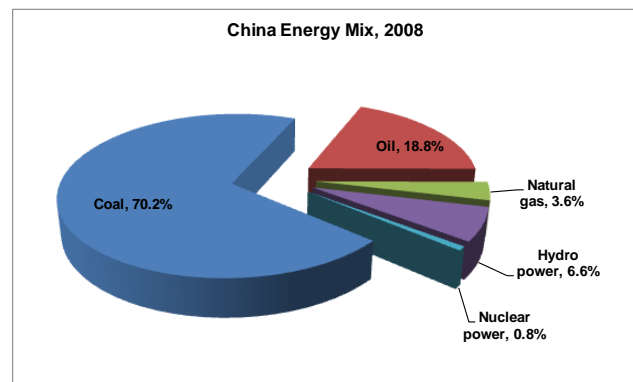


China clean burning Fossil Fuel Technology *By the JLJ Group*

Introduction

The clean energy sector is attracting increasing amounts of attention in China. Because of the rapid development and economic growth that the nation has been experiencing, problems of environmental pollution and rising levels of energy consumption have inevitably arisen. As a result, China has injected significant amounts of funds into the development of clean and efficient energy technology. Currently, 90% of China's energy mix comes from three non-renewable energy sources: coal, oil, and nuclear power. Coal, as one of China's most abundant energy resources, makes up 70% of the energy mix overall. This article will focus on these areas, and will analyze current technology levels and market potential for clean and efficient technology applications in such non-renewable sectors.



Market Overview

Chinese energy consumption has increased drastically in recent years, and nearly doubled in the past two decades. Total primary energy consumption reached 2.85 billion tons of standard coal equivalent in 2008¹, and is expected to grow at a rate between 5.5 and 6.5% annually until 2015. At the same time, Chinese energy efficiency is around 10% less² than that of developed countries. This, coupled with heavy reliance on coal and a lack of clean technologies, has caused adverse impacts on the environment and has resulted in China's status as a leading global polluter of CO₂, SO₂, and NO_x.

The Chinese government is increasingly emphasizing the development of clean energies. Its Energy Conservation Plan (2004) has become a major guide in the field of mid and long-term projects, with ten key energy conservation projects and a projected goal of 240 million tons coal equivalent of energy savings by 2010. In addition, the 11th Five-Year Plan outlines specific

¹ National Bureau of Statistics of China

² International Energy Agency

targets for environmental improvement by 2010. Objectives include energy infrastructure



building, exploration of resources, emissions reductions, and development of advanced technologies. Furthermore, the state has been actively encouraging the expansion of domestic technology and manufacturing capabilities through preferential policies, tax breaks, and import duties or exemptions on equipment (which depend on relative benefits to domestic markets). Regarding

future regulations, the government plans to issue an Energy Law by 2010 which will further advocate clean technologies and efficiency, tighten pollution enforcement, and introduce new laws to assess energy efficiency.

Clean Coal Technologies

China is the largest producer and consumer of coal in the world. In 2008, total consumption amounted to 2.74 billion tons³. Over half of the coal consumed fuels power plants to support the population's energy needs. In light of the dominance of the coal industry, the government is currently seeking to develop Clean Coal Technologies (CCTs) to improve efficiency and reduce environmental costs.

Although State-Owned Enterprises have dominated the industry in the past, an increasing number of private Chinese and foreign companies have entered the market in recent years. Because of the longstanding prominence of the coal sector, CCTs are not entirely new in China. While some technologies are already well established, however, there is an increasing demand for certain newer, more advanced technologies. In general, areas with higher levels of government support and lower domestic product maturity offer the best prospects for foreign companies.

Coal Mining

The process of coal mining is one major area where clean energy is required. Coal beneficiation, which cleans coal to improve quality, improves thermal efficiencies and removes high levels of sulfur and ash. This is particularly well suited to Chinese coal. The government requires every

³ National Bureau of Statistics of China

coal mine to have a coal beneficiation facility, although in practice only 30% of coal is properly washed. Targets are set for this number to increase to 50% by 2010. In general, domestic technologies are adequate in this sector, though foreign technologies are generally of higher quality (and price). The best prospects for foreign companies in this area are in sulfur removal technology and dry coal beneficiation.

Methane extraction is another area of coal mining in which technologies are needed. The Coal Mine Methane (CMM) sector is particularly underdeveloped in China. In the “Coal Mine Methane 11th Five-Year Plan,” the government specified plans for increased CMM production and utilization by 2010. To further stimulate the industry, China also formulated a series of favorable policies, such as a favorable 5% VAT, reduced income tax rates, and small levels of state intervention. This, combined with a high dependency on foreign technologies and expertise, make the CMM industry particularly attractive to foreign enterprises. In particular, there is demand for advanced CMM recovery technologies, CMM exploitation in deep coal mines, effective CMM liquefaction, and value-added CMM conversion and utilization.

Power Plants

In China, Pulverized Coal Power Plants generate the vast majority of electricity, although highly efficient plants that can produce and deliver both electricity and heat to end users (known as Combined Heat & Power (CHP) plants) are also emerging. For both types of plants, pollution control processes can reduce harmful emissions.

Pulverized Coal Power Plants, the traditional coal-fired plant in China, supply the majority of China's power. Most of these are outdated and inefficient, with efficiencies of around 33%. As a result, the government aimed in its 11th Five-Year Plan to eliminate small scale PCPs and build more supercritical power plants, which are more efficient (46% efficiency). In this industry, current technologies that are being adopted include advanced combustion boiler and pollution control technologies for subcritical PC plants, high-medium pressure rotors, low pressure rotors, and high & low pressure combined rotors for supercritical PC plants, and distribution control systems, cold-state oil-less plasma ignition technology, high-efficiency dust removal, and flue gas desulphurization units for ultra supercritical PC plants.

Combined Heat & Power plants (CHPs) accounted for about 12% of China's total installed thermal power generation capacity in 2008. These plants produce electricity and heat from a



single fuel source and thus are up to three times more efficient than conventional plants, with overall efficiencies ranging from 70% – 90%. Although CHP use is still limited, there is significant potential in this area as China has prioritized the development of dispersed power generation. Currently, all components of CHPs can be manufactured in China, although certain equipment such as the gas turbine

is often imported for its higher quality.

Because coal-fired power plants produce 50% of SO₂ and NO₂ emissions in China, they are a major target of pollution control campaigns. The 11th Five-Year Plan outlines several laws and preferential policies to help reduce such emissions, and the industry shows increasing potential. Sectors and technologies with particular opportunities include advanced desulfurization, circulating fluidized bed boilers, de-NO_x, and de-dusting technology.

Other Industrial Applications

While coal is used to generate electricity in power plants, in other industries it is generally used for heat generation. Two extremely coal- and energy-intensive industries are those of construction and iron & steel. In the construction sector, China's cement market is the largest in the world. It is also highly inefficient due to small and outdated kilns. To solve this issue, the government is currently encouraging the establishment of energy efficient and environmentally-friendly kilns as well as power generation by waste heat recovery from kilns. There is a particular need for precalciner dry process kilns, waste heat recovery boilers, and de-dusting units. The iron & steel industry consumes even more (about 18%) of China's total coal supply. In this sector, large-scale companies utilize about 200 kg coal-equivalent less than small ones, offering opportunities for more efficient equipment. In particular, the government is encouraging the use of dry coal quenching and automation & control systems to save water and increase thermal



efficiency.

While these two industries can burn the coal directly, it is also possible to first convert coal to another form. The processes of coal gasification and coal-to-liquid are two examples of such areas. Coal gasifiers convert coal into a synthetic gas (syngas), which can be used as a substitute for natural gas and thus boost efficiency. There is expected to be a large market for advanced pulverized coal gasifiers, with a demand for 225 sets in total by 2020. China is also actively developing the coal-to-liquid (CTL) industry, and plans to spend around \$46 billion in investments by 2010. It is currently the world's technology leader in this field. In the country's attempts to establish this sector, it welcomes foreign knowledge and advanced technologies. In addition, Carbon Capture and Storage (CCS) technology may be useful in reducing the amount of CO₂ emissions resulting from the process of CTL.



Other Non-Renewable Technologies

After coal, oil and nuclear power compose the highest percentages of non-renewable energy in China's energy mix. Oil accounts for 19% and nuclear power for .8%.

To reduce dependence on foreign oil (imports account for half of demand), the Chinese government is encouraging energy efficiency in this sector. Because Chinese companies have limited experience in refining the increasingly large amounts of imported crude oil, the state is encouraging joint ventures in this sector between SOEs and foreign companies. Key areas where foreign technology is needed are heavy crude oil recovery and refining, offshore recovery, and petrochemical refining.

Although nuclear power amounts to a very small percentage of China's energy total, it is considered a clean energy and as such is attracting increasing amounts of focus. The government's "Mid- and Long-Term Nuclear Power Development Plan (2005-2020)" aims for nuclear power to account for 6% of the energy mix by 2020. Therefore, this sector will provide more and more opportunities for foreign companies dealing with nuclear reactor technologies.

Key Challenges

China's government focuses increasingly upon sustainability and efficiency. Nevertheless, many challenges remain for new entrants. In particular, the need to establish a presence in China as a pure import strategy can often be difficult to sustain, as the government strongly prefers domestic production over purely foreign imports. Especially for more mature technologies in China, it can be very difficult to compete with domestic production, manufacturing and assembly. Even for components which are widely imported, companies who already have a local presence are favored. There is a significant degree of competition between foreign companies as well, most notably those from leading European countries, Japan, and the US. Finally, China's large SOEs prefer to partner with very large MNCs. While smaller suppliers can serve as subcontractors to engineering projects in some cases, they still usually face competition from locally established companies.



Key Opportunities

The application of clean and efficient technologies to coal, oil, and nuclear is not new in China. Although some segments are relatively developed, other more advanced or more complex processes still require foreign technologies. In general, the level of domestic innovation and skilled personnel is still low. There is significant room for growth in these sectors, particularly that of coal. Domestically produced CFB boilers are generally of a capacity that is too low for power plants and many industrial applications. Foreign-technology CFB boilers of 300 MW and over can be sold on the Chinese market, especially if they are manufactured locally through JVs/WOFEs. In addition, the coal mine methane sector is still young in China, and in great need of foreign assistance. Pollution control equipment (desulphurization technology and high-efficiency de-dusting technology) will also be in high demand.

In the oil sector, key prospects include offshore oil recovery, heavy crude refining, and ethylene plants. The nuclear power sector in general also has a high degree of market concentration, with a preference for large foreign companies in possession of leading technologies and expertise. Lastly, there are good opportunities for companies in the energy services (energy

audit) sector, as the government is in the process of developing a system for calculating, auditing, and supervising energy consumption and emissions.

This article was contributed by the JLJ Group, a one stop service provider assisting foreign companies to enter and grow in the China market. For more information please email to yan.wu@jljgroup.com.