



INFRASTRUCTURE

# Infrastructure in China: Foundation for growth

INFRASTRUCTURE, GOVERNMENT & HEALTHCARE

AUDIT ■ TAX ■ ADVISORY

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# Introduction

The development of infrastructure within China has consistently been a key focus for the government in the economic development initiatives encapsulated in regular Five-Year Plans, which are now into their eleventh cycle (2006 to 2010). With the announcement of an RMB 4 trillion stimulus package in November 2008, the scale and importance of infrastructure for the development of China's economy has been further underlined and increased the attention of domestic and foreign investors, as well as operators in this area.

The foundations upon which new infrastructure is being developed are supporting continued rapid economic growth with railway, roads, airports, water, energy and rural projects seeing significant investment. The continued expansion of the high speed rail and city-wide metro networks are prime examples of China's ambitions to further enhance its transport systems to benefit the wider economy.

For infrastructure investors, contractors, operators and equipment companies, China has for many years been and continues to represent a land of great opportunity, but also of significant challenges. Looking forward, China's impressive infrastructure building targets to 2020 are set to bring a major flow of infrastructure projects on stream. In order to benefit from infrastructure's stable cashflows and returns, domestic insurance, pension and other funds are increasingly being attracted towards the infrastructure sector.

Financing for infrastructure investment is likely to be a major consideration. The continued development of China's financial system and growing awareness of investors may see changes in the way infrastructure projects are financed and owned, and greater use of different project financing options.

This report aims to provide a snapshot view of some of the key infrastructure sectors in China together with brief commentary on implications for investors, operators and other market participants. KPMG also has a range of publications on specific infrastructure sectors which provide further analysis and commentary.



*“China’s stimulus package has had an impact and is fundamental to achieving the target GDP growth rate”*

In November 2008, China announced a massive stimulus package of RMB 4 trillion (USD 585 billion) to support the domestic economy during the global downturn and the consequent decrease in export-driven sectors. The sources of funding for the package have been identified as being the central government (30 percent) and local governments and non-government sources (70 percent).<sup>1</sup> This stimulus package is intended to be used to both finance new projects, and rapidly accelerate the development of projects already included under the 11<sup>th</sup> Five-Year Plan as well as other projects previously announced.

Individual announcements released by local governments and ministries have together already exceeded RMB 4 trillion, and include:<sup>2</sup>

- RMB 1.5 trillion on public infrastructure, including railway, road, irrigation and airport construction
- RMB 1 trillion for post-quake reconstruction and RMB 400 billion on social welfare, including construction of affordable housing, rehabilitation and other social safety projects
- RMB 370 billion on technology advancements, including upgrades in the industrial sector, improving high-end production
- RMB 370 billion for rural development, including building public amenities, relocating displaced communities, supporting agricultural works and providing safe drinking water
- RMB 210 billion for sustainable development, including improving energy efficiency, reducing gas emissions and developing environmental engineering projects
- RMB 150 billion for educational and cultural projects.

<sup>1</sup> Source: Sohu.com “4万亿投资账单公布民生和基础设施建设占大头”, 22 May 2009  
<sup>2</sup> National Development and Reform Commission, March 2009

*“The impact on the construction materials and equipment sector is already being seen”*

In conjunction with direct funding, banks have been encouraged to lend to infrastructure projects, an offer which they have readily accepted. Between January and June 2009, bank lending of RMB 7.3 trillion exceeded government post-stimulus targets for the whole of 2009 by nearly 50 percent.<sup>3</sup>

#### **Impact of the stimulus package on foreign investment and private sector involvement**

Although this stimulus package is massive, the immediate impact this will have on levels of private and foreign investment is not clear as many of the initial projects are development-driven and financial investors often require higher rates of return. In addition, the market is typically dominated by local construction companies and operators (particularly rail).

However, the scale of the acceleration of new projects has resulted in a sharp increase in demand for construction materials, heavy equipment and technology, which is benefiting key players in this sector, including international companies.

Indirect opportunities for financial infrastructure investors are also arising, particularly as some local authorities and private sectors look to raise capital in order to participate in new infrastructure projects.



<sup>3</sup> Source: China Daily, 9 July 2009



*“China has the world’s largest network of toll roads, representing 70 percent of the total”*

Many years of road building has given China an extensive highway network, particularly in the eastern regions. Since 2000, China’s expressway network, which is already the second largest in the world, has been growing at an average of 20 percent per year.<sup>4</sup>

China continues to focus on the expansion of its road system, highlighted by the programme in China’s 11th Five-Year Plan for an extension of the country’s National Trunk Highway System (NTHS) from around 41,000 km in 2005 to 65,000 km in 2010. The highway network (including expressways and class 1, class 2 and class 3 highways) is targeted to reach 3 million km by 2020, up from about 2 million km in 2008.<sup>5</sup>

On the demand side, there are a number of key drivers for new construction, including:

- Continued economic growth, particularly in terms of domestic consumption, which is driving freight transport levels.
- Increasing wealth, especially for the growing middle class, has led to rapidly increasing car ownership. In 2009, China became the world’s largest car market with private vehicle ownership quadrupling since 2000.<sup>6</sup>
- Infrastructure investment, particularly in highways, is critical for the success of China’s ‘Go West’ policy to develop central and western China.

With regards to supply, China’s highway plan is structured around the development of a 36-trunk highway network, which includes seven highways radiating from Beijing, nine north-to-south “vertical” expressways, and 18 east-to-west “horizontal” expressways.<sup>7</sup> This “7918” network will link cities which have a population of more than 200,000 and cover a total population of one billion across China. In addition, the 11th Five-Year Plan identifies roads around the capital, link roads to coastal ports, and east-west highways as being key investment targets.

Toll collection on Class 2 roads (making up most of China’s overall toll-road network) is being gradually phased out from 2009. But this may actually provide a boost to the expressway market, as many Class 2 highways are feeder roads for expressways.

<sup>4</sup> Source: KPMG analysis

<sup>5</sup> Source: Ministry of Communication “Development Policy on Resource-efficient and Environment Friendly Road and Waterway Transportation”, 26 February 2009

<sup>6</sup> Source: Reuters, 13 March 2009

<sup>7</sup> Source: National Expressway Network Plan 2005

### Private sector involvement

Generally, highway and expressway construction and maintenance are the responsibility of local city governments. However, the cost of building highways can pose a challenge for local authorities with tied budgets.

Since the establishment of the first Build, Operate, and Transfer (BOT) concession, the private sector has been actively courted to participate in the toll roads sector. In fact, there are now more toll roads in China than any other country, and the Chinese network of toll roads represents more than 70 percent of the world's total.<sup>8</sup>

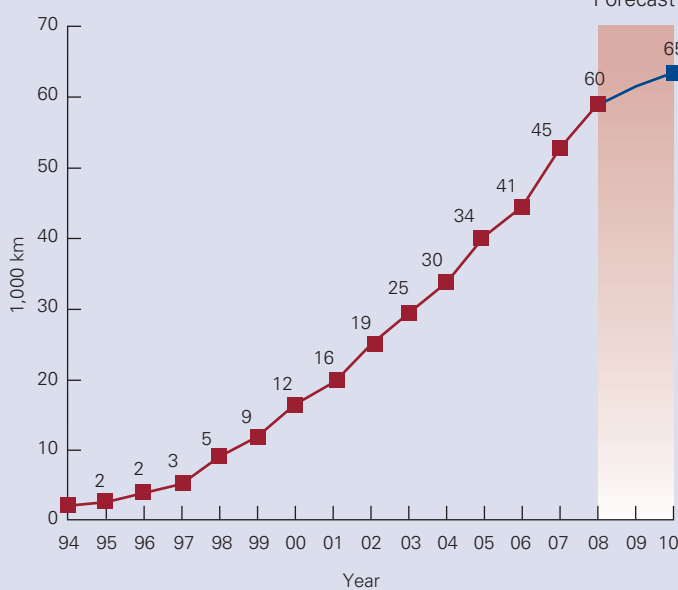
In addition to greenfield construction, there is an increasingly active secondary market, as entities such as local authorities and domestic construction companies look to release capital from their asset portfolios in order to invest in new highway and other infrastructure projects.

However, with the large level of capital available in the domestic market, and with the expected growth in direct and indirect investment by domestic insurance and pension funds into infrastructure, pricing for good operating assets is likely to become increasingly competitive, putting pressure on returns.

New opportunities may also present themselves from the recent permitting of private participation in government funded toll-road concession projects, subject to a competitive bidding process.

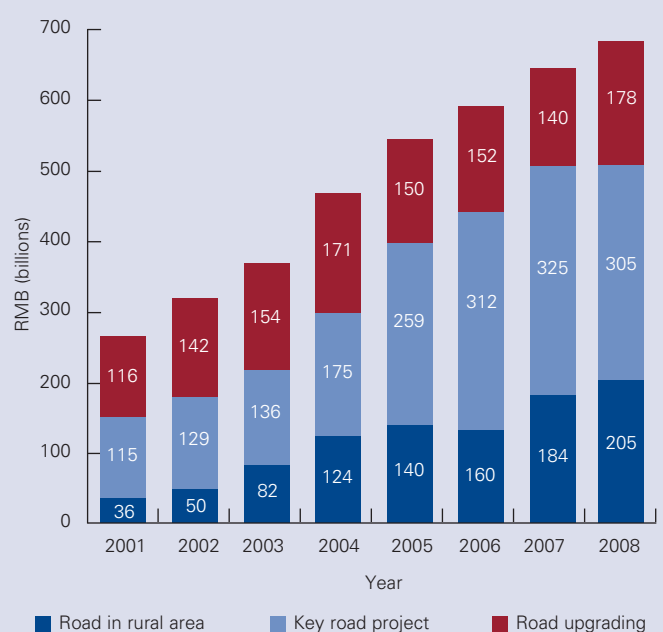
Other opportunities for investors are mainly in related construction materials and heavy equipment businesses, which are seeing rapid demand growth from the stimulus investment programme—though even then care must be taken as there is a possible risk of oversupply in certain sectors, such as cement, in some provinces.

Figure 1: Total expressway length in China



Source: Ministry of Transportation: The Master Plan for National Expressway Network (2008); China Statistical Yearbook 1994-2008

Figure 2: Roads investment in China



Source: Ministry of Transportation: The Master Plan for National Expressway Network (2008); China Statistical Yearbook 2001-2008

<sup>8</sup> Source: Xinhua News Agency, 6 August 2007

## Rail and metro

*“China’s rail network is fundamental to its infrastructure and transport policy, and is a major part of the stimulus package”*

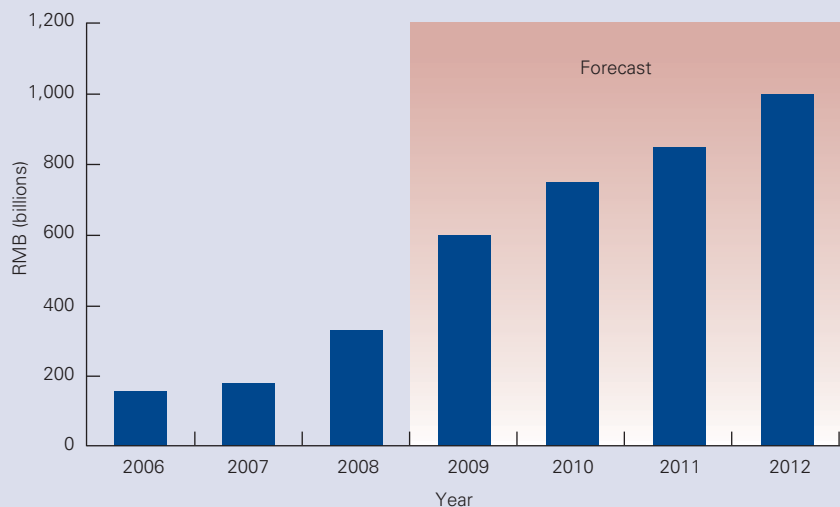
### Rail

China’s railway system has been at the heart of China’s long-term growth. It is the world’s third largest network, with 6 percent of the world’s track length (and rising), but carries 25 percent of the world’s traffic. Further, of the total network, 59 percent of passenger turnover and 35 percent of freight traffic is carried by just 13 percent of tracks, further increasing traffic density on key lines.<sup>9</sup>

This high traffic concentration poses challenges for scheduling and average traffic speeds. With the added funds from the stimulus package, the Ministry of Railways is addressing this through:

- expanding the rail network to 120,000 km by 2020 from 78,000 km in 2007, of which 60 percent is to be electrified
- investing RMB 3.5 trillion in projects starting during the next three years, of which RMB 1.5 trillion will be for the construction of 80 new projects starting in 2009<sup>10</sup>
- investing in 800 high-speed trains over the next three years and upgrading old trains at an investment of RMB 300 billion.

Figure 3: Railway infrastructure investment



Source: Ministry of Railways; Deutsche Bank “China Railway Infrastructure”, 23 January 2009

<sup>9</sup> Source: Ministry of Railways

<sup>10</sup> Source: BOC International “On the Roll for Railway Spending Spree”, 22 January 2009



Figure 4: China's high-speed railway network plan



A vital aspect of the network is supporting the transfer of coal and iron ore. Coal makes up approximately 50 percent of the total volume of goods transported by rail. Of the planned network expansion, 7,000 km will be for coal transport.

Another key development has been the implementation of a high-speed rail network (with speeds over 200 km/h). There is currently 4,000 km of high-speed track in operating in China. However, this is expected to grow rapidly, with a total of 16,000 km to be laid by 2020, of which 13,000 km is planned to be completed by 2012.<sup>11</sup>

One of the biggest challenges to implementing the expansion of the rail network will be construction and manufacturing capacity. The massive amount of construction will require extensive resources from contractors, particularly for

<sup>11</sup> Source: Ministry of Railways

skilled workers, as well as logistical and management challenges. In particular, for very high-speed rail (350 km/h), there are a small number of companies with the capabilities to lay high-speed lines, such as China Railway Construction Corporation.<sup>12</sup> Further, currently the sole domestic producer of 350 km/h trains is China Northern Locomotive.<sup>13</sup>

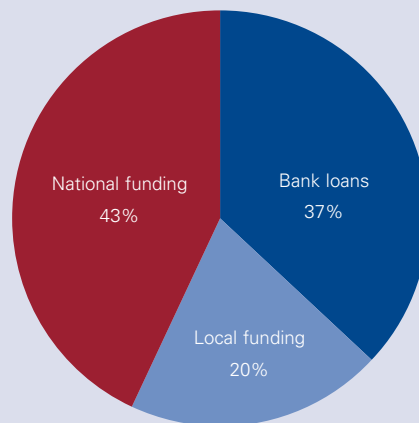
Securing land is another crucial area and care must be taken when dealing with incumbent residents so as to avoid delays while also addressing their needs.

Finally, even with central government stimulus funds, the method of project funding will still be a significant consideration, particularly where local government or private funds are also required. Securing expected returns from investment is also important, as for a number of lines recently entering operations, demand has proven to be quite price sensitive.

### Private sector participation

Even with stimulus funds, the massive expansion of the rail network will need economic support from the Ministry of Railways. To meet the funding, various sources are being tapped, including a special railway fund and local governments, as well as planned listing of certain parts of the network.

Figure 5: Railway investment sources forecast – 2009



Source: BOC International "On the roll for railway spending spree", 22 January 2009

<sup>12</sup> Source: Credit Suisse "China Construction Infrastructure Sector", December 2008

<sup>13</sup> Source: Deutsche Bank "China Railway Infrastructure", 23 January 2009

The role of foreign companies at this stage is limited, as they are not permitted to have a controlling stake in the construction or operation of rail networks or rail passenger services.

However, Chinese private investment opportunities are gradually coming to market, as seen by the 29 km Pengzhou-Bailu freight line in Sichuan, which was the first privately funded railway developed in 2007 under a BOT scheme by the Chinese company Sichuan Dezhong Investment Construction Co.

The biggest opportunities for international companies are proving to be in the delivery of high-tech equipment and systems, such as signalling equipment.

*“The metro sector is expected to grow rapidly over the next five years as first-tier cities expand and second-tier cities build their own metro systems”*

### **Metro and light rail**

Subways and light rail are proving critical in alleviating the traffic challenges which are becoming more pronounced in China’s major cities.

By 2009, ten cities had built rail transit systems with a total length of more than 770 km. In addition, another fifteen cities have over 1,100 km under construction.<sup>14</sup>

China’s first-tier cities are investing heavily in expanding their networks. The Beijing Subway is already carrying 4 million passengers a day.<sup>15</sup> However, in response to the addition of an extra 1,240 cars per day<sup>16</sup> to the 3.56 million cars in the city as at July 2009<sup>17</sup>, it is also adding an extra 100 km by 2010 to the current 200 km system.<sup>18</sup> This rate of construction is approximately 10 times faster than construction speeds elsewhere around the world.

Second-tier cities have also been seeking approval for metro systems, and in 2009 a number of cities, including Qingdao, Ningbo, Nanchang and Fuzhou all broke ground on the construction of new metro systems.

By 2015, it is estimated that there will be 2,100 km of tracks in 19 cities, costing a total of RMB 800 billion.<sup>19</sup>

As with the rail sector, investment in and operating of metro systems is most likely to benefit China companies. However, Hong Kong’s MTR Corporation has become an active player on a number of metro projects, including in Shenzhen, Beijing and Hangzhou.

For most international companies, the opportunities primarily arise in the production and delivery of high-tech equipment and solutions.

<sup>14</sup> Source: China Daily, 21 August 2009

<sup>15</sup> Source: China Daily, 16 June 2009

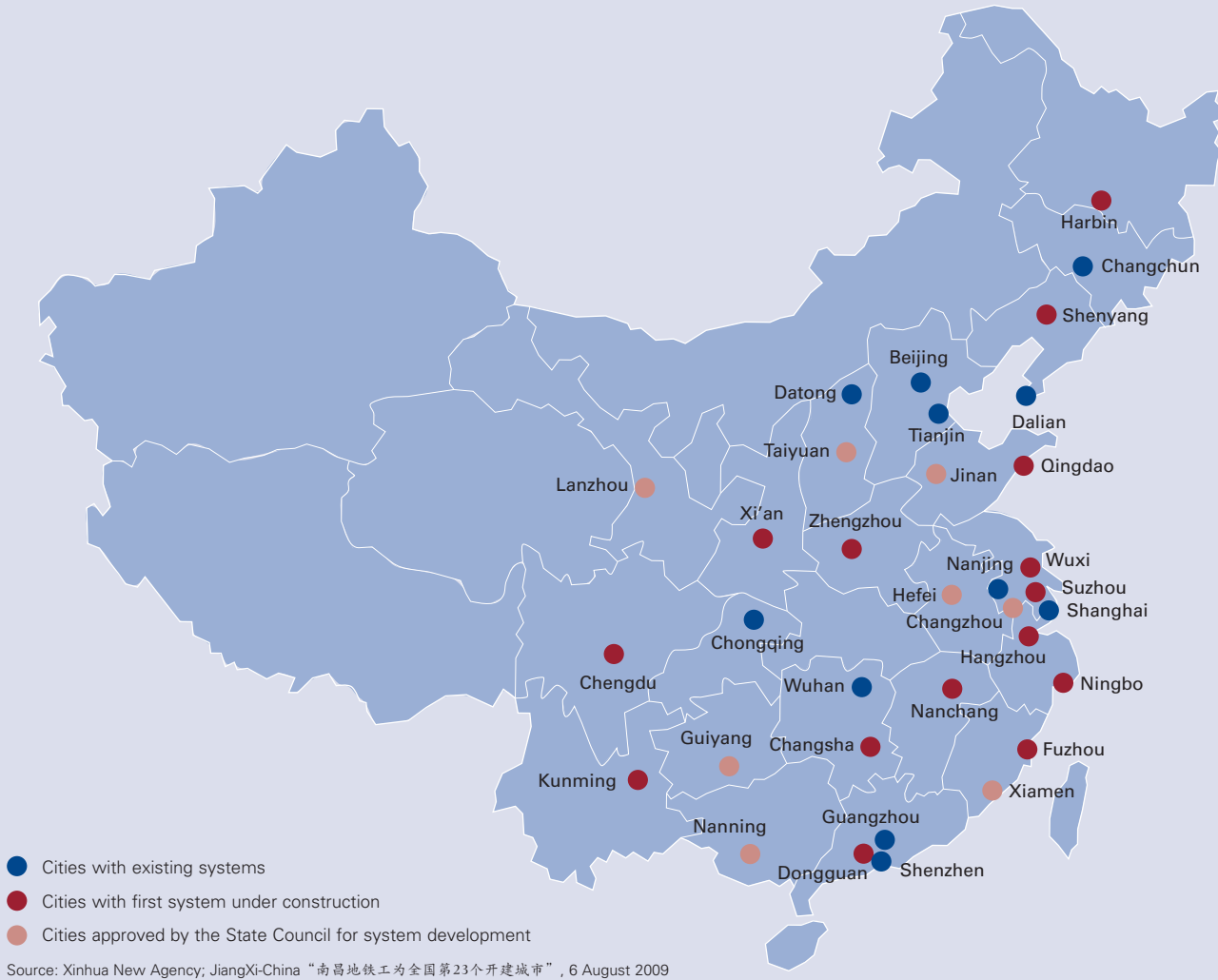
<sup>16</sup> Source: China Daily, 16 August 2009

<sup>17</sup> Source: CCTV, 31 May 2009

<sup>18</sup> Source: Beijing Daily, 17 June 2009

<sup>19</sup> Source: China Daily, 16 June 2009

Figure 6: Location of China's light rail and subway systems





# Ports

The establishment and expansion of coastal ports has for a long time been a priority in China in order to support export growth and facilitate more efficient movement of resources and products along China’s coast. China now has three of the top five busiest ports in the world, with Shanghai expected to become the world’s largest container port in 2010/11.

Table 1: Container throughput of the world’s five largest container ports

Rank	Port	2008 (in thousand TEUs)
1	Singapore	29,918
2	Shanghai	27,980
3	Hong Kong	24,248
4	Shenzhen	21,414
5	Pusan	13,425

Source: Cosco  
 Note: TEU = Twenty-foot equivalent unit

The major ports are primarily located close to the three main manufacturing hubs in China: the Pearl River Delta around Guangdong, the Yangtze River Delta around Shanghai, and the Bohai Rim around Beijing/Tianjin.

With the global economic downturn, the Pearl River Delta ports, where container throughput primarily carries consumer goods such as consumer electronics, toys and textiles, have experienced a slowdown. Shenzhen has seen its container traffic fall 20 percent and its cargo traffic 16.6 percent for the first half 2009, compared to the same period in 2008.<sup>20</sup> The Yangtze River Delta has also seen a drop in traffic, with the Shanghai International Port Group seeing a 17.8 percent drop in handled TEU and 7.6 percent drop in cargo for the same period.<sup>21</sup>

<sup>20</sup> Source: Shenzhen Port Administration  
<sup>21</sup> Source: Shipping News, 25 July 2009

Table 2: Container throughput of Top 10 China mainland container ports

Rank	Port	2008 (in thousand TEUs)
1	Shanghai	27,980
2	Shenzhen	21,414
3	Ningbo-Zhoushan	11,226
4	Guangzhou	11,001
5	Qingdao	10,320
6	Tianjin	8,500
7	Xiamen	5,035
8	Dalian	4,503
9	Lianyungang	3,001
10	Yingkou	2,030

Source: [www.portcontainer.cn](http://www.portcontainer.cn), Cosco

Many ports responded to falling throughput through increased price competition, particularly around storage and empty box business. However, we have also seen ports entering into strategic alliances with other ports such as the Qingdao, Rizhao and Yantai ports.

Bulk ports focused on raw materials imports, such as Qinhuangdao in Hebei province, are holding up better than container ports with China's record of 16.07 million tons of coal import in June 2009.<sup>22</sup> This trend is expected to continue as China's growth picks up as a result of the stimulus package, so maintaining China's appetite for raw material imports.

Another key trend is the increased utilisation of the river systems feeding the major ports, particularly along the Yangtze River. The Three Gorges Dam has facilitated river traffic farther up the river, so making feasible the recent establishment of a bonded zone at Chongqing.

In terms of new developments, the 11<sup>th</sup> Five-Year Plan identified 639 new deep water berths and 340 new berths in inland ports, and earmarked RMB 40 billion of the several hundred billion required. With the relatively long lead-time for greenfield investment, there is a potential challenge of managing capacity at some ports as existing port developments come into service. These capacity and related funding issues are expected to impact on the speed of new greenfield investment in the short to medium term.

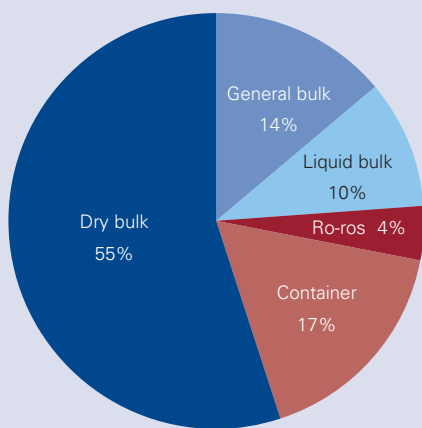
<sup>22</sup> Source: Reuters, 30 July 2009

### Opportunities for investors

According to the 2007 Catalogue for Guidance of Foreign Investment Industries, foreign private sector involvement in port operations is encouraged with 100 percent foreign ownership permitted. There are already significant overseas investments in most major ports through minority strategic stakes held by Hong Kong and other Asian and global port operators.

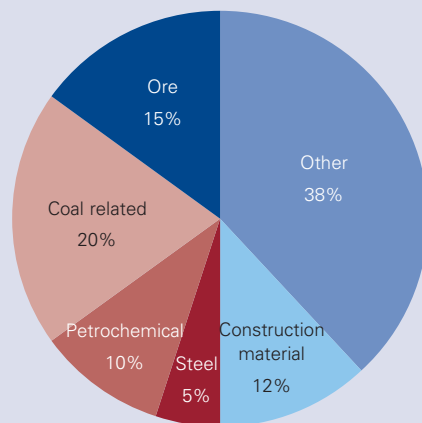
The drop in the volume of imports/exports, as well as price competition driving down handling fees, will likely impact greenfield investment in the sector. However, financial investors and some industry players may see strategic acquisition opportunities.

Figure 7: China throughput breakdown, 2007



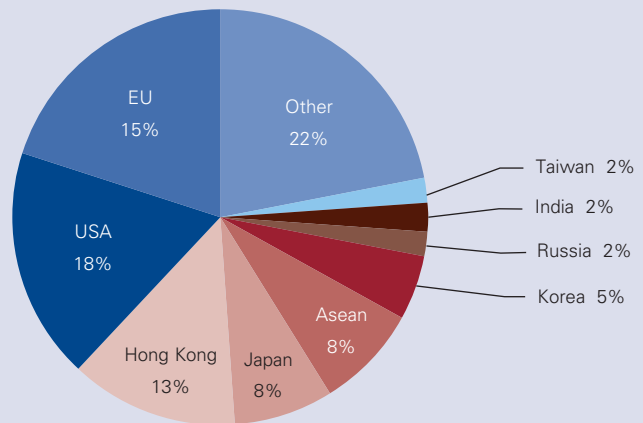
Source: Ministry of Transport

Figure 8: Bulk throughput breakdown, 2007

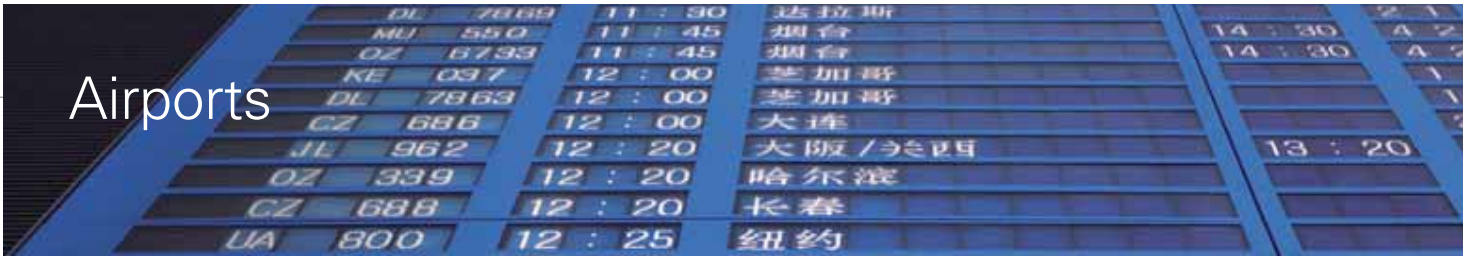


Source: Ministry of Transport

Figure 9: China exports by value, 2008



Source: China Statistics Bureau



*“The goal is a ‘hub-and-spoke network’ with 244 civilian airports in operation by 2020”*

As the purchasing power of the Chinese population increases, more people are spending money on air travel. In 2008, mainland China travellers made 37.8 million outbound journeys, an increase of 25 million outbound journeys taken in 2001.<sup>23</sup>

Domestic air traffic has grown particularly quickly, from 242 million passengers in 2004 to 405 million in 2008.<sup>24</sup> This has been very beneficial for the development of the larger regional airports. Access to domestic routes for airlines is tightly restricted with limited competition. Air congestion, particularly around Shanghai and in the Pearl River Delta, is being addressed.

Of more than 159 civilian airports in China, the largest ten account for over 57 percent of total passenger volume, while almost 80 airports have fewer than 500 passengers a day.<sup>25</sup> Capital Airports Holding Company owns more than 30 airports in nine provinces, including Beijing Capital International Airport, and covers 30 percent of passenger throughput of the whole Chinese market.<sup>26</sup>

Beijing Capital International Airport handled almost 56 million passengers in 2008, marking a 4.3 percent increase over 2007 and making it China’s largest airport by passenger volume. Shanghai Pudong International Airport moved the most cargo in 2008, accounting for 2.6 million tonnes, or one third of the entire cargo volume for the country.<sup>27</sup>

The Chinese government is developing a “hub-and-spoke” network similar to that in the United States to move the rapidly growing tonnage of cargo moving around the country. Between 2006 and 2010 an additional 43 new airports, 25 terminal expansions and nine runway upgrades are planned, with a long term goal of having 244 civilian airports in operation by 2020. Airport fees and commercial income (such as rental of retail space and advertising) represent the two main sources of revenue for airports.

Under the Reform Scheme for Civil Airport Charges promulgated by the General Administration of Civil Aviation of China (CAAC) and the National Development and Reform Commission (NDRC), aviation business fees were adjusted in March 2008 for both domestic and foreign airlines. Through this scheme, airports have been permitted to negotiate landing fees within a limited range. To promote industry growth, the CAAC set a ceiling price for airport charges for the first half 2009 which has impacted airport revenues for the period.<sup>28</sup>

<sup>23</sup> Source: Civil Aviation Administration of China

<sup>24</sup> Source: Civil Aviation Administration of China

<sup>25</sup> Source: Civil Aviation Administration of China

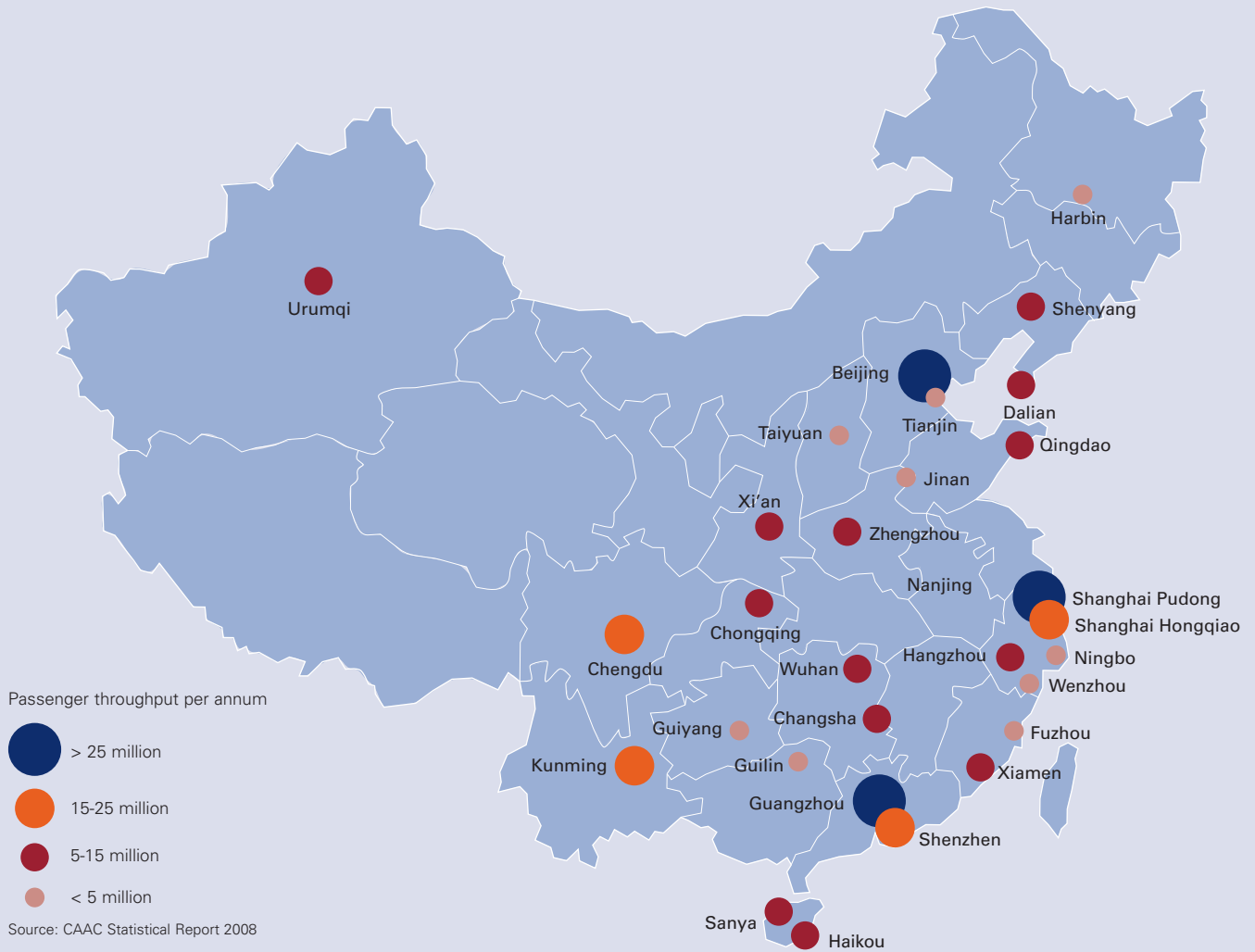
<sup>26</sup> Source: Capital Airports Holding Company

<sup>27</sup> Source: Civil Aviation Administration of China

<sup>28</sup> Source: Beijing Capital International Airport Annual Report 2008



Figure 10: Graphical map of the largest 30 airports in mainland China



Commercial revenues for airports in China are generally lower than those seen internationally. Relevant to this is the high proportion of domestic flights taken in China, which means that there is no access to duty-free products. In addition, for a number of smaller airports, the footfall is insufficient to attract major retailers or caterers, so either rental incomes are low or the airports provide and manage retail and catering services themselves. However, for those airports which are able to reach critical traffic mass, there are substantial opportunities to optimise levels of commercial income.

**Private investors**

According to the 2007 Catalogue for Guidance of Foreign Investment Industries, foreign investors are able to invest with equity interest up to 49 percent in the construction and operation of airport activities, including airport terminals and runways. Further, since 2005, domestic private investors can own up to 100 percent of provincial airports, though they are also limited to a 49 percent stake for the country’s main airports, including capital cities of provinces and autonomous regions, municipalities and nine other large cities.

*“The potential of commercial retail and ancillary opportunities relating to airports is relatively untapped”*

Table 3: Chinese airports listed on stock markets

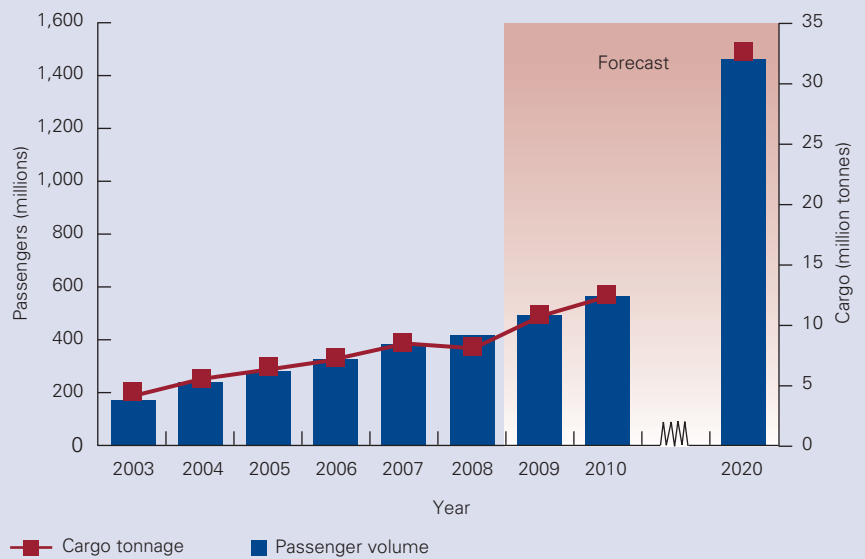
Listed Chinese airports	Listing Code
Hong Kong listing	
Beijing Capital Int'l Airport Co., Ltd.	HKG: 0694
Hainan Meilan Int'l Airport Company Ltd.	HKG: 0357
Mainland China listing	
Shanghai International Airport Co., Ltd.	SHA: 600009
Guangzhou Baiyun International Airport Co., Ltd.	SHA: 600004
Xiamen International Airport Co., Ltd.	SHA: 600897
Shenzhen Airport Co., Ltd.	SHE: 000089

So far, most investment in the China airport sector has been by strategic investors, such as Hong Kong Airport Authority (Hangzhou and Zhuhai), Changi Airports (Nanjing), Fraport (Xian), Aeroport de Paris (Beijing Capital – since disposed) and Copenhagen Airport (Hainan Meilan – since disposed).

Many international financial investors have shown interest in the sector due to the expected long-term traffic growth and opportunities for commercial development. However, accepting structural features, such as regulatory control over airport fee growth, has often proved challenging and attention has been given to auxiliary services relating to airports (such as catering and logistics) as a proxy form of participation in the sector.

Another key issue for investors to be aware of is the timing of investment in relation to the capital expenditure cycle. Capital investment by airports is generally lock-step and large (for example, expenditure on a new terminal or runway), while there can be a lag for cash inflow relating to such investment. Timing of capital expenditure can therefore have a major impact on expected returns.

Figure 11: Passenger volumes and cargo tonnage through airports



Source: CAAC Statistical Report 2006-2008; Chongyang Securities, 2007



## Utilities – water and waste

*“The water supply and waste water treatment sectors are going through great changes and offer significant opportunities for consolidation”*

China has over 100 cities with a population of 1 million people or more and has sustained an average annual GDP growth of about 10 percent over the last 30 years.<sup>29</sup> To maintain this level of growth, improve standards of living across China, and enhance the efficient running of China’s many large municipalities, massive investment in water and waste management infrastructure is urgently required.

### **Water and wastewater**

Due to geographic factors, China has limited and unevenly distributed water resources across the country. China’s rainfall and water resources are concentrated mostly in southern China while there have been substantial shortfalls in northern China. Because of this, China has turned to the use of groundwater, while trying to manage problems such as deforestation, subsidence and water contamination. In 2004, China’s water consumption per unit GDP was four times the world average.<sup>30</sup>

As part of the 11th Five-Year Plan, and with additional funding from the stimulus package, China is addressing a number of major challenges with regards to managing water resources, and has a target of reducing water usage per unit of GDP by 20 percent by 2010.

The government also intends to spend RMB 1 trillion to improve water treatment and recycling facilities, including the construction of 800 to 900 new water processing and wastewater treatment plants. It is also building three canals for its south-to-north water diversion project, of which the eastern and central routes have started construction, with a total construction cost of USD 62 billion. Those canals are financed by the central and provincial governments and bank loans.

### **Private investment**

The market is currently relatively fragmented and offers opportunities for consolidation. As at the end of 2008, 19 water supply or waste water treatment projects was the most any single private water company in China concurrently owned.<sup>31</sup>

<sup>29</sup> Source: China Urban Statistical Yearbook, 2006

<sup>30</sup> Source: Ministry of Water Resources

<sup>31</sup> Source: The World Bank Group, June 2009

Foreign investors are encouraged to invest in water treatment and wastewater treatment plants in urban areas through wholly-owned foreign enterprises or joint ventures. Further, foreign shareholders are permitted to own a maximum of 49 percent stake in distribution networks through joint ventures with municipal utility companies.

Key risks for concessionaires on projects are often related to operations, such as the ability to reflect the quality of influents in the quality of treated water or wastewater, and the ability to pass on significant cost rises for key inputs, such as energy or chemical costs, in a timely manner. Counterparty credit risk for operations in smaller cities or towns can also be an issue, and banks have been known to refuse lending on certain projects of foreign operators due to such perceived risks.

Other areas of growing opportunity include the application of specialist technologies, such as water-reuse and sludge treatment.

Figure 12: Structure of China's water market

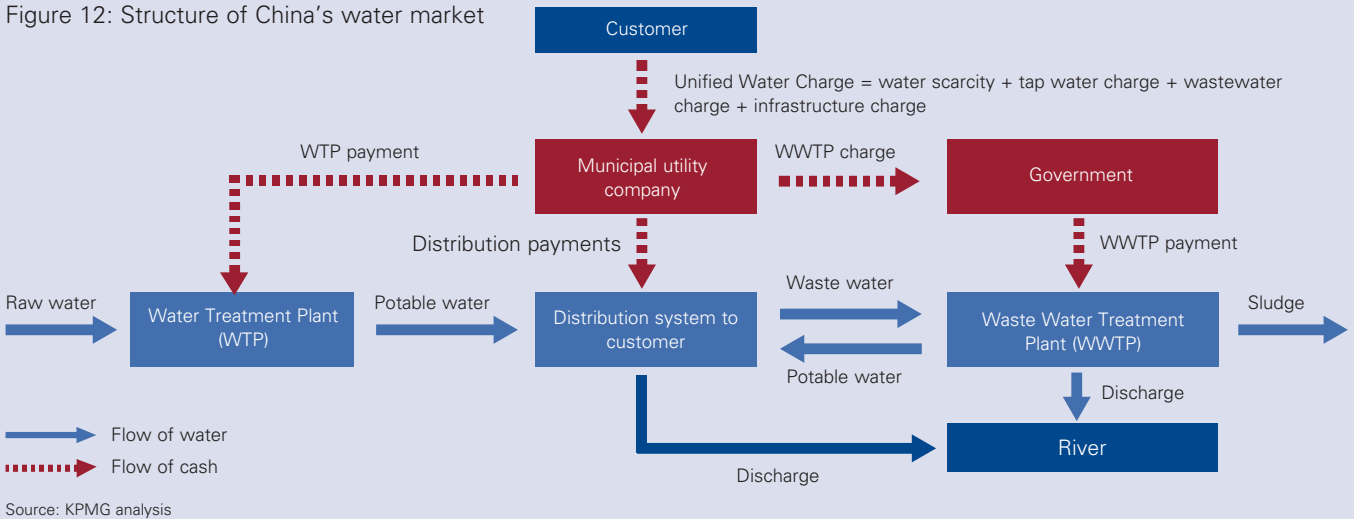
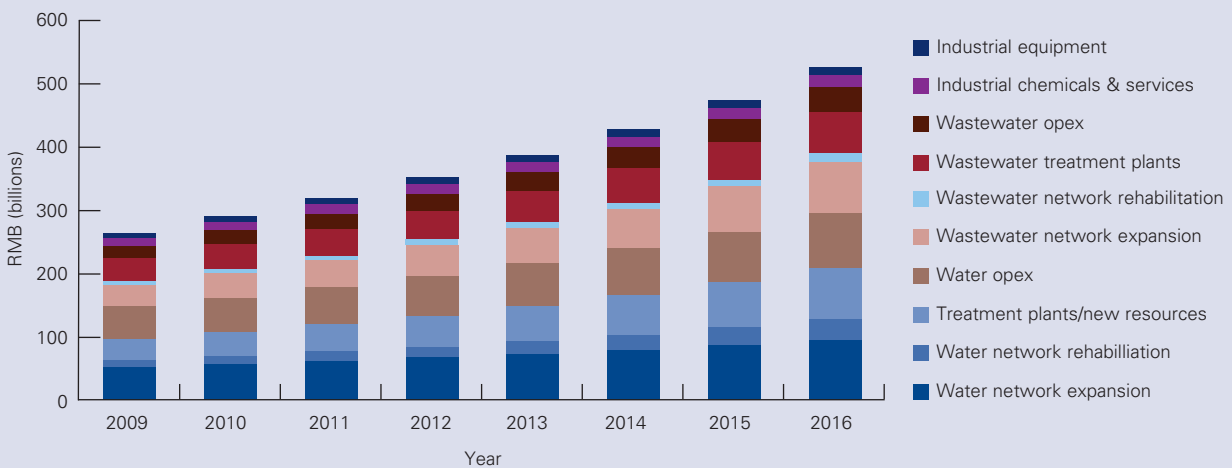


Figure 12: Water sector expenditure forecast



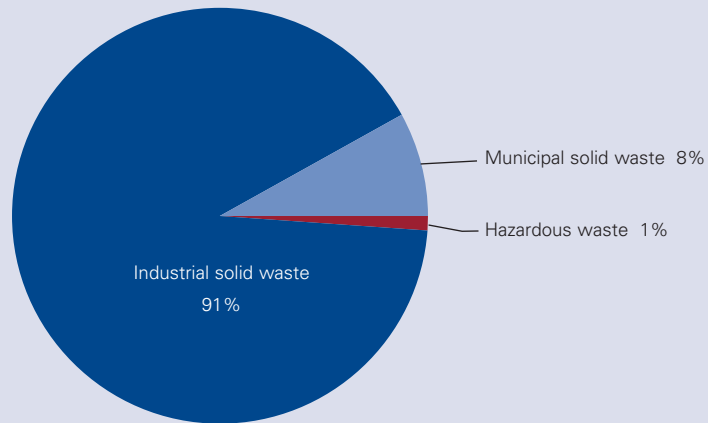
*“Foreign and private investment is encouraged in the solid waste treatment sector”*

**Solid waste**

It is estimated that China will need 1,400 new landfills over the next 20 years and in cities with a population over one million over 5,000 brownfield sites need cleanup.<sup>32</sup> Foreign investment is encouraged in the solid waste treatment sector and local governments are looking to attract private investment through BOT concessions.

Solid waste can be categorised into three types: industrial, municipal, and hazardous. In China, the bulk of waste produced is industrial.

Figure 13: Breakdown of waste by source in million tons (2007)



Source: National Bureau of Statistics of China, Ministry of Environmental Protection

Treatment will depend on the types of waste, but will usually either be landfill, incineration or reuse (such as recycling or use for construction materials).

With economic development comes the need to manage the quantity of waste. China has recently surpassed the United States as the world’s largest municipal solid waste generator. In line with economic output, most municipal waste is produced in the eastern provinces.

In large cities where land is limited, incineration is an increasingly popular form of treatment, with eastern regions targeting to increase incineration rates to 30 percent in 2010 from 19 percent in 2005. However, the calorific quality of China’s waste is often very low (about 5MJ/kg) due to the high ratio of organic contents.<sup>33</sup> As waste for incineration needs a calorific value of about 6-6.5MJ/kg, the addition of fuel is usually required, which substantially reduces the commercial benefits of incineration. This can be explained by the high level of recycling, due to large number of informal “wastepickers” in China, though this results in the level of recyclable materials at incineration or landfill plants being relatively low.

<sup>32</sup> Source: Waste Management in China: Issues and Recommendations – World Bank Report  
<sup>33</sup> Source: UMTEC “Waste Incinerator in China”

The older landfill sites in China are of basic construction and have limited leachate collection systems, which can cause water contamination problems, particularly in northern China where there is a high reliance on groundwater. However, substantial focus is being placed by municipal authorities on resolving these issues. In addition, landfill gas collection systems are gradually being introduced at new sites, which can be used for electricity generation or fed into municipal gas systems.

China encourages both domestic and foreign investors to invest in the solid waste treatment sector and local governments to attract private investment through BOT concessions. For incineration, a subsidy of RMB 0.25 per kilowatt hour is paid for the first 15 years of production.

The NDRC is promoting collection fees in cities, with 40 percent of cities already charging fees as at 2005. However, fees cannot always cover all the costs, so additional subsidies from local authorities are often required.

Waste to energy projects such as landfill gas and incineration projects may also be eligible for generation carbon credits under the Clean Development Mechanism (CDM), which provides additional revenue.

Key challenges for investors include waste volume risk (including that resulting from competing projects), waste quality, and in securing land and related approvals.





# Energy

With economic growth has come a massive increase in demand for energy. In 2009, China’s power capacity is expected to exceed 900 GW and soon be on par with the United States’ capacity of 1,000 GW. Further, it is expected to reach up to 1,500 GW by 2020.

The bulk of the growth in power capacity will likely still come from thermal generation, but strong growth rates for renewable energy are anticipated.

Of this 1,500 GW, 15 percent is targeted to be generated by non-hydro renewables, 6 percent by nuclear, and 20 percent from hydropower. However, government officials, agencies or draft energy plans have announced several revised 2020 targets for the different sub-sectors.

Table 4: Renewable installed capacity targets

Renewable energy Targets	2008		2010		2020	
	Actual	Initial	Revised	Initial	Revised	
Installed capacity (GW)						
Hydro	171	190	–	300	–	
Wind	12	10	20 - 30	30	120 - 150	
Biomass	<4	5.5	–	30	–	
Solar	0.1	0.3	–	1.8	10 - 20	

Source: China’s 11<sup>th</sup> Five-Year Plan, and KPMG analysis  
 Note: The revised targets have not been officially published

## Coal

Coal is the principal source of generation in China, accounting for 69 percent of its total energy demand in 2007.

Despite there being over 7,000 companies operating around 20,000 mines, since the removal of price controls in December 2006, coal companies have generally been able to maintain a strong negotiating position due to user constraints over infrastructure for supply, and users’ specific requirements over moisture and ash content.

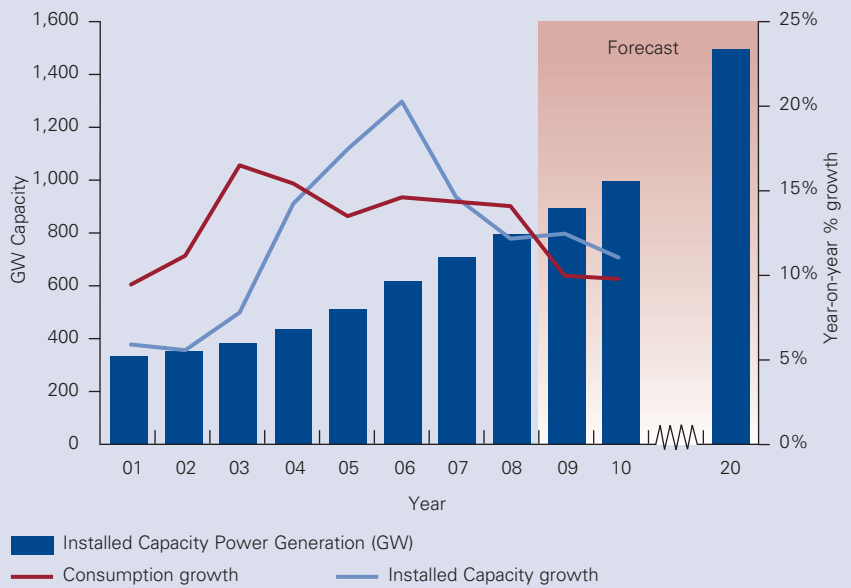
The Government is trying to facilitate consolidation of the mines to increase efficiency and better regulation.

Although foreign companies face licensing restrictions and due diligence requirements, they are actively encouraged to participate in related businesses, such as Coal Bed Methane or Coal Mine Methane extraction projects, where they may be able to introduce new technologies or techniques.

The coal-based power generation market is dominated by the “Big Five Gencos” of Huaneng, Huadian, Guodian, Datang and China Power Investment. Since the deregulation of coal prices, all Gencos have suffered from margin squeeze. However, the global downturn has offered some respite as coal prices dropped on lower demand.

The government is committed to improving efficiency in the sector and has implemented programmes such as the “Program of Large Substituting Small” to close China’s least efficient coal power stations. From 2006 to the first half 2009, it shut down 54 GW worth of those least efficient coal fired power plants and plans to close an additional 31 GW of other small plants in the next three years. Those plants are being replaced by medium and large ones, with the larger ones (over 600 MW) required to be ultra-supercritical.<sup>34</sup>

Figure 14: Installed generating capacity; capacity and consumption



Source: State Electricity Regulatory Commission (2000-2004, 2006-7); China Electricity Council (2005); Director of National Energy Board (2008-10); Manager of State Grid (2020); EIU (consumption)

<sup>34</sup> Source: Caijing magazine “China holds its breath for clean coal power”, 30 April 2008



*“China expects 15 percent of primary energy to come from non-hydro renewable sources by 2020”*

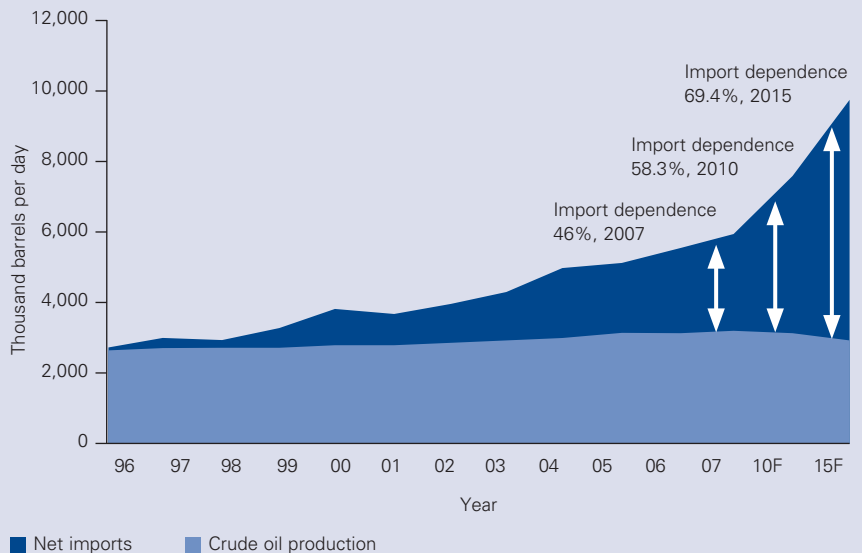
**Oil and gas infrastructure**

Over the last 10 years, while China’s crude oil production has grown from 3.3 million to 3.7 million barrels per day, its demand for oil has continued to grow rapidly, such that by 2025 China is expected to import more than three quarters of its oil.

Downstream, refining capacity has increased from 4.6 million barrels per day in 1997 to 7.6 million barrels per day in 2007, while consumption reached 7.9 million barrels in 2007.

According to BP, China’s natural gas reserves are 1.88 trillion cubic metres. Consumption hit 67.3 billion cubic metres in 2007 and continues to grow. To cope with this growing demand for natural gas as well as to take advantage of stimulus monies, there is currently heavy investment in pipeline systems, the bulk of it by Petrochina.

Figure 15: Growing dependence on crude oil



Source: Historical production up to 2007 and import and export data up to 2006 from the National Bureau of Statistics; 2007 import and export data from Xinhua News Agency; forecasted production taken as the difference between consumption and import data from Wood Mackenzie cited by Dow Jones Newswires

**Renewables**

The Chinese government is aiming for 15 percent of the country’s primary energy to come from non-hydro renewable sources by 2020, an increase of nine percent over 2006 levels. In 2006 the Renewable Energy Law became effective, setting out a detailed plan for the development of hydroelectricity, wind power and solar energy.

Hydroelectricity accounts for most of China’s current “renewable” electricity output, with 171 GW installed capacity at end 2008. Of this, the massive Three Gorges Dam project accounts for 22.4 GW. However, by 2012 it is expected that

*“China doubled its wind capacity in the first half of 2009”*

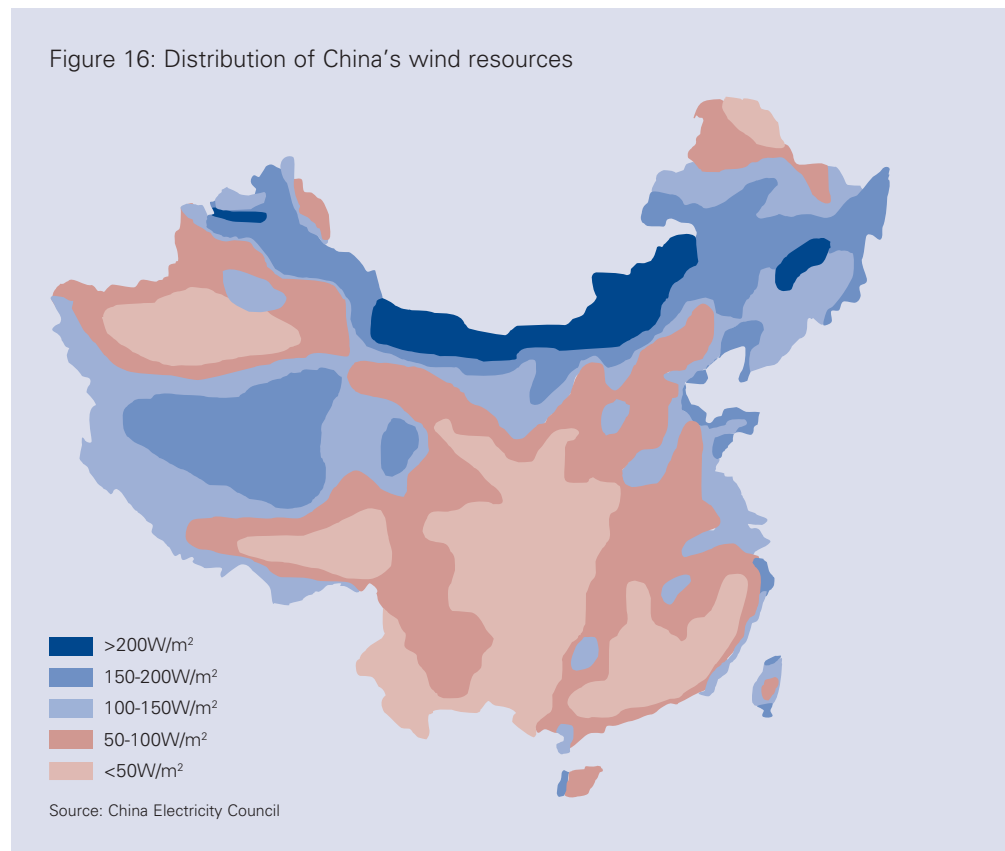
three quarters of all of China’s hydroelectric capacity will be reached. While there is an increased focus on the environmental impacts of large projects, strong growth is expected to continue in the smaller and micro-hydro projects.

The wind sector is currently a very dynamic market, with a wide range of local and international stakeholders and participants, massive potential exploitable resources, and strong government support. As at the end of 2008, installed wind capacity totalled around 12.1 GW, beating the previous target set by NDRC by two years. In August 2009, China announced that it had doubled its wind capacity during the first half of the year, adding 11.8 GW of capacity.<sup>35</sup>

According to industry news, the 15 percent non-hydro renewable target set for 2020 may also beat the “new” target set by the new energy stimulus plan drafted in 2008 by the China’s National Energy Administration (NEA).<sup>36</sup> This plan encourages further wind sector investment, with 2020 targets of at least 100 GW for wind projects and 10 to 20 GW for solar capacity (which in 2008 had a total capacity of just 100 MW).

The Chinese Wind Energy Association announced in June 2009 that the seven super wind bases selected by the NEA, with each site targeting to have at least 10 GW, could reach a total installed capacity of 120 GW by 2020. Those bases are located in Gansu (12 GW), Xinjiang (20 GW), Hebei (10 GW), Jiangsu (10 GW), western Jilin (18 GW) and Inner Mongolia provinces (Western 20 GW; Eastern 30 GW). Projects in those wind bases will mostly be developed by large Chinese corporations using domestic wind turbines.

Figure 16: Distribution of China’s wind resources



<sup>35</sup> Source: Xinhua News Agency, 2 August 2009

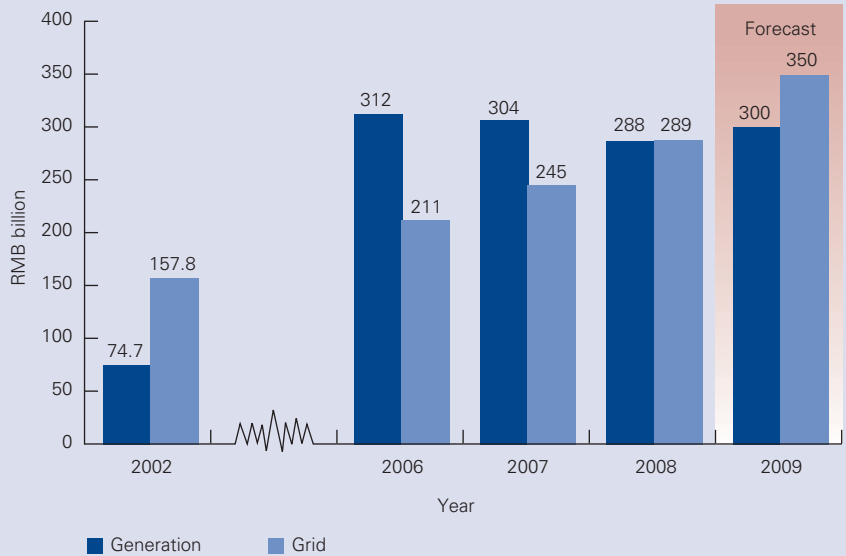
<sup>36</sup> Source: China Daily, 10 June 2009

After many years of utilising solar energy for domestic purposes, such as water heaters, and other micro-power generation, such as street lighting, China has recently shifted up a gear, with the development of large scale solar power generation projects.

The first Chinese demonstration project of 10MW will be developed in Gansu Province by the Belgian company Enfinity NV in partnership with China Guangdong Nuclear Power Group and LDK Solar. Although bids for the project ranged from 0.69 to 1.9 RMB/kWh, the consortium for this RMB 200 million project won the tender with a proposed tariff of 1.09 RMB/kWh, demonstrating the Government’s focus on long-term sustainability for the project and the nascent solar energy market as a whole.<sup>37</sup>

With many renewables projects being established in remote rural locations, and given their fluctuating power output levels (windfarms in particular), a key requirement for the long-term development of the renewables sector is having a large and stable grid network. The Chinese government has recognised this and is investing heavily in developing the state grid, including the development of a network of ultra-high voltage transmission lines and the introduction of smart grid technologies which will facilitate the management of and matching of electricity supply and demand through digital metering, and central control of generation and transmission facilities. It has been estimated that at least RMB 147 billion will be needed to build an international-level quality smart grid.

Figure 17: Investment in China’s state grid



Source: China Electricity Council

<sup>37</sup> Source: Renewable Energy Magazine, 10 July 2009

*“Favourable policies to encourage the growth of renewables”*

To further encourage the growth of renewables, the government has introduced favourable policies, including the following:

- Power companies with installed capacity over 5 GW are required to ensure 3 percent of their installed capacity is from non-hydro renewables by 2010, and 8 percent by 2020.
- Non-hydro renewables should reach 1 percent of China’s total power generation by 2010 and 3 percent by 2020.
- A “3+3” Corporate Income Tax holiday and a 50 percent reduction on VAT payable for wind farm projects.
- A subsidy of RMB 20 per watt of solar photovoltaic installed for installations of at least 50 kW which represents about 50 percent of the total installation cost.
- Classification of renewable energy as an encouraged sector in the Catalogue of Encouraged Foreign Investment Industries.

The government is also investing heavily in nuclear power, with a target of 5 percent of China’s electricity to be from nuclear power by 2020. There are currently 11 nuclear power stations in operation and seven more are under construction.

Nuclear power characteristics of stable base-load, coastal location and little or no direct carbon emissions mean they are an attractive alternative to provide power to China’s major eastern cities.





## Social infrastructure

*“Healthcare reform is high on the agenda, with clear short-term and long-term goals”*

The government strongly focuses on the provision of social welfare – particularly in rural and disadvantaged areas – in order to improve quality of life and boost long-term economic stability and development.

### Healthcare

In recent years, healthcare expenditure in China has been relatively low, both in absolute terms, and also relative to GDP. In 2008, total health expenditure per capita was USD 139 in China, compared with USD 1,532 in Hong Kong, USD 3,138 in Japan, and USD 4,403 in Australia. Further, total health expenditure as a proportion of GDP in China was half of that in Japan and Australia.<sup>38</sup>

In October 2008, the NDRC released a national healthcare reform proposal as a policy guideline for the overall direction of the country’s healthcare system over the next 10-20 years. Following that, in January 2009 a final draft for the healthcare reform, outlining both short and long term goals, was approved by the central government.

The long-term vision is of a “Healthy China” by 2020, giving all citizens, urban and rural, equal access to public healthcare. This means major changes throughout public and private healthcare institutions, as well as to supporting industries such as pharmaceuticals and equipment manufacturers.

The short-term goals to be reached by 2011 focus on three main areas:

- Basic medical insurance coverage that reaches over 90 percent of urban and rural residents
- Improved accessibility and service standards for basic healthcare facilities (construction/upgrading of 3,700 community healthcare centres and 11,000 community clinics), along with government-sponsored training to increase the supply of trained staff, especially in rural areas
- Reduced costs of medical services and pharmaceuticals for end-users. As well as boosting insurance coverage, the government seeks to promote price-competitive generic medicines, consolidate pharmaceutical distribution channels, and control the price of medicines which are covered by insurance.

<sup>38</sup> Source: KPMG “Healthcare in China”, August 2009

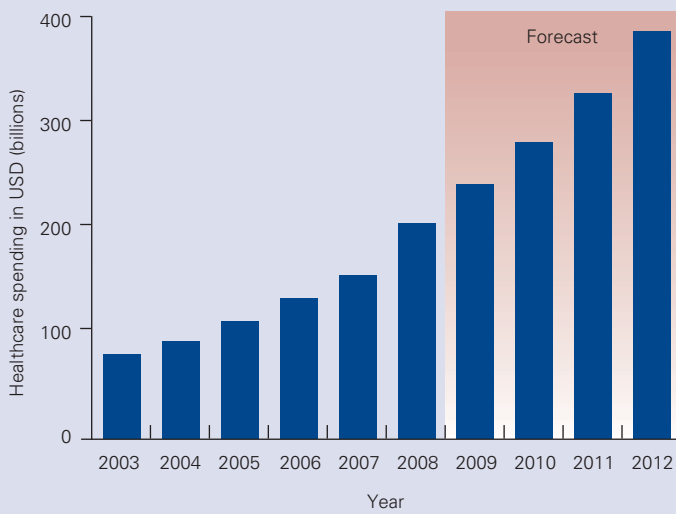
An estimated RMB 850 million will be injected by all levels of government over the following three years to achieve these short-term goals.

For hospital developers and operators, healthcare reform should result in increasing opportunities to invest in both specialist and general hospitals, though it is expected that such investment will remain challenging in the short term, and it is unlikely that the maximum 70 percent ownership restriction will be raised.

Foreign investment opportunities in greenfield general hospitals are likely to be limited in large cities as these generally already have well-established hospitals. Such opportunities instead will likely be greater in smaller cities (some second- as well as third-tier) with a growing wealthy population requiring high-end services.

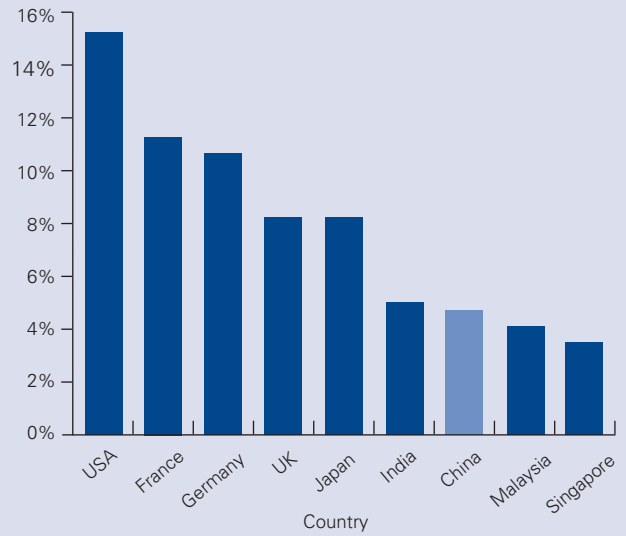
The main opportunities in large cities are likely to be in niche or specialist hospitals such as cardiovascular or eye hospitals. However, each city will have specific needs depending on their existing facilities. The related medical equipment, supplies and pharmaceuticals sectors are also expected to expand rapidly.

Figure 18: Healthcare spending



Source: CAAC Statistical Report 2006; Chongyang Securities, 2007

Figure 19: Proportions of GDP spent on healthcare



Source: China Healthcare data, EIU ViewsWire, August 2008; World Healthcare data, WHO, 2008

*“The education sector is of keen interest to private equity and corporates alike, and the commercial opportunities are relatively untapped”*

## Education

Compulsory education in China comprises a nine-year programme for children aged 6–15 years (six years of primary school and three of middle school), a policy that was introduced in 1986.

After completing this programme, students can choose to pursue further study in high school and then university or go to vocational schools. Over the last 10 years, the number of graduates and doctorates has increased fivefold. China is currently ranked second in the world in terms of the number of workers with a tertiary education, with a total number of 70 million.<sup>39</sup>

In 2008, the education budget in China was RMB 56.2 billion, a 45 percent increase over 2007.<sup>40</sup>

Table 5: Education institutions in China

Education institutions in China			
Level	Number of institutions	Age	Students (millions)
Primary	396,567	6-12	17
Junior secondary	62,431	12-15	19
Senior secondary	31,685	15-18	9
Vocational	31,685	15-18	3
Higher education	2,000	18-22	20

Private post-secondary training includes 22,322 private training institutions, offering on-the-job or part-time training for more than 8.8 million people.

In 2007, about 410,000 physically disadvantaged students were studying in more than 1,540 special institutes.

According to the Ministry of Education, between 1978 and the end of 2007, more than 1.21 million mainland Chinese people went abroad to study. Out of that total, 319,000 returned to China after their studies (with most returning to either Beijing or Shanghai), and currently there are 657,000 Chinese students at schools overseas.

Due to complex regulations regarding the eligibility and qualifications of who can own and operate educational institutions in China, foreign investment so far has been focused mainly on private primary and secondary schools in first- and second-tier cities, as well as English language training, and specialist, vocational training facilities for young adults, mature students and professionals.

<sup>39</sup> Source: Xinhua News Agency, 22 April 2008

<sup>40</sup> Source: ChinaToday.com “China Education: Information, Facts and Figures & News Links”

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Publication date: September 2009

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