Press Release

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Trend Report No. 17: Environment / Climate

China's place in the greenhouse gas landscape

- **The nation is committed to greenhouse gas reduction**
- **Improved energy efficiency is the goal right across all the process industries**
- **During the 11th Five-Year-Plan period China will spend 1,400 billion RMB on pollution control**

Global warming is one of the great hazards facing mankind, hence the reduction of greenhouse gas emissions is one of man's greatest challenges. In the CO_2 emissions charts China is already second only to the USA. Admittedly, as far as environmental protection is concerned the Middle Kingdom cannot be accused of dragging its feet, but hitherto its tremendous economic growth has simply annihilated all its efforts. In the 11th Five-Year-Plan the Chinese government has set itself ambitious targets to improve environmental protection by the year 2010; this could open up the enormous potential of the environmental market to western investors. Advanced technology is the only way out of this dilemma.

AchemAsia 2007, 7th International Exhibition-Congress on Chemical Engineering and Biotechnology, from 14 to 18 May 2007 in Beijing, offers the anticipated 500 exhibitors and 20,000 visitors from 25 countries an opportunity to exchange ideas and experience with other professionals from industry and to make new contacts.

China is one of the world's largest producers of carbon dioxide emissions, second only to the U.S. With continued expectations of rapid industrial growth in China, goals of reduced greenhouse-gas (GHG) emissions in that country will be quite challenging to achieve. In fact, there are some concerns that China's GHG emissions could easily escalate, rather than recede.

As a developing nation, China is not bound to any GHG emissions-reduction targets set under the Kyoto Protocol. In the creation of the Kyoto Protocol, developing nations, such as China, made the point that industrialized countries by comparison have contributed far more to creating this problem and thereby have more means to contribute to its solution. At the same time, though, "[China's] rise in greenhouse gases could easily offset any reductions that would be made by the European Union," warned Benita Ferrero-Waldner, the European Union's head of foreign relations, during recent talks with Chinese Foreign Minister Li Zhaoxing. And since GHG's are readily dispersed, well-mixed and long-lived in the

atmosphere, a ton of a given GHG has the same effect on atmospheric concentration — and thus on climate change — whether it comes from Beijing or Hamburg. The bottom line, Ferrero-Waldner added, “Neither energy security nor climate change can effectively be addressed without China.”

The good news for GHG watch-dogs is that although China has no legal obligation to cut GHG emissions, its ratification of the Kyoto Protocol and other resolutions suggest a meaningful intention by the nation to make cuts voluntarily. Given those goals, China’s status as a leading producer of greenhouse gases is being viewed globally as more and more of a business opportunity for companies that can provide the necessary technological innovation. Indeed, in almost the same breath as her warnings regarding increased GHG emissions in China, Ferrero-Waldner said that the EU was already working with China on adopting new technology to trap and store carbon dioxide emissions in coal-fired power plants. Meanwhile, on the other side of the Atlantic Ocean, U.S. President George W. Bush recently used his State of the Union address to emphasize the “critical role” for American technology and innovation in reducing global GHG emissions.

At the World Economic Forum’s Annual meeting this January, Zhang Xiaoqiang, vice – chairman of China’s National Development and Reform Commission (NDRC), stressed that China intends to follow the Kyoto Protocol, and urged speeding up negotiations and establishing concrete emission targets. While China intends to keep its emissions low, Zhang pointed out that cement and steel production in China are highly energy intensive, and only around half as efficient as technologies used in the West. To meet its targets, Zhang said, China would need help from the industrialized world.

The attraction and potential impact of such cooperation is already evident in China’s participation in the Kyoto Protocol’s Clean Development Mechanism (CDM). The CDM offers a way for industrialized countries to get “credits” towards their own emissions targets by funding sustainable development projects in developing countries. As a developing country, China has 164 projects either in existence or in the planning stages with help from around the globe, according to Lu Xuedu, deputy director-general of the office of global environmental affairs at the Ministry of Science and Technology. In 2006, China’s GHG reduction was more than 40% of the total reduction of the 40 countries involved in the CDM, according to Xuedu.

China’s plans for the short term

Cement: China is the world’s biggest cement producer, recording a production of 1.05 billion tons in 2005. The majority of the production currently comes from small factories, which are inefficient in energy consumption and backward in environmental technologies. China’s 11th Five-Year Plan (2006–2010) for the cement industry aims to shut down some 1,600 small factories, phasing out 250-million tons of backward production capacity. According to the Asia-Pacific Partnership on Clean Development and Climate — launched in January 2006 by Ministers from China, Australia, India, Japan, Republic of Korea and the United States — old technology, primarily involving the wet-kiln process, will eventually be replaced in favor of dry processing technologies, energy-efficiency and process improvements, power generation from waste-heat recovery and enhanced co-processing of low-grade primary fuels and industry wastes.

Coal: China satisfies around 70% of its power needs from coal, which produces about three times more carbon dioxide than natural-gas derived power. To meet the country’s rising electricity demand, a new coal-fired power plant is built every two weeks in China. By 2010, China's coal-output capacity is expected to hit 2.45-billion tons, up 16% from 2005, to realize the goal of an overall balance of supply and demand. In 2005, China's coal output stood at 2.26-billion tons.

With the goals of accelerating technological modernization in the industry and meeting projected growth in demand, the Chinese government is planning to establish five to seven

major coal producers over the next five years. Each of the giants will have an output capacity of 100-million tons of coal annually under the proposals in the country's 11th Five-Year Plan (2006-2010). The restructuring policies for the coal industry worked out by the National Development and Reform Commission allow for mergers, renovation and regrouping of small mines. By 2010, the output of large and medium-sized coal mines should account for 75% of the country's total, compared with the current 56%.

The Asia-Pacific Partnership on Clean Development and Climate refers to a range of advanced coal and gas technologies with the potential to significantly reduce greenhouse gas emissions levels, including carbon dioxide capture and storage, as well as advanced power-generation systems. These include integrated gasification combined cycle (IGCC), oxy-fuel and post-combustion capture. The partnership also cites ultrasupercritical pulverized fuel, coal cleaning and treatment, poly-generation, hydrogen production, enhanced coal-bed and waste coal-mine methane and coal gasification and liquefaction as other important elements of a cleaner fossil energy future. Meanwhile, increased availability of liquefied natural gas is also needed to meet the rapidly growing need for high quality, affordable and low emission fuel in the region.

China targets efficiency in general: China has recently set a goal of reducing energy consumption by 20% for the five-year period from 2006 to 2010. The goal is aimed at guiding China's social and economic development, but the country is already well behind schedule. Official figures from China's NDRC show that China has failed to meet its target of reducing energy consumption per unit of GDP by 4% in 2006. In fact, China witnessed an 0.8% increase in its energy consumption per unit of GDP in the first half of the year, and indexes for major pollutants have continued to rise. In a national meeting mapping out economic policies for 2007, China's central authorities recognized that more efforts were needed to improve energy efficiency in the country and issued a stark warning to uncooperative local governments in the future.

Regulatory expectations

Likelihood of GHG regulations in China: China recently set up a think tank on climate change, the country's Xinhua news service reports. Qin Dahe, director of the China Meteorological Administration, said the think tank is designed to offer advice and devise strategies and regulations to tackle climate change. Dahe said China is following the lead of other countries that have put climate change on their lists of national security threats. The 12 members of the think tank are from 11 government agencies and research institutes, including the State Environmental Protection Administration and the NDRC.

Outside of China, two precedents for GHG regulations are already in the works. According to research from SRI Consulting's GHG Program, the EU will probably begin regulating emissions of several GHG chemicals, and controls will most likely be expanded again in 2013. Meanwhile, in September of 2006, the U.S. State of California's Governor Arnold Schwarzenegger signed the Global Warming Solutions Act into law, which caps the state's global warming emissions at 1990 levels by 2020 — an equivalent 20–25% reduction. Experts anticipate the law's significant influence on federal U.S. policy in the years to come. And, if history proves itself, China will look to these U.S. and European initiatives in framing its own longterm regulatory policy.

Impacts of eventual regulation

How GHG regulations will affect the process industries: SRI Consulting has pinpointed chloralkali producers as the process-industry segment most likely to suffer financially from GHG regulations in any part of the globe. Others who may suffer include makers of products via oxidation, such as carbon black or acetylene. A beneficiary, on the other hand, would be urea producers.

In addition to the effects on the above specific industries and a general trend in efficiency improvements, SRI Consulting's Greenhouse 2006 Greenhouse Gases Handbook expects that mandated GHG reductions will give momentum to the four general technological trends in chemical processing.

Catalyst and reactor design: Introduction of carbon regulation will put further pressure on the drive to maximize selectivity. This is likely to move the economic design optimum in the direction of modified catalysts, lower space-time yields, and larger reactors in order to obtain better selectivity.

Improvements in feedstock utilization: Processes will see a move toward greater efficiency and feedstock utilization in areas other than reactors, too. One area may be the recovery of streams that are now rejected from the process. As carbon values go up, that which is currently seen as uneconomic to recover will become more valuable.

A shift away from electrochemical processes: Carbon regulation hits electricity prices harder than it hits fuel prices. This occurs for two reasons. One is that at most locations — especially true in China — a significant fraction of the electrical mix is coal-fired and, thus, more carbon intensive than most chemical plants that run on gas or oil. The other has to do with the thermodynamic losses associated with power generation. SRI Consulting expects that carbon regulation will raise the price of electricity over the long term. This will accelerate the exit of some electrochemically driven processes from the scene.

Movement of high electrical intensity processes to locations with low carbon electrical mix: The same factors influencing the shift away from electrochemical processes are likely to result in migration of electrically intensive processes, e.g. chloralkali, to lower-carbon (and thus lower electrical cost) locations.

A shift towards biorefineries: Enzyme and other process technologies are improving for some of the bio-based routes to commercially desirable products. While the biorefinery concept is still a ways off, the well-to-product lifecycle carbon cost incurred by the usual conventional process chain can really add up. This should provide another motivation, along with the current high price of crude oil, to move from the traditional synthetically-derived chemical value chain to a bio-based one. Over time, perhaps within 10 years, we may see significant inroads into some end uses by biobased products.

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