




# China's Energy Sector: A clearer view

INDUSTRIAL MARKETS



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## Introduction



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The growing sophistication of China's industrial base and the rising power of domestic consumers are critical factors shaping China's energy needs. As China's export markets weaken, domestic consumption is becoming a more critical driver of growth.

No other economy in history has developed under the kind of international scrutiny that China faces today. In particular, this scrutiny has focused on the country's environmental record and its global ambitions to secure energy and natural resources. As many as 350 million additional people are expected to inhabit China's cities in the coming decades<sup>1</sup> and this will require extensive investments in the energy sector.

China, like the United States, Britain and Germany, has relied on coal to generate the power it needs to drive its economic growth. But as this report shows, China is diversifying its energy sources by adopting renewable energies and applying clean-burning technologies to coal-fired power plants.

The interplay between different energy sources in China, not least the continued reliance on coal for power generation, need to be fully understood before one can consider how the sector may develop in the future.

<sup>1</sup> "Preparing for China's urban billion," *McKinsey Global Institute*, March 2008



China's authorities are acutely aware of the country's environmental challenges and its dependence on energy imports. They recognise that one way to manage these issues will be through greater efficiency and innovation in all areas of the energy sector. They have also recognised that there are opportunities to attract investment through the Kyoto Protocol's Clean Development Mechanism. This increasingly complex backdrop of policy and investment considerations is making it an ever greater challenge for companies and planners to build a modern and integrated energy infrastructure.

The following KPMG report shares our observations on key trends in each area of the energy sector, from upstream oil and gas through to power generation. We hope you will find it particularly relevant in light of the recent developments in the world economy. As always, we would welcome the opportunity to discuss our findings with you.

## Upstream oil and gas:

# Focus on performance and efficiencies



More than any other factor, China's thirst for oil and petroleum products has shaped the country's recent energy policy, particularly as its reliance on imports has increased since the mid 1990s. For this reason, it is logical to start any assessment of China's energy sector by looking at upstream oil and gas developments.

China has never been an especially resource-rich nation, relative to the size of its population. However, if oil consumption continues rising at recent levels, China is likely to import as much as three-quarters of its oil needs by 2025.<sup>2</sup>

In this context, sustaining output from domestic reserves has been an increasing challenge, which has led to a greater focus on performance by the domestic oil giants PetroChina (the listed entity of China National Petroleum Corp) and Sinopec (the listed entity of China Petroleum and Chemical Corp). Both have already set targets to enhance the sustainability and efficiency of production, while taking steps to restructure and consolidate upstream divisions more efficiently.<sup>3</sup>

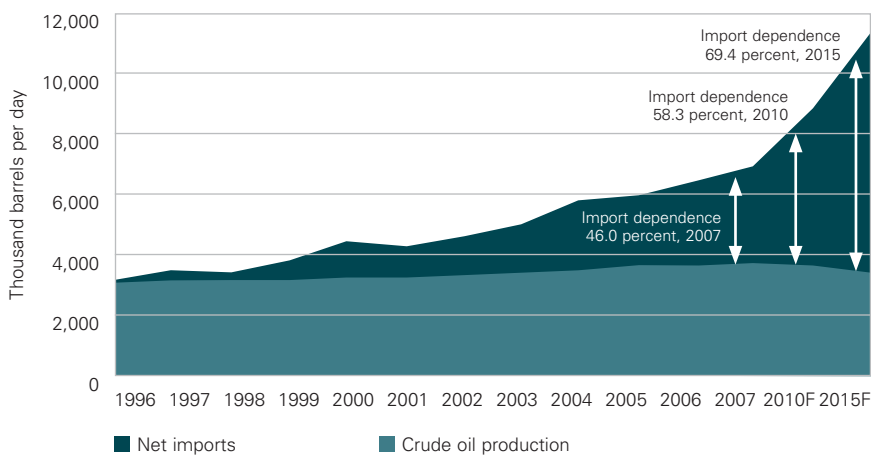
The country's achievements in maintaining domestic production levels are impressive considering that several of the largest individual oil fields are approaching depletion. Until the 1990s, China could comfortably rely on output from a relatively limited number of established fields in the northeast as well as further south in Shandong province. The largest of these, the Daqing field in Heilongjiang, has been exploited continuously for almost five decades.

<sup>2</sup> The Energy Information Administration forecasts consumption to double to 15.7 million barrels per day in 2030 compared to 7.58 million per day in 2007. The Chinese Academy of Social Sciences also predicts that the country will consume 563 million tons of crude oil in 2020, which is 62.5 percent more over 2006; see "China's oil consumption to hit 563M tons in 2020," *China Daily*, April 2008

<sup>3</sup> China Mining Association: "CNPC, Sinopec integrate upstream sector to sharpen competitive edge, report," 10 March 2008



**Figure 1: 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*; forecasted production taken as the difference between consumption and import data from Wood Mackenzie cited by *Dow Jones News Wire*, available at <http://www.uofaweb.ualberta.ca/chinainstitute/nav03.cfm?nav03=48264&nav02=43884&nav01=43092>

As oil prices surged between 2001 and early 2008, domestic crude oil production achieved some modest growth, from 3.31 million barrels per day to 3.74 million barrels per day.<sup>4</sup> Declining production from the most established oil fields was offset by increased production elsewhere, including in more remote or geologically complex regions. With demand now slowing and global oil prices falling, the need to limit import dependence is, arguably, less critical.

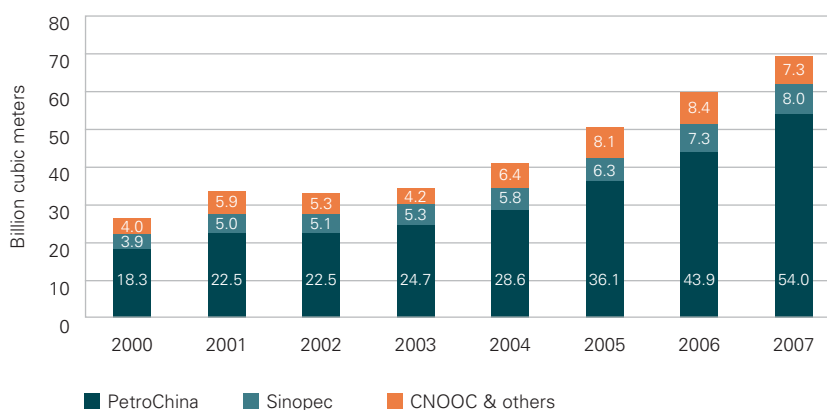
<sup>4</sup> BP Statistical Review of World Energy 2008; EIA data shows CAGR of 2.8 percent for the same period 2001-07

To support development of new oil and gas-producing regions, the government has encouraged major international players to pursue joint production with the domestic oil companies.<sup>5</sup> In addition to PetroChina and Sinopec, CNOOC Ltd (the listed entity of the China National Offshore Oil Corp) has been particularly active in sharing concessions with foreign companies that offer advanced exploration and production technologies.

More so than with oil, foreign companies have been invited to participate in gas exploration and production, particularly in offshore locations. In terms of reserves and production, PetroChina is the largest natural gas supplier by virtue of its assets in the central and western regions of China, while CNOOC has been particularly active in offshore exploration and production.

According to BP, China's natural gas reserves amount to a relatively modest 1.88 trillion cubic metres, but due to increasing demand, the reserve-to-production ratio has fallen from 58 years in 1998 to 27 years in 2007. Over the past decade, natural gas consumption has increased more than threefold, from 20.3 billion cubic metres in 1998 to 67.3 billion cubic metres in 2007.<sup>6</sup> However, this represents just 3 percent of the country's total energy consumption, far below the world average of 23 percent.<sup>7</sup>

**Figure 2: PetroChina remains the largest producer of natural gas among oil majors**



Source: CNPC, Sinopec and CNOOC annual reports from 2000 to 2007

<sup>5</sup> "International energy companies' activities in China over 30 years," available in Chinese at <http://mnc.people.com.cn/GB/7220686.htm>

<sup>6</sup> BP Statistical Review of World Energy, 2008

<sup>7</sup> Energy Information Administration: World Consumption of Primary Energy by Energy Type and Selected Country Groups, available at [www.eia.doe.gov](http://www.eia.doe.gov)





The extent to which China's dwindling oil output leads to higher import dependence will be determined to a large degree by the future role of oil in transportation. According to the *China Statistical Yearbook 2007*, vehicles accounted for about 30 percent of total oil consumption in 2006 and this figure could rise to 59 percent by 2020, if vehicle use continues to rise at current rates.<sup>8</sup> The big question will be the speed and extent to which hybrid vehicles may be adopted more widely as this could dramatically alter that equation over the next few years.

## Impact of the export slowdown

The global economic downturn has hit manufacturing enterprises across China with many sectors seeing dramatically lower orders from their normal export markets. The knock-on effect for oil and gas companies is likely to be felt in contrasting ways on the upstream and the downstream sides of the business.

In many parts of China, demand continues to outstrip the domestic availability of oil and gas, so in the first instance, any slowdown in demand is likely to curtail the need for imports, as well as slowing domestic production. Pricing is likely to fall, reflecting the decline in global oil prices from their highs in mid-2008. While this will gradually erode the operating margins for many upstream units, vertically-integrated companies such as PetroChina and Sinopec stand to benefit from stronger margins on their refining operations, particularly as prices for refined products in China are set significantly above world averages.<sup>9</sup>

Natural gas is consumed by households, power generation companies and a range of industrial sectors including chemicals, fertiliser and glass producers. The slowdown in manufacturing is sure to have an impact on the demand for these products and consequently the demand for gas. The availability of natural gas for power generation has been somewhat constrained in recent years, so there remains room for continued growth in many regions, albeit at slower rates than previously anticipated.

<sup>8</sup> "Where will the power of China automobile come from in the era of post-oil," *Xinhua News Agency*, 30 May 2008

<sup>9</sup> Deutsche Bank: China Oil and Gas report, 19 November 2008

## Oil and gas infrastructure:

# Redrawing the map



Over the past decade, the shift in reliance towards imports has required many new investments in pipeline infrastructure, import terminals, storage facilities and refineries. The geographical focus of this investment has inevitably moved away from China's traditional oil-producing regions to coastal regions. Examples of new investments include a crude oil pipeline connecting the port city of Ningbo to Shanghai and Nanjing, and a pipeline linked to a major storage facility at Yizheng in Jiangsu province.<sup>10</sup> The government's new economic stimulus measures, announced in November 2008, allow for further investment in a number of energy projects (see box, page 11).

The market dominance of Sinopec and PetroChina has historically made downstream oil and gas a challenging area for foreign companies. Compounding these challenges, high crude prices over much of the past decade have squeezed margins.

While margins have been tight, they have not proved a deterrent to investment by the domestic oil giants. Refining capacity has grown steadily from 4.6 million barrels per day in 1997 to 7.6 million barrels per day in 2007, while consumption grew from 4.2 million barrels per day to 7.9 million barrels per day during the same period.<sup>11</sup>

The country's accession to the WTO has reduced tariffs on imported petroleum products and eased the rules on investments. In June 2007, a number of international oil companies, including Shell, BP and SK Energy, revealed interest in acquiring private refineries.<sup>12</sup>

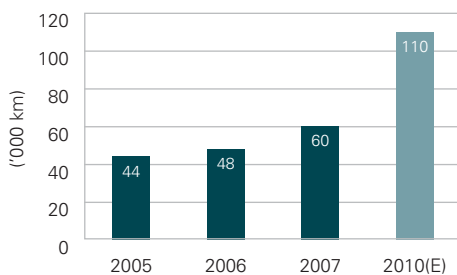
<sup>10</sup> HKTDC: Post WTO entry petroleum and chemical industry, 1 January 2007

<sup>11</sup> BP Statistical Review of World Energy, 2008

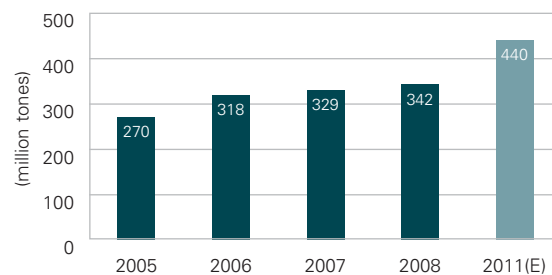
<sup>12</sup> Sohu Business, 8 March 2008, available in Chinese



**Figure 3: China's total pipeline length**



**Figure 4: China's total refinery capacity**



Source:  
 Deutsche Bank: China Oil & Gas  
 Woori Investment & Securities: China Research — China Oil Refining  
 Market Avenue: 2008 Report on China's Pipelines  
 3E Information Development & Consultants: China Refining and Ethylene Capacity Survey (2007-2008)  
 National Bureau of Statistics of China: China Statistical Yearbooks 2004-2007

Several foreign companies are making significant investments in large-scale integrated refining and cracking projects. In 2007, China's largest joint venture deal worth USD 5 billion was signed between Kuwait Petroleum and Sinopec. Other investments include a USD 4.3 billion Huizhou petrochemicals complex being built by Shell and CNOOC in Guangdong province and a major ethylene plant being developed jointly by Sinopec, ExxonMobil and Saudi Aramco in Fujian province.<sup>13</sup>

<sup>13</sup> "Asia petchem expansions to 2015 increase demand for naphtha," *Oil and Gas Journal*, 15 December 2008



Sinopec has teamed up with ExxonMobil and Saudi Aramco to develop an integrated refining and petrochemicals project in Fujian province that could ultimately involve USD 4 billion of investment.<sup>14</sup> In June 2008, PetroChina has signed agreements with Qatar Petroleum International and Shell to develop a new refinery and petrochemicals complex.<sup>15</sup> Shell said that all parties are leaning towards to locate the complex in Eastern China. Shell also squashed the speculation that the project might be shelved amid current global economic crisis.<sup>16</sup>

Infrastructure developments are equally dramatic in the gas sector. Until recently, all of China's natural gas was produced domestically and no infrastructure existed for gas to be imported, either by pipeline or in the form of liquefied natural gas (LNG).

Major investment in domestic gas transportation infrastructure is crucial, as China's domestic gas reserves are also located far from the main areas of demand. The main onshore reserves of natural gas are located in the western and northern parts of the country, such as the Sichuan Basin, Tarim Basin, Ordos Basin, Junggar Basin and Songliao Basin. Offshore reserves comprise the East China Sea Basin, Yinggehai Basin and Bohai Bay.

Consequently, China has been pouring huge amounts of capital into development of gas pipeline networks. By the end of 2007, there were 15 major domestic pipeline routes in the country, with a further three projects due for completion by 2010. PetroChina operates 22,000 kilometres of gas pipelines across the country accounting for 80 percent of total pipelines in the country.<sup>17</sup>

<sup>14</sup> "China approves Aramco-ExxonMobil petrochemical plants, refinery upgrade 6," *Platts Petrochemical Report*, April 2007

<sup>15</sup> "Shell Signs On for Possible China Refinery," *Wall Street Journal*, 25 June 2008

<sup>16</sup> "Shell, QP, PetroChina to move on with E. China integrated complex," *Singapore Platts*, 3 Mar 2009

<sup>17</sup> "Chinese oil firms expected to see more efficient transportation with pipeline building," *Xinhua News Agency*, 12 January 2009

PetroChina's network has doubled in size since 2000 and this is in no small part thanks to the completion in 2004 of the country's longest gas pipeline, which runs from Xinjiang in the far west to Shanghai. The company plans to open a further 21,000 kilometres of pipeline by 2015 and this will include constructing the West to East II gas pipeline, running for 9,100 kilometres on a more southerly route to Guangdong province.<sup>18</sup> The new project includes eight sub-lines and will have an estimated cost of USD 20 billion. About 30 billion cubic metres of capacity will be added to China's pipeline network after its completion.<sup>19</sup> Another key project in-progress is in Puguang gas field. In August 2007, Sinopec started construction of a 1,702-kilometre pipeline running from the Puguang gas field in Sichuan to Shanghai. The project is expected to cost RMB 62.7 billion with an annual transport capacity of 12 billion cubic metres per year.<sup>20</sup>

A number of LNG import projects have been successfully completed, despite initial concerns about the ability of imported LNG to compete with cheaper fuel sources, such as coal. This is a particular concern because neighbouring countries such as Japan and Korea have historically paid high tariffs for LNG for their own power sectors.

China also intends to build cross-border pipelines with several neighbouring gas-rich countries. In June 2008, construction started on the Central Asia-China gas pipeline, which runs for 7,000 kilometres from Turkmenistan. The pipeline will be capable of transporting 30 billion cubic metres per year and is scheduled to begin operations in 2011. Other proposals involving lengthy overland pipelines are being discussed with Myanmar and Russia.

## China's stimulus plan

In November 2008, the Chinese government responded to the economic downturn by announcing a RMB 4 trillion economic stimulus plan. While not all the money announced was additional, it included financing to initiate or accelerate several major infrastructure projects as well as tax rebates on a range of exported goods. Early analysis of the package suggests that at least RMB 180 billion will be allocated to highway, railway and power grid development, with a further RMB 350 billion directed to ecological and environmental projects, including renewable energy facilities.<sup>21</sup> The programme also includes new funding for rural development initiatives, many of which are likely to include an energy component.

In the gas sector, the government has accelerated approvals for a major pipeline from the northwestern Ningxia Hui Autonomous Region to the southern economic hubs of Guangzhou and Hong Kong, an investment estimated at RMB 93 billion.<sup>22</sup>

The stimulus package also includes a two-year finance programme to rebuild infrastructure in light of recent disasters, most notably the May 2008 earthquake and the February 2008 snow storms. Both incidents caused extensive damage to electricity and pipeline infrastructure in central, southern and western regions of the country.

<sup>18</sup> "China's Natural Gas Industry and Gas to Power Generation," *The Institute of Energy Economics*, Japan, July 2007

<sup>19</sup> "China lays 2nd west-east natural gas pipeline," *Xinhua News Agency*, 14 July 2008

<sup>20</sup> "Sinopec finalizes gas pipeline route" *Shenzhen Daily*, 5 September 2006

<sup>21</sup> "China's Green Investment Challenge," *The Guardian*, 5 January 2009, see also "NDRC reveals details of stimulus package," *China Daily*,

27 November 2008

<sup>22</sup> "China announces multi-billion-dollar infrastructure projects, higher export rebates to stimulate economy," *Xinhua Business Weekly*, 17 November 2008

## The coal sector:

# Bedrock of the economy



According to state statistics for 2007, 69 percent of China's total energy demand was met through coal.<sup>23</sup> While clean-burning fuels and renewables are emerging as alternative energy sources, the low cost of coal and the abundance of domestic reserves mean that it is likely to continue to form the major part of China's energy mix over the next decade.

Although a relatively abundant fuel, coal producers have enjoyed strong bargaining power over their main users, the power generation companies. Many power plants are effectively tied to a limited number of suppliers, partly due to infrastructure constraints and also because they are set up to handle coal with a very specific moisture and ash content.

In December 2006, the government took the decision to remove price controls on coal and has encouraged coal companies to be fair in negotiations and to honour supply contracts. However, in some cases coal companies have taken the opportunity to raise prices.

With more than 7,000 companies operating an estimated 20,000 mines, China's coal sector is highly fragmented. The government is encouraging consolidation and hopes to create between six and eight dominant coal players, each responsible for around 100 million tons of output annually. These companies would be accompanied by between eight and ten smaller consolidated companies with output in the range of 50 million tons. These top players would ultimately account for 50 percent of the total production.<sup>24</sup>

<sup>23</sup> China Statistical Yearbook 2007

<sup>24</sup> China Energy Society: "The Address in a Meeting of Huainan by director Hong Jiu Pu"





Between 2000 and June 2008, 37 major merger or acquisitions deals were recorded in the coal sector.<sup>24</sup> Large-scale domestic coal miners consider both domestic and international M&A as important parts of their expansion strategy. For instance, China Shenhua Energy Co. Ltd declared in its prospectus that a significant proportion of the capital from its IPO on the Shanghai Stock Exchange, would be used for M&A activities.

Foreign direct investment in the coal industry can be challenging because of the difficulty in obtaining a license. Between late 2007 and mid-2008, four inbound deals were completed, with two undertaken by BP Overseas Development Co. Ltd. BP spent USD 420 million to raise its interest in Asian American Coal Inc. to 100 percent after two increases in holdings in October 2007 and June 2008.<sup>25</sup> The latest foreign direct investment guidelines show that the government is also encouraging foreign companies to enter the coal chemicals industry on the condition that Chinese companies hold dominant shares.

An increasing number of opportunities exist for multinationals to help improve efficiency, reduce environmental impact and enhance safety. Specifically, opportunities exist in open-pit mining, where China has little home-grown experience, and methane drainage, which removes a chief mine hazard and produces fuel.

<sup>25</sup> Thai Banpu to buy rest of China coal miner — Reuters, 6 Jun 2008



Coal transportation is a crucial issue, as bottlenecks can impact the overall reliability of energy supply. While most of China's mines are found in the north and west, the majority of the country's coal consumers are located further to the south and in coastal provinces. The government plans to spend RMB 300 billion (USD 42.8 billion) in 2008 and RMB 2 trillion (USD 300 billion) in the next decade to expand China's railway network. This is likely to include a focus on improving coal transportation.<sup>26</sup> Some upstream coal miners, including Shenhua Group, now run their own transportation business.

China has seven major coal ports in the north and these saw a 32 percent increase in coal transport year-on-year to 45 million tons in February 2008.<sup>27</sup> A number of ports including Qinhuangdao, Tangshan, Tianjin, Cangzhou and Ningbo-Zhoushan have set targets to expand coal handling capacity by up to 295 million tons per year.

<sup>26</sup> "China to invest 300bn yuan in railways," *China Daily*, 12 January 2008  
<sup>27</sup> China Energy Review, February 2008



## Coal bed methane (CBM)

There are many opportunities for foreign companies to assist Chinese companies in applying methane extraction technologies in the country's coal mines. In 2007, CBM production totaled 4.3 billion cubic metres but the NDRC has set a goal for China to produce 10 billion cubic metres of coal bed gas by 2015, with the expectation that local industrial systems will adopt CBM as a fuel.<sup>28</sup>

The China Coal Information Research Institute estimates that the country has reserves of 31 trillion cubic metres of gas, the third largest in the world. About 60 percent of this is located more than 1,500 metres underground, typically in more remote inland provinces.<sup>29</sup> As of April 2008, CBM power plants had a total installed capacity of 710 MW, an increase of 137 percent since December 2005.<sup>30</sup>

CBM projects require sophisticated drilling and extraction equipment, so foreign companies with cutting-edge technologies in this field are welcome. The China United Coal-bed Methane Corporation (CUCBM), a joint venture between PetroChina and China National Coal Group, has dominated the sector and for several years acted as the main concessionaire, attracting investment from a number of overseas companies.

Under these contracts, the foreign partner is responsible for exploration risk and technology while profits are shared according to the investment ratio. By 2007, Chevron Texaco was the largest acreage holder in China, followed by Green Dragon, Far East Energy, ConocoPhillips and PetroChina. Shell, with CUCBM and Verona Development Corporation, entered the Chinese CBM market with a deal that was announced in January 2008.<sup>31</sup> To further boost the sector, the State Council has given a set of beneficial policies on land use, taxation (tax rebates are being offered to foreign investors) and loans to power grid companies that use CBM. Since mid 2008, the government has been in discussions with PetroChina and China National Coal Group to break up the CUCBM's assets between the different parent companies, in order to promote future development and competition in the sector.<sup>32</sup>

<sup>28</sup> McGraw-Hill: International Gas Report, 19 January 2009

<sup>29</sup> "China Eyes Coal-Bed Methane Gas as New Energy Source," *Asia Pulse*, 4 September 2006; the reserve statistic is stated as 37 trillion cubic meters, yet we use the more conservative figure found elsewhere of 31 tcm

<sup>30</sup> "China building first coalbed methane pipeline to ease energy strains," *Energy Bureau reported through Xinhua News Agency*,

25 June 2008

<sup>31</sup> Evolution Securities: Report on Green Dragon, April 2008

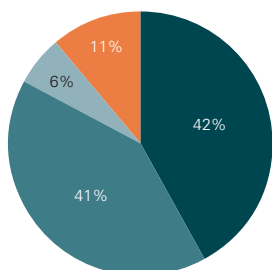
<sup>32</sup> "Dust Not Settled After CBM Monopoly Ends," *Dow Jones Newswires*, 21 January 2009

## Power generation:

# The balancing act



**Figure 5: Installed capacity is largely state-owned (2007)**



- Five state-owned power generating groups
- Local state-owned generating entities
- Private and foreign-owned generating entities
- Other state-owned generating entities

Source: SERC, Electricity Annual Report 2007

China encountered increasingly severe shortages in generating capacity between 2000 and 2004, but since then, generating capacity has risen dramatically while grid capacity has struggled to keep pace. The current slowdown in manufacturing and weaker GDP growth forecasts mean that a repeat of that supply squeeze is unlikely in the near future.

With electricity pricing closely administered by a number of ministries and regulatory bodies, recent increases in fuel prices, particularly for coal, have added to the financial strain on China's power generating companies.

When the China State Power Corporation was broken up and restructured in 2002, four new power generating groups were created: China Datang Corporation, China Huadian Corporation, China Guodian Corporation and China Power Investment Corporation. These were in addition to China Huaneng Group, which was founded in 1985. Two grid operators — State Grid Corporation of China and China Southern Power Grid Corporation — were also created.

Among the five state-owned power generating groups, installed capacity and electricity sales respectively reached 299GW and 1.34 trillion kWh in 2007. This equated to just over 40 percent of the total output. Local state-owned electricity generators together accounted for a similar share, while private and foreign generators supplied only 6 percent of output.<sup>33</sup>

The interrelationship between the price of coal and the price of electricity is a key factor affecting the profitability of the sector. Concerned with inflation and the corresponding effect on low-income households, the government has been reluctant to allow electricity prices to rise to fully reflect higher input costs.

<sup>33</sup> SERC: "China Electricity Annual Report 2007," pages 2-4



The government relaxed price controls in the coal sector in 2006, but electricity prices continued to be administered closely by a number of ministerial and regulatory bodies, including the NDRC, the Ministry of Finance and the State Electricity Regulatory Commission (SERC).<sup>34</sup> Prices did increase by an average of 4.7 percent in mid-2008 in response to the intensive requests from domestic power generating groups, but the average on-grid electricity price of the top five power generating groups in late 2008 remained little changed since 2006.<sup>35</sup> The SERC has acknowledged that many generating entities face the prospect of losses unless on-grid electricity prices are allowed to rise further.<sup>36</sup>

China's authorities are increasingly supportive of privately funded power projects, also known as independent power producers (IPPs), especially where they can offer new technologies as they seek to meet carbon emission targets.

Among the biggest investors are Hong Kong-based China Resources Power Holdings Co Ltd, Korea Electric Power Corporation, and Meiya Power Company. As of April 2008, China Resources Power Holdings' operational installed capacity was 12,837MW, making it one of the biggest joint venture power generators in China.<sup>37</sup> Korea Electricity Power Corporation owns 14 power plants and in mid-2008 pledged to buy more through its Chinese subsidiary, Gemeng International Energy Co Ltd.<sup>38</sup> Meiya Power Company has to date invested in 15 power projects in mainland China.

The Chinese government is now supporting clean energy technologies and has welcomed the introduction of clean-burning systems to both new and existing power projects. Many of these systems are being developed by U.S. energy

<sup>34</sup> "China Mulling Power Price Reform," *Caijing Magazine*, 12 August 2008

<sup>35</sup> "China's power plants forecast profit plunge on higher coal price," *Xinhua News Agency*, 19 January 2009

<sup>36</sup> SERC: "China Electricity Annual Report 2007," page 26

<sup>37</sup> China Resources Power Holdings Company Limited, company website

<sup>38</sup> "KEPCO's China JV to buy 14 China power generators," *Reuters News*, 26 May 2008

companies, which also continue to rely heavily on coal-fired generation. Ultra-supercritical technology, which uses advanced coal combustion, enables power plants to operate at higher temperatures and pressures, thereby providing higher thermal efficiencies of 45–50 percent. Integrated gasification combined cycle (IGCC) systems are highly effective in reducing sulphur and nitrogen. Both can sequester carbon dioxide emissions if fitted with carbon capture technology.

The government is encouraging investment in IGCC systems and requiring new coal-fired units with installed capacity of at least 600MW to be ultra-supercritical.<sup>39</sup> In 2005, Emerson won a USD 7 million contract to install its Ovation expert control system in China's first ultra-supercritical site, Huaneng Yuhuan Power Plant.<sup>40</sup>

Currently, there are over 420 gasifier units operating at gasification plants worldwide in industrial and power sectors, of which 29 were licensed or built in China since 2004.<sup>41</sup> In Tianjin, GreenGen, a joint venture partnership between American firm Peabody Energy and state-owned enterprises, has begun constructing a USD 1 billion, 650MW IGCC power plant, aiming for completion in 2009.<sup>42</sup> The government is also sponsoring the development of six additional IGCC projects.<sup>43</sup>

Coal-fired power plants have traditionally required high up-front investment, but have lower operating costs, compared to gas-fired plants. However, the adoption of more sophisticated, clean-burning systems will alter that equation, entailing higher costs for maintenance and disposal of by-products.

Hydropower plays an important role in many regions and China is one of the few countries in the world where sizeable opportunities exist to expand hydroelectric generating capacity. Nuclear power development is being encouraged in the coastal regions. Nuclear power is viewed as an increasingly attractive option in China's coastal regions, which lie further from the country's traditional source of fuel. Although nuclear reactors require significant investments, they provide stable base load generating capacity, which can balance reliance on gas-fired and hydroelectric power generation sources in these regions. Investment in China's nuclear power industry rose by 88 percent in 2008, according to the China Electricity Council.<sup>44</sup>

There are presently 11 nuclear power reactors in commercial operation in China, located at four separate sites. A further seven reactors are under construction and several more about to start construction. With 9GW of installed capacity in 2007, the sector provided 62.86 billion kWh — equivalent to 2.3 percent of China's total energy needs. The State Energy Bureau (SEB) has set a target of at least 5 percent of China's electricity to be generated from nuclear power by 2020.

<sup>39</sup> "China Holds Its Breath for Clean-Coal Power," *Caijing Magazine*, 30 April 2008

<sup>40</sup> Emerson's Power & Water Solutions Industry Center, "Emerson Awarded \$7 Million Contract to Automate China's First Ultra-Supercritical Power Plant," April 5, 2005, <http://www.emersonprocess-powerwater.com/news/pr/yuhuan.cfm>

<sup>41</sup> Gasification Technologies Council database, April 9, 2008, <http://www.gasification.org/library/overview.aspx>

<sup>42</sup> "Clean-coal project funding wins praise from US investor," *South China Morning Post*, 15 December 2008

<sup>43</sup> "China to Build Six IGCC Plants by 2010, GreenGen Construction to Start Soon," *Gasification News*, March 2008

<sup>44</sup> "Investment in nuclear and wind power soaring," *China Daily*, 6 January 2009

Three state-owned corporations are approved to own and operate nuclear power plants: China National Nuclear Corporation (CNNC), China Guangdong Nuclear Power Group (CGNPC) and China Power Investment Corporation (CPI). Others are limited to minority shares in new projects.

China is aiming to become self-sufficient in reactor design and construction, as well as in other aspects of the nuclear fuel cycle. The industry is open to foreign investment only in key areas such as nuclear equipment and technological cooperation, but participation is limited in terms of investment, management, operation and share participation. Despite these restrictions, companies from France, the US, Russia, Canada and Germany have all been involved in nuclear power development in China.

## Clean development mechanism (CDM)

The Kyoto Protocol, the international treaty that sets targets for reductions in greenhouse gas emissions, gives industrial companies in China a new reason to team up with foreign companies. The protocol's Clean Development Mechanism (CDM) allows investors in developed markets to offset their own carbon footprint by funding carbon reduction initiatives in emerging economies.

China's size and its status as a developing economy give it potential to play an enormous role in the emerging carbon market. As of February 2009, more than 400 CDM projects in China have been registered with the United Nations.<sup>45</sup> These cover a range of initiatives, from improving processes at existing power and industrial facilities, to greenfield investments in renewables projects.

The enthusiasm for CDM investments in China is understandable given the growth in industrial output and the potential to improve environmental performance. However, investors in China can face challenges in producing accurate financial analysis to project a target rate of return and a suitable contractual basis for the investment.<sup>46</sup> The reason for this is that carbon credits, or Certified Emission Reductions (CERs), are only applicable to projects that not would otherwise be commercially viable, in other words, to turn an uneconomic project into an economic one.

"The Chinese government has set clear targets for renewable energy production and energy efficiency, so a key issue going forward will be demonstrating that CDM schemes are additional, in order to qualify," says Matthew Walker, head of KPMG's Global Infrastructure and Projects Group in China. "There are also questions around what will happen after the commitments required under the Kyoto Protocol end in 2012."

For tax purposes, CERs are widely defined as intangible non-produced assets, but the way they are traded differs in different jurisdictions. In China, there are implications in terms of transfer pricing and the applicability of Business Tax (BT) are still being clarified.

<sup>45</sup> Source: United Nations Framework Convention on Climate Change. As of 10 February 2009, China had 410 registered projects, out of a total of 1,390 projects globally

<sup>46</sup> "CDM projects bring windfall to China," *China Daily*, 15 September 2008

## Renewable energy:

# Winds of change



China is one of the world's leading producers of solar and wind energy, but renewables account for less than 1 percent of its total installed capacity, if hydropower is excluded.<sup>47</sup> China's first Renewable Energy Law, which was passed in 2006, provides support for unconventional energy development through subsidies and tax breaks, while imposing responsibility on power grid companies to give grid access to renewable power producers.<sup>48</sup>

Renewable energy has grown at a rapid pace over the past decade, not only because of the public's growing awareness of sustainability issues, but also because of some stark economic realities. In a world of volatile resource prices and uncertain supplies, the low operating costs associated with wind and solar have proved increasingly attractive. Many large power companies have openly acknowledged that renewable energy offers them a way to reduce their commercial risks over the medium term.

The retreat in oil prices since mid-2008 has led some companies to reassess their enthusiasm for renewables and may undermine the viability of certain projects. Nevertheless, the flood of investment, particularly into research and development, has helped to establish renewables as a sector with great potential. This is illustrated by the fact that there are now opportunities to develop wind power facilities with capacities in excess of one gigawatt, a scale of operations which is quite different from just a few years ago.

<sup>47</sup> "Renewable Energy Has Huge Potential," *People.com.cn*, available in Chinese, October 2006  
<sup>48</sup> SEFI UNEP: "Global trends in sustainable energy investment 2008" page 52



Globally, there was USD 150 billion of new investment in renewables during 2007, a 60 percent increase year-on-year. However this was overshadowed by USD205 billion of transaction activity. The tightening of capital markets during 2008 has had an effect on investment in renewables, although the longer-term political and market drivers behind the sector have sustained interest.<sup>49</sup> A further peculiarity of the market in China is that many renewable energy projects start off on a small scale, since any project with capacity of less than 50MW only requires approval at the local level. Such companies make the calculation that it will be easier to ramp up their scale and obtain the further approvals once they have demonstrated that the project is viable.

Wind power adoption is growing rapidly in China and many of the capacity goals set over the past decade have been easily surpassed. Starting with a mere 352MW in 2000, China had 6GW of wind capacity by 2007, having added 3.45GW that year alone. In 2008, the total figure rose again to 12.2GW, pushing China into fourth position worldwide for total wind power capacity.<sup>50</sup> The NDRC has announced that wind to account for 3 percent of electricity generation by 2020.

A key step in the development of the sector occurred in 2003, when the NDRC launched a wind power concession programme. Under the programme, international and domestic players can bid to develop 100MW level wind farms with a fixed-price purchasing agreement.<sup>51</sup> By the end of 2007, more than 40 projects had been approved, although foreign companies have typically struggled to compete with domestic state-owned companies.<sup>52</sup>

<sup>49</sup> KPMG International and the Economist Intelligence Unit: Turning up the heat: An insight into M&A in the renewable energy sector, May 2008

<sup>50</sup> The American Wind Energy Association: U.S. And China In Race To The Top Of Global Wind Industry, 2 February 2009

<sup>51</sup> National Development and Reform Commission: Renewable Energy Law, 28 February 2005

<sup>52</sup> "CBN, FDI to Windpower in China: Surge Again," <http://news.hexun.com> available in Chinese, May 2008





The Renewable Energy Law of 2006 provided tax breaks, subsidies and preferential grid access for wind projects, but stricter enforcement is required to achieve the desired results.<sup>53</sup> The legislation prescribes that the wind price premium should be shared across the country, but implementation has not been entirely consistent. Therefore, grid operators often lack the incentive to buy more expensive wind power to sell at capped retail prices, let alone construct new transmission grids to connect new wind farms.

In addition, the law stipulates the necessity of surplus coal-fired capacity to make up for any fluctuations in wind power output. Thus, good relationships with grid operators continue to be necessary for success in this sector.<sup>54</sup>

China has also been emerging as a manufacturing centre for solar energy technologies and this could support its growth as an end market. It is now the third-largest solar photovoltaic cell producer behind Japan and Germany, accounting for 16.7 percent of global solar cell capacity, or 450MW, in 2007.<sup>55</sup>

Between 2005 and mid 2008, a total of 11 Chinese solar companies raised capital through listings in the US and Europe and many have relied heavily on sales to overseas markets for their growth. Companies have been less active in the domestic market, with one solar company listed domestically and one other listed in Hong Kong.

<sup>53</sup> SEFI UNEP, "Global trends in sustainable energy investment 2008," page 52

<sup>54</sup> Global Wind Energy Council: Global Wind 2007 Report , page 50

<sup>55</sup> "Big solar cell producer has not solar market domestically," *Xinhua News Agency*, 13 March 2008



With lower orders coming from countries such as Spain, Germany and the US, solar cell producers face the prospect of lower prices and are shelving plans for further expansion.<sup>56</sup> The government is looking at opportunities to promote solar adoption domestically, by funding further research and development and providing subsidies to enable renewable projects to compete against coal-fired plants.<sup>57</sup>

## Technology transfer issues and tax implications

China's openness to foreign investment in the energy sector is strongly driven by a wish to attract foreign technology. This is particularly applicable to upstream exploration and production technologies, power generation technologies and a range of areas relating to renewable energy.

Investing in an energy project is a long-term commitment so investors need a long-term perspective on how the tax environment is changing. "China's tax incentives target sectors and processes that are in the developing stage," says Jean Li, tax partner with KPMG China in Beijing. "Therefore it is inevitable that tax policies and incentives will change as the sector matures." Exemptions on withholding tax and business tax can be obtained if certain conditions are met. Double taxation treaties may allow tax credits in the home country to offset withholding tax paid in the PRC, but this is not applicable on business tax. Therefore, although business tax rate is generally lower than withholding tax rate (business tax on royalties is 5 percent), it may amount to a bigger cost burden to taxpayer.

It is important for investors to fully understand the tax and regulatory processes relating to technology transfer. Any technology transfer agreement needs to be registered with the Division of Science and Technology of the Bureau of Commerce. Without that registration, investors will not be able to remit any money out of China.

Technology transfers may take place in various forms, including transfers of registered intellectual property such as patents and transfers of know-how, through training and technical services. Different forms of technology transfer can have quite different tax treatments. If a technology transfer initiative requires extensive training by overseas staff, this may entail individual income tax issues and raise the possibility of a Permanent Establishment being created. China's tax authorities are likely to look at these various forms of royalty payments in more detail in the coming years, particularly from a transfer pricing perspective, as they begin to focus their attention on shared costs. At present, their scrutiny focuses on ensuring that payments to shared services centres are made on an arm's-length basis. In the energy sector, these shared services centres are often located in separate jurisdictions such as Singapore.


One option for companies to ensure tax stability is to enter into a cost sharing agreement (CSA), which helps to clarify the situation with regards to deductibility — whether the costs can be deducted from the tax liability.

CSAs also help to ensure cheaper costs, since a larger group can negotiate a better price. Some types of cost sharing agreements will need specific approval from the State Administration of Taxation (SAT), but procurement, marketing, and joint development of intangible assets will all be allowed. As this is still a new concept in China, companies in the energy sector will have to monitor developments in this area and keep up with new legislation as it is issued.

<sup>56</sup> "Sun is setting on China's solar industry," *China Daily*, 29 January 2009 and "Suntech lays off 10 pct of staff, halts solar expansion," *Reuters*, 13 January 2009

<sup>57</sup> McGraw-Hill: Renewable Energy Report, 12 January 2009

## Conclusions



This report addresses some of the issues facing different parts of the energy sectors and clearly each area is challenged by its own market dynamics.

However, one message shines through. As China's energy companies restructure their operations and adopt more modern automation and controls processes, there will be many opportunities to raise efficiency and reduce emissions. The government recognises that imported technologies and foreign capital can play a key role in this process, alongside domestically-driven R&D.

The market is now one where many players, from foreign oil companies and independent power producers to local privately-owned renewable energy companies can compete and contribute to China's development. In many areas, approval processes are becoming clearer and tax policies more supportive.

Easing inflation may actually hasten the lifting of certain regulatory and pricing controls. For example, in January 2008 the National Development and Reform Commission introduced temporary curbs on a number of product prices including liquefied petroleum gas and thermal coal, in order to combat inflation. The authorities lifted these price controls in January 2009.<sup>58</sup>

Perceptions of China are being challenged as the government imposes new regulations and tax policies to combat wastage and pollution. China is already a leading producer and adopter of renewable technologies and is pressing forward with the adoption of other clean forms of energy such as LNG and nuclear power.

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<sup>58</sup> Temporary controls are lifted, *Shanghai Daily*, 1 Jan 2009



There are of course still many challenges. China's extractive industries are in some cases still blighted by low recovery rates and inefficient use of key inputs, including water. While energy-intensive industries such as steel, automotive and construction have been drivers of recent growth, the signs of economic downturn are hastening the shift towards less energy-hungry service sectors.

Policy support at the highest level will be important, as China's vast legacy of energy infrastructure cannot be changed overnight and environmental considerations need to be balanced with security and reliability of supply. The authorities also appreciate that in many sectors further consolidation and restructuring is needed.

Nevertheless, change is occurring in many areas of the energy sector and in the years ahead this promises to bring greater efficiency, professionalism and strategic thinking throughout the industry.

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