.

- M&A activities are ongoing in order to increase efficiency.

- The government strongly promotes clean power (renewable, nuclear generation)
- Concrete measures have been carried out to boost the development of nuclear power and renewable power, in order to foster a carbon-sensitive economy.

The government is planning to establish a nationwide carbon trading platform to enforce a compulsory carbon trading scheme across the country's provinces as part of its strategy to create a "low carbon civilization." The plan has the goal of ensuring that carbon emissions are treated as a "scarce resource". Under this plan, power plants with low carbon emissions will be able to earn money from those plants that have high fuel consumption.

What kinds of energy saving technologies are expected to be implemented during the next five years? What level of support will the state provide in this respect? How will it influence consumption?

The implementation of energy saving technology directly influences the prices of energy and electricity. With higher energy and electricity prices, people become more sensitive to energy saving as it is seen to reduce their costs, thus energy saving technology is becoming more widely adopted and anticipated in China, according to the respondents.

"Currently, energy saving

technologies are becoming more and more popular and gaining more recognition from both the government and enterprises.

I believe that this is the trend for the future. There should be many opportunities in this respect."

- Major financial institution -

The state level is also making great efforts to boost the application of energy-saving technologies in different sectors, such as the residential and the commercial sector.

"In many places in Yunnan Province, roofs are installed with solar energy; the street lights in many parts of the Baoding development zone use solar energy; the

Bird's Nest for the Olympics adopted energy-saving technology."

- Major market participant -

Commercial enterprises have also realized the importance of increased energy efficiency. There are many effective measures and steps being taken to achieve better energy efficiency.

In 2007 the electricity sector underwent consolidation in order to make better use of the limited energy resources. The government has been making solid efforts to enhance efficiency by promoting the policy "Replacement of Small Generation Units with Large Ones" and supporting new power plants using supercritical

and ultra-supercritical technologies of high efficiency.

Key challenges

Based on the conducted analysis, the most important challenges determining the long-term development of the country would be connected to skill development, regulatory effectiveness, technology transfer, and renewable energy utilization.

China faces challenges on many fronts. The state is facing a significant development boom in terms of population, economy, and as a result in electricity consumption. In the coming decades, it is of vital importance that China be organized well as the smallest missing component could lead to set-backs in the country's development.

Does China have enough skilled and available labor to lead and execute the necessary investments in the electricity sector in the next five years?

According to the respondents, generally speaking, there is enough skilled labor to execute investments in the electricity sector, especially in the area of coal-fired power generation.

However, there are some areas where the demand for skilled labor is not being met. Therefore, a labor shortage is expected in the next five years in the following areas:

- *Technology specialists especially in the newest fields such as nuclear and renewable power generation (wind power)*



“Although we have many universities in the electricity industry, we lack human resources in the latest fields: nuclear and wind power, etc.”

- Survey participant -

- Specialists in electricity industry law
- Financial experts specializing in investment in electrical projects

“I can feel the lack of human resources in our industry: I often get calls from headhunters...”

- Major technology supplier -

What can be the solutions for China to fulfill the increasing demand for equipment and technology services of the electricity sector over the next five years? How will suppliers be able to serve this demand?

In China, the market for technology suppliers is very competitive, and attracts a large number of players, including both domestic and international suppliers. In this situation, there is generally enough technology equipment offered (in certain areas there is even a surplus) and, as such, the supplier’s service is considered as a distinct competitive advantage for China.

For foreign investors, service localization is the key to winning more business; for example, having a specialized local service team to serve local clients, and translating international service value into local management.

- Generally, the equipment and technology demand regarding coal-fired power is not critical due to China’s leading position in the supply of related equipment and technology.
- Nuclear power and renewable power development is still in the initial stage, however, and the related equipment and technology demands are comparatively pressing.

Financial and economic crisis
What are the expected effects of the global financial turmoil on China’s electricity market in the next five years?

With growing globalization, China cannot develop in isolation from the world economy. Affected by the world economic slow down, the investment priority is now shifting to spur the domestic demand; to boost the domestic economy in terms of infrastructure, including roads, bridges, housing, etc.

The global financial crisis has had a strong impact on China’s electricity sector, is characterized by a sharp decrease in power usage.



“The financial crisis did have a severe impact on China’s electricity sector. The electricity sector experienced slower growth this year. In my estimation, there was almost no growth in electricity consumption until June; January and February even had negative growth.”

- Major market participant -

The industrial sector, especially the export business, is the most severely affected area, resulting in a 20 percent decrease in total industrial electricity consumption. Many enterprises have been running under capacity or have even been shut down.

“The effect of the crisis is also spreading to certain sectors in China such as the electricity sector. Many enterprises are running under capacity, thus they are shut down, decreasing the electricity demand.”

- Survey participant -

Fluctuations in residential and commercial electricity consumption are slight. However, as the major economies around the world have made great efforts to rescue the current economy from recession, the Chinese power sector has seen some recovery in 2009.

Price levels are the same as before the global crisis. Without the financial turmoil, the costs and prices of electricity would be higher.

When the Chinese economy was growing, the prices of electricity increased from 10 to 20 percent, but now the prices are fixed.

The growth of the electricity sector is



primarily related to China’s economic development. As long as the economy continues to prosper, the impact of the financial crisis will not be widespread. Yet, the global financial turmoil also represents an opportunity for structural adjustments and development of the power sector.

“We have a chance to adjust the structure of power generation. As for the plants, they can close a subsidiary company that operates with lower profit and higher waste.

If the economy develops rapidly, the adjustment will not be so significant.”

- Survey participant -

Specifically, adjustments can be made to the electricity network. Due to the financial turmoil, the network now has a stable workload (as before, it was overloaded), making it easier to modify. Thus, security and stability are

enhanced.

Future developments

The most important factor determining the development of China’s electricity sector will depend on the availability of its natural resources, as this will primarily define the country’s future power generation mix.

Investments in electricity distribution are lagging behind power generation and transmission. The opening of these sectors is requested by both domestic and international investors as well as technology suppliers. However, the current abundance of capital in China is considered as the main barrier for the commencement of privatization in the medium term.

What are the issues / matters of the highest importance, those that are the most influential regarding the future of the electricity sector? What



will determine the next five years of the sector?

- The balance of supply and demand in power generation.
- The government policy on the electricity sector is always considered normative.
- Regulatory agencies are playing a coordinating role in maintaining macro-control, adjusting the electricity environment, and in the development of power generation. These agencies have great influence, especially in pricing, investment, etc.
- New technologies promoting energy-saving and emission reduction also have a great impact on the future of the electricity sector.
- The development of nuclear power and renewable power, although the main barrier of technology must be considered.

"In China, we are comparatively rich in coal and short of gas and oil, which essentially determines the current power generation mix. In the meantime, there are plenty of water, wind and solar resources, indicating that new power sources will appear in the future."

- Major market participant -

5. Investment Opportunities

As described in this publication, China's electricity sector holds enormous potential for growth and business development, but exploitation of these opportunities requires tailor-made investment strategies and careful planning processes.

This study aims to assist both domestic and international financial investors in identifying business opportunities in the Chinese power sector throughout the asset lifecycle.

The main results of our assessment of the Chinese power sector are outlined in the following chart.



Macro-economic trends

- The global financial crisis does not have a strong impact on the electricity consumption of China.
- The optimistic economic environment and the rapid development of all regions of the country may lead the stable increase of electricity demand within the next years.
- The growing electricity demand is mainly brought on by the trend of urbanization.
- In addition, the electricity demand is expected to further increase in the future as the consumption capacity in China is still very low compared to the world average level.

Investment characteristics

- China today is relatively rich in capital reserves.
- Transmission and distribution are considered to be key areas from a strategic and social security point of view, thus these are controlled by the state and foreign investment is not allowed.
- However, there might be many investment opportunities in the power generation industry.
- The rural electrification program is believed to provide several investment opportunities over the next 5 years, since there are still many people living without electricity in remote rural areas of China.

Market factors

- There is a lack of technology, know-how and specialists in some areas of the power sector, especially regarding alternative electricity sources (wind, nuclear power) which are still incipient in China.
- The price of electricity is not market-based, it is determined centrally as a result of the political system. Changes in political environment might cause significant changes in prices and regulations in the future.
- The government focuses on nuclear and renewable power related research, and is ready to invest huge amounts in order to develop these sectors.
- People in China are open to foreign companies and new technology, goods and services. Many believe that foreign goods represent high quality and standard regulations.
- Relationships are the key in China when exploring or entering any market, including the power industry.
- There is an increasing demand for new technologies: technology safety and energy efficiency are key areas.

Acronyms

BRIC – Brazil, Russia, India, and China

CAGR – Compound Annual Growth Rate

CDM – Clean Development Mechanism

FDI – Foreign Direct Investment

FGD – Flue Gas Desulphurization

GDP – Gross Domestic Product

GHG – Greenhouse Gas

IEA – International Energy Agency

IPP – Independent Power Producer

M&A – Mergers and Acquisitions

NPC – National People's Congress

OECD – Organization for Economic
Co-operation and Development

PP – Power Plant

SERC – State Electricity Regulatory Commission

SME – Small and Medium Enterprise

SPC – State Power Corporation

T&D – Transmission and Distribution

WEC – World Energy Council

KPMG's ENR Practice Overview

KPMG's Global Energy and Natural Resources (ENR) practice is dedicated to helping our firms' clients tackle the issues affecting them in today's operating environment. From global super majors to next-generation leaders, KPMG member firms strive to tailor our service offerings to specific client needs and deliver the highest standards.

KPMG's Global ENR practice is organized through a global leadership team aligned with member firms' ENR practices. The global leadership team focuses on our strategic framework, reputation and performance, supported

by an executive group dedicated to driving their implementation, and measuring and communicating our performance. Our management team focuses on providing account management, proposals, marketing, knowledge management, and administrative support to KPMG client service teams operating in the ENR industries.

KPMG's ENR professionals help our member firms' clients address the complexities and challenges that affect their businesses by creating industry groups that tackle different areas of the

global energy marketplace. The industry groupings facilitate outstanding coverage of this vast industry, which are: Oil & Gas, Power & Utilities, Mining & Forestry.

KPMG firms have Centers of Excellence (CoE) throughout the globe, dedicated to the Oil & Gas, Power & Utilities, Mining, and Forestry sectors. These centers are strategically located near major hubs of activity within the industry. CoE teams of experienced KPMG energy professionals provide high quality advisory services to clients based in those specific areas.



KPMG's Global Power & Utilities Knowledge and Resource Center – Budapest, Hungary

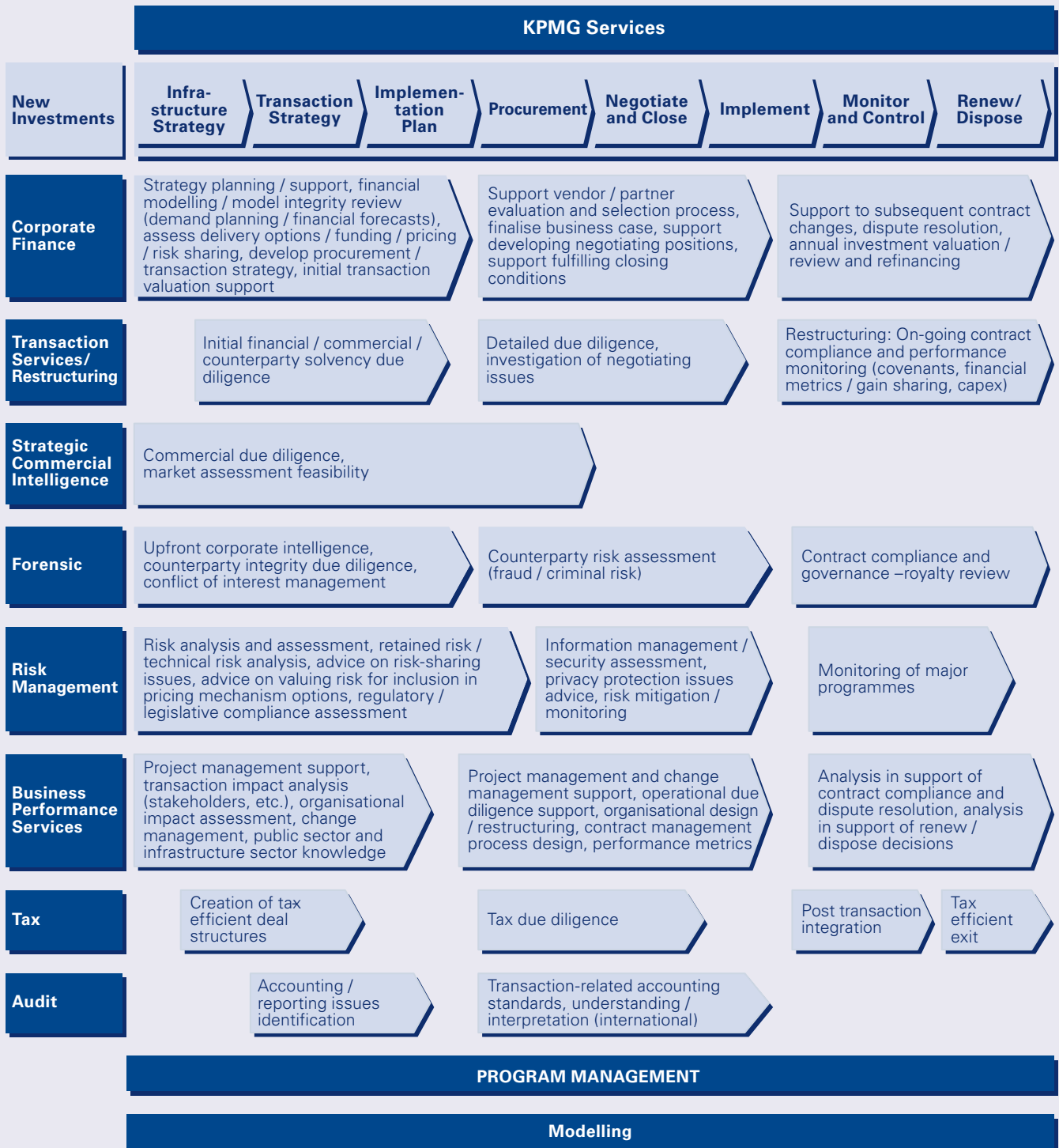
The Power & Utilities market has been developing at an extremely rapid pace globally in recent years. This fast development is characterized by large scale infrastructure projects that require a global base of experience and a high level of specialized industry knowledge.

As a focal point of Power & Utilities, KPMG's Global Power & Utilities Knowledge & Resource Center based in Budapest, Hungary (Central and Eastern Europe) consolidates global know-how and knowledge in a single location and takes a hands-on approach to match client needs with KPMG's

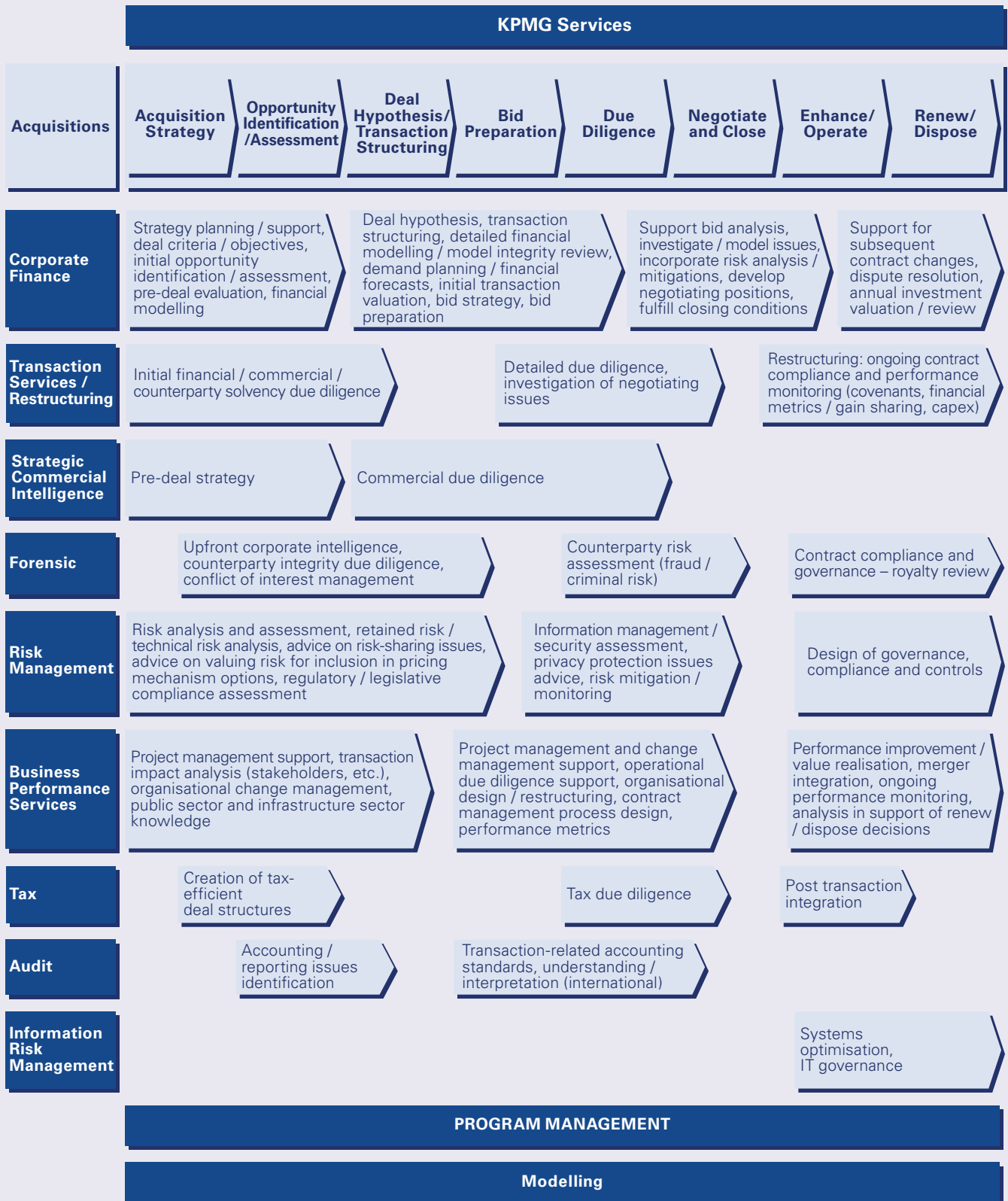
Centers of Excellence (CoE) across the globe that are best suited to providing professional advice and support that addresses clients' strategic and transactional activities.



Throughout the globe, KPMG member firms provide clients with offerings in relation to the following services:



Throughout the globe, KPMG member firms provide clients with offerings in relation to the following services:



KPMG's "Think BRIC! Key considerations for investors targeting the power sectors of the world's largest emerging economies" publication series

"Think BRIC! Key considerations for investors targeting the power sectors of the world's largest emerging economies" publication series aim to highlight major trends and challenges shaping the evolution of the BRICs countries' power sectors over the course of the next decade in light of the global economic crisis. Perspectives of top-level executives and stakeholders of the BRICs power sector are included in these country reports which are based on a qualitative research and KPMG analyses.



Think BRIC! Key considerations for investors targeting the power sectors of the world's largest emerging economies –
Comparative study

This KPMG report sizes the investment needs of the power sectors in Brazil, Russia, India and China; including historical analyses from 2000–2008 and also projected investment needs until 2020 by assessing socio-economical, technical, environmental and legal aspects.



Brazil's electricity sector bears enormous potential for growth and business development, but accessing the opportunities

requires tailor-made investment strategies and careful planning processes. This study aims to help both domestic and international investors in identifying business opportunities in the Brazilian power sector throughout the asset lifecycle.



The **Russian** market is one of the largest on the planet. Scores of power plants feed almost 1 million gigawatt hours of electricity into a vast grid that

comprises some 3.2 million kilometers of cables that stretches across 11 time zones. More recently, the global financial crisis, along with the fall in the price of oil, has hit Russia hard but the Russian electricity sector is still a target for foreign investments.



India's population around 1.1 billion in 2009, is growing fast, and is expected to surpass that of China soon after 2020 – making it the largest in the

world. To fuel its economic growth, which is expected to be over 9 percent for most of the next decade with electricity, total generating capacity should jump by 90 GW to 241GW, with an increased emphasis on nuclear, clean coal and renewables, including solar and small-hydro.



China invested some USD 83 billion in the electricity sector in 2008. Longer term estimates predict that China will need to invest USD 2,765 billion

into the industry by 2030 to cope with its power demand – an estimated one quarter of the total global energy sector investment within that period. How will such a gigantic sum be spent, and what opportunities will it offer investors and suppliers?

Authors and co-authors of the "Think BRIC! Key considerations for investors targeting the power sectors of the world's largest emerging economies" publication series:

Péter Kiss, Global Head of Power & Utilities, Attila Szepesi, Judit Pintér, Balázs Zambó and KPMG's Global Power & Utilities Knowledge & Resource Center, Budapest, Hungary; IPSOS

Other KPMG Thought Leadership

To receive electronic copies or additional information about any of the documents below please contact your local KPMG firm. Alternatively, please visit the following web sites:

KPMG.com:

<http://www.kpmg.com/Global/WhatWeDo/Industries/Energy/Pages/default.aspx>



China's Energy Sector – A Clearer View

The following KPMG report shares our observations on key trends in each area of the energy sector, from upstream oil and gas to power generation



Central and Eastern European Nuclear Energy Outlook

A discussion of the nuclear energy industry in Central and Eastern Europe, this document discusses both the region as a whole and individual nations.



Bridging the Global Infrastructure Gap: Views from the Executive Suite

Global research commissioned by KPMG International and conducted in cooperation with the Economist Intelligence Unit



The Application of IFRS – Power and Utilities

The publication examines trends and challenges in implementing true IFRS across the Power and Utilities industry and is based on the reports of various companies across a variety of countries.



The Winds of Change

The Winds of Change is the 2009 version of an annual publication which discusses trends in M&A in the Renewable Energy Industry. Over 200 executives were surveyed, and supplementary interviews were carried out by the Economist Intelligence Unit.



Indian Power Sector – Rising up the Curve

The Indian power sector is going through an exciting growth phase-high GDP growth lead to increased demand, generation capacity, transmission and distribution.

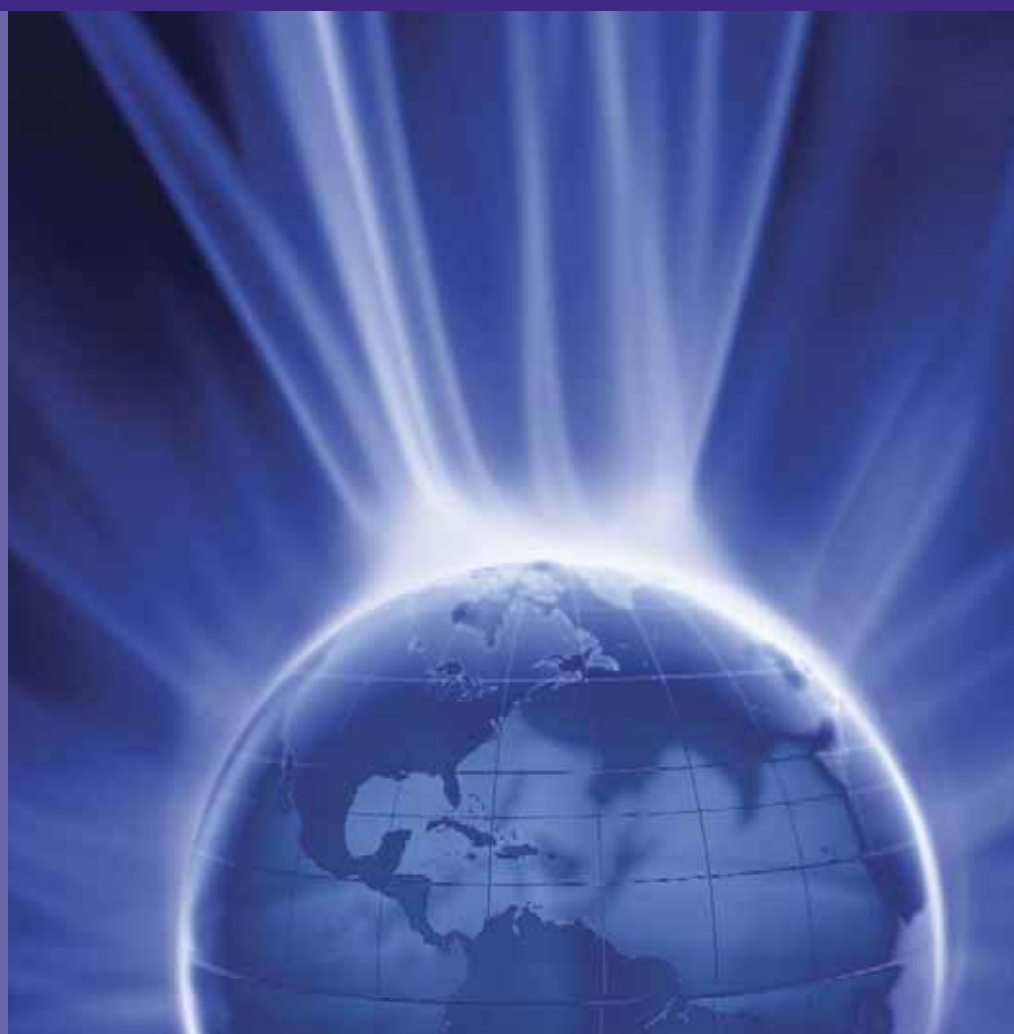
About the KPMG Global Energy Institute (GEI)

The KPMG Global Energy Institute has been established to provide an open forum where industry financial executives can share knowledge, gain insights, and access thought leadership about key industry issues and emerging trends.

Power and utilities financial, tax, risk, and legal executives will find the GEI—and its Web-based portal—to be a valuable resource for insight on emerging trends.

To register for your complimentary membership in the KPMG Global Energy Institute, please visit www.kpmgglobalenergyinstitute.com.

For more information about the GEI, please e-mail us at globalenergyinst@kpmg.com.



Comments and questions in relation to the *Think BRIC!* publications series and their content are welcome and should be addressed to:

E-mail: ThinkBRIC@kpmg.com

Péter Kiss

Global Head of Power & Utilities
KPMG's Global Power & Utilities
Knowledge and Resource Center

KPMG in Hungary
Tel: +36 70 333 1400
E-mail: pkiss@kpmg.com

Media relations:

Judit Pintér

Business Development Coordinator
KPMG's Global Power & Utilities
Knowledge and Resource Center

KPMG in Hungary
Tel: +36 1 887 7118
E-mail: jpinter@kpmg.com

Global ENR Contacts

Michiel Soeting

Global Chair
Energy & Natural Resources

KPMG in the UK
Tel: +44 20 7694 3052
E-mail: michiel.soeting@kpmg.co.uk

Pamela O'Leary

Global Executive
Energy & Natural Resources

KPMG in the UK
Tel: +44 20 7311 8438
E-mail: pamela.o'leary@kpmg.co.uk

ENR and Power & Utilities
Contacts in China

Peter Fung

Partner
KPMG in China
Tel: +86 (10) 8508 7017
E-mail: peter.fung@kpmg.com.cn

Terry Chu

Partner
KPMG in China
Tel: +86 (10) 8508 7035
E-mail: terry.chu@kpmg.com.cn

Global Infrastructure Projects
Group Key Contacts

Dr. Timothy Stone

Chairman
Global Infrastructure Projects Group

KPMG in the UK
Tel: +44 20 7311 8244
E-mail: timothy.stone@kpmg.co.uk

Nick J. Chism

Global Head of Infrastructure
Global Infrastructure Projects Group

KPMG in the UK
Tel: +44 20 73118603
E-mail: nick.chism@kpmg.co.uk

Stephen Ip

Partner
KPMG in China
Tel: +86 (21) 2212 3550
E-mail: stephen.ip@kpmg.com.cn

The information contained herein is of a general nature and is not intended to address the circumstances of any particular individual or entity. Although we endeavour to provide accurate and timely information, there can be no guarantee that such information is accurate as of the date it is received or that it will continue to be accurate in the future. No one should act on such information without appropriate professional advice after a thorough examination of the particular situation.

KPMG and the KPMG logo are registered trademarks of KPMG International, a Swiss cooperative.

© 2009 KPMG International. KPMG International is a Swiss cooperative. Member firms of the KPMG network of independent firms are affiliated with KPMG International. KPMG International provides no client services. No member firm has any authority to obligate or bind KPMG International or any other member firm vis-à-vis third parties, nor does KPMG International have any such authority to obligate or bind any member firm. KPMG and the KPMG logo are registered trademarks of KPMG International, a Swiss cooperative. All rights reserved.