

China Renewable Energy and Sustainable Development Report

China's extraordinary economic growth and heavy reliance on increasingly expensive foreign oil, the vast environmental toll that is one of the most apparent costs of China's economic success, persistent rural poverty in China and periodic power shortages all have impressed upon Beijing that renewable energy must be a large part of China's economy if China is to both complete its economic transformation and achieve "energy security".

China rapidly has moved along the path of renewable energy development. By 2006 China's total renewable energy output equaled 8% of non-renewable energy generation or 200 million MT of coal equivalents, though coal generated power consumption continued to account for 69% of total energy consumption in China. China's goal is for renewable energy to account for 10% of all energy consumption by 2010. In the medium term China plans to develop 120,000 MW's of renewable energy by the year 2020; this would account for 12% to 16% of China's total installed energy producing capacity that year. In the long term China has set an objective of having 30% or more of its total energy requirements satisfied by renewable sources by 2050. China's ambitious growth target for renewable energy production will require an investment of approximately 2 trillion Yuan (~\$263 billion U.S.D.) by 2020.

□ Our goal at the ***China Renewable Energy and Sustainable Development Report*** is to provide authoritative, timely, informative and useful information about the emerging renewable energy and sustainable development sectors in China for global companies who have products and services to sell to or buy from China's rapidly growing renewable energy and sustainable development sectors and other policy makers, NGOs and interested parties. Drawing from original Chinese language materials of Chinese companies, industry associations, central and local government agencies and non-governmental organizations, the ***China Renewable Energy and Sustainable Development Report*** will cover developments in China's solar, wind, bio-fuel, bio-mass, small hydroelectric and other renewable energy sectors, including regular features on investment, growth, local and national laws and regulations, leading Chinese companies, industry meetings, tradeshow, exhibitions and conferences and business opportunities.

An interactive map of China's renewable energy projects is now available on China Strategies' website. China Strategies' website also now has a map of significant companies/projects in China in the solar energy sector. To view the *China Renewable Energy Interactive Map* and the *China Solar Map*, visit www.chinastrategiesllc.com, click on the tab for "China's Renewable Energy Industry" and follow the directions to register and receive access. We invite our readers to submit Chinese renewable energy projects to be included on the *China Renewable Energy Interactive Map* and the *China*

Solar Map. Please send all submissions to lou@chinastrategiesllc.com. Shortly the *China Renewable Energy Interactive Map* will be upgraded to include a host of additional projects, including nearly 150 Chinese CDM projects.

The *China Renewable Energy Interactive Map* and the *China Solar Map* were developed with the assistance of Ryan Hodum, an environmental and renewable energy professional who recently completed a Master of Arts in Global Environmental Policy from American University in Washington, D.C. with a focus on renewable energy utilization in China.

For more information about subscribing to the ***China Renewable Energy and Sustainable Development Report***, please contact us at lou@chinastrategiesllc.com. For more information about China Strategies, LLC, please visit us at www.chinastrategiesllc.com.

This Month's Top Story

At a news conference recently organized by the Electric Power Regulatory Commission to discuss the state of energy conservation and emissions reductions by the electric power industry in 2007, the spokesperson said that there was clear progress in energy conservation and emissions reduction work in 2007, which was spurred on by various policies, including “supporting the establishment of large (projects) and suppressing small (projects)”, “differential power pricing”, “energy conservation management” and “electric power generating rights trading”. In 2007, the power industry saved the equivalent of 64.92 million MT of coal equivalents, had 10.3 million MT less of sulfur dioxide emissions (equal to 7.65% of sulfur dioxide emissions in 2006) and reduced carbon dioxide emissions approximately 180 million MT by increasing energy efficiency, through reductions in the loss rate of power line transmissions and coal consumption, development of renewable energy power generation and strengthening demand assessment and management.

From January 29, 2007 when the Henan Anyang Power Plant closed two 100,000 KW units, through December 27, 2007, a total of 14,380 MW of smaller power plants (a total of 553 units) were closed. By the end of 2007 the total capacity of coal fired power plants having a capacity of 100 MW or greater with desulphurization systems was 110,000 MW, an increase of 4.8% compared with year end 2006; the rate of adoption of desulphurization systems among newly constructed coal fired power plants in this class was 70% and among power plants undergoing upgrades was in this class was 30%. Of coal fired power plants having a capacity of 60 MW to 99 MW total desulphurization capacity was 60,400 MW or 55% of the total power generating capacity in this category. In all, through the end of 2007, the total capacity of coal fired power plants operating with desulphurization systems was 270,000 MW; this 53 times greater than the amount of desulphurization equipment operating at the end of the 10th Five Year Plan Period in 2005. The increases in adoption of desulphurization equipment by China's coal fired power plants has been aided by the rapid development of a domestic industry producing

desulphurization equipment; prices for domestic desulphurization equipment generally are 1/5th the amount of imported desulphurization equipment. In 2007, among power plants with 6 MW or greater power generating capacity, the amount of consumption of coal equivalents was 357 grams/kwh, a reduction of 10 grams/kwh compared with 2006 consumption of coal equivalents; this was equivalent to a total reduction in coal equivalents consumption of 24.23 million MT or 2.75% of the coal equivalents that power plants consumed in 2007. In 2007, electric power transmission line losses were further reduced by 0.19% to 6.85%.

Existing problems with the effort to continue increasing energy efficiency and reducing emissions include the insufficient capabilities of local power structures to bring about change; for example, though the five largest state-owned power generating group companies account for 40% of China's power generating capacity, the amount of electric generating capacity owned by these five power group companies that was closed in 2007 accounted for 61.06% of total closed electric power plants. Second, there isn't a good power pricing system that accurately reflects resource depletion and environmental costs. The current power pricing system can't immediately register changes in prices of resources, such as the large increases in the price of coal, oil and gas. Moreover, the difficulty in raising the price of electricity is increasing. Third, there isn't a unified energy conservation and emissions reductions index for the power industry. Fourth, the legal system and governmental oversight mechanisms governing energy conservation and emissions reductions aren't well developed.

China's Solar Industry

On May 5, 2008, the cities of Hong Kong and Shenzhen agreed to work with DuPont on the establishment of a solar energy research and industrial platform at the Hong Kong Science Park. DuPont will locate its global thin film photovoltaic business, research and development center in the science park. Shenzhen will collaborate with Hong Kong to provide land and facilities to support downstream development and manufacturing of solar energy products.

Construction began in early May on China's first high rise solar building in the National High Technology Industrial Zone in the city of Baoding. This project will be a showcase for China's new energy and new energy equipment industries. The outer skin of the building will use large-scale solar power glass curtain wall. The building will be able to produce 0.3MW, or the equivalent of a small-scale power plant.

In early May one of China's first megawatt class, grid connected photovoltaic demonstration power plants began construction in the city of Wuwei in Gansu Province on the edges of the Tengger Desert. The yearly sunshine in this part of China is 3000 to 3200 hours/year. The Datang Wuwei grid connected photovoltaic science and technology model power plant will be constructed in two stages. In stage one a 0.5MW-class solar power plant will be constructed and in the second stage another 0.5MW-class solar power plant will be built. Long-term plans call for a total of 5MW to be constructed

at Datang Wuwei. The cost of the first phase of the project is estimated to be 38.0537 million Yuan. The first phase project is expected to be operational by September 2008.

The Chinese solar industry not only has contributed funds to help the victims of the Sichuan earthquake, it also has provided materiel, including 20,000 multi-function LED lights, 2000 solar powered lawn lights, 1000 solar bivouac lights, 2000 solar powered flashlights, 100 sets of 200W portable solar powered PV power sources, 100 sets of track-able solar powered satellite TV and lighting systems, 10,000 household pressurized water, water treatment apparatuses, etc., etc.

China's Wind Power Industry

Inner Mongolia is now the first Chinese province to have in excess of 1000 MW of wind power operating.

As of the end of 2007 China's installed base of wind farms totaled slightly in excess of 6000 MW. China is now the fifth largest producer of wind power, after Germany, the U.S., Spain and India, up from sixth place worldwide in 2006. Five large generating companies in China have begun developing wind power projects; those five companies are Shenhua, Huarun, Guotou (National Investment), the State Power Grid Company, the China Hydropower Construction Group and the China Hydropower Consultancy Group. In 2007 the State Power Group and the Datang Group's installed capacity of wind power exceeded 1000 MW and by the end of 2007 the State Power Group's Longyuan Power Group Co.'s wind power capacity reached 1680 MW. The domestic wind power equipment industry is not as well developed as the wind power generating companies, but lately more domestic wind power developers have begun to use domestic wind power equipment manufacturers. One early adopter is the Longyuan Group, which has been sourcing turbines since 1994. In 2008, Longyuan Group purchased 485 fifteen hundred Kw turbines, with a total cumulative output of 727.5MW from the Jinfeng Company and Huatuo; these purchases represent at least 60% of Longyuan Group's total investment in installed capacity this year. According to one survey, at present China has at least 40 wind-power turbine manufacturers, among which there are 17 state-owned and state-controlled companies, 12 private Chinese companies, 7 joint venture companies and 4 wholly foreign owned companies. Though the number of Chinese wind power equipment manufacturers is large, these manufacturers lack experience and investor recognition and have relatively low technological capabilities; for example there are only a few capable of producing gear boxes (perhaps only three). Because of a general lack of confidence in the abilities of the domestic wind energy equipment manufacturers, Chinese wind power developers would rather pay a premium for foreign equipment.

As a consequence of the rapid build-out of wind power projects in China, in April 2008 the National Development and Reform Commission revised its 11th Five Year Plan Period plan for wind power development from an installed base of wind power in China as of 2010 of 5000 MW to 10,000 MW. Wind power industry statistics, however, show

that by the end of 2008 China's total installed base of wind power production will have reached 10,000 MW, two years ahead of the revised plan. The growth rate of wind power development in the following provinces is approximately 50%/year: Inner Mongolia, Gansu, Hebei and Jiangsu Province. It is now being estimated that by 2010 total installed capacity for wind power generation will reach 20,000 MW and that by 2020 China's installed base of wind power will total 100,000 MW. Estimates by experts in wind power development in Inner Mongolia have an even more optimistic assessment; they believe that by 2010 China's total installed base of wind farms will total 27,700 MW and that China will then be the fourth largest producer of wind power in the world. The Inner Mongolia experts further predict that China will become the third largest producer of wind power worldwide by 2015. Because of the rapid growth of wind power in China, the percentage of total power output that wind power accounts for is rising.

China's first sea-based wind farm is now operating in the Bohai Sea oil fields.

Jilin Province's Daan City is promoting the development of wind power. The latest wind projects are the China Guangdong Nuclear Power Group's Daganzi Wind Farm, the China Huadian New Energy Development Co., Ltd.'s Wind Farm and the China Huaneng Group's Wind Farm. The total investment of these three wind farm projects is 2.53 billion Yuan. By the end of 2008 the total installed capacity of wind power in Daan City will be 200MW, primarily located on the banks of the Nen River; long term these three companies will build a total of 3200 MW of wind farm projects. The Daan city region is one of Jilin Province's most plentiful wind resources with an area of some 1200 square kilometers that could be used for the development of wind farms with a total potential capacity of 6000MW. If the full potential of the Daan city region's wind resources were exploited, as much as 12 billion kwh of power could be generated from wind power in that region. The Daan region also has good infrastructure for the transmission of power generated there. The first phase of the China Guangdong Nuclear Power Group's Daganzi Wind Farm project was constructed in 2006 and 2007, went into operation in late 2007 and was successfully connected to the Northeastern Power Grid in December 2007.

Gansu Province's Jiuquan City is poised to develop the world's largest wind farm base. Jiuquan city, which is located in the Hexi Corridor of Gansu Province, has some of China's best wind resources; Guazhou County is referred to as the "World's Wind Reservoir". According to a report issued by the Climate Bureau, the potential wind resources in the Jiuquan region total 150,000 MW and the developable wind resources totals 40,000 MW over a landmass of 10,000 square kilometers. The China Hydropower and Water Conservancy Design Institute recently issued a report approving a plan to develop a 10,000 MW wind power base in Jiuquan city. The estimated cost of this plan is 110 to 120 billion Yuan, all of which will be invested by commercial entities; to date more than 20 large companies have investigated the development of wind farms in Jiuquan city. According to Liu Shengping, the Deputy Director of the Jiuquan City Development and Reform Commission, since 1996, when Jiuquan city began to develop its wind resources, there have been five large-scale wind farms constructed, having a cumulative total of 410 MW.

China's Geothermal Industry

China's geothermal energy resources are the equivalent to 250 billion MT of coal equivalents and the geothermal resources that can be developed are the equivalent to 32.84 million MT of coal equivalents/year.

In early May 2008 a geothermal resources survey and planning project officially got underway in Shandong Province. This project, which is being spearheaded by the Shandong Province Geological Survey Institute, is one of the geothermal surveys being conducted under the auspices of the China Geological Survey Bureau, which collectively are referred to as the China Eastern Region Geothermal Resources Survey and Planning. Geothermal resources are distributed in approximately 100,000 square kilometers, or 2/3 of the land area of Shandong Province and at a depth of 3000 meters or less. The Shandong geothermal resources generally have water temperatures of 25 degrees centigrade to 85 degrees centigrade range. According to preliminary estimates the Shandong Province geothermal resources are equivalent to 17 billion tpy of coal equivalents.

The deep and shallow geothermal resources that Hebei Province already has discovered are estimated to be equivalent to 50 billion tpy of coal equivalents. In order to facilitate the work of drilling and exploring, managing and utilizing the Hebei Province geothermal resources the Hebei Province Geothermal Resources Development and Research Office was recently established. Among other things, the Hebei Province Geothermal Resources Development and Research Office will be responsible for formulating relevant laws and regulations to govern the exploration, development and use of geothermal resources in Hebei Province.

China's Hydropower Industry

According to a report issued by China's Electric Power Regulatory Commission, the capacity of the Three Gorges Hydropower Plant is now 14,800 MW.

The May 12, 2008 earthquake whose epicenter was northwest of Chengdu, Sichuan Province in the area of Wenchuan resulted in 2380 reservoirs being threatened, among which there are 69 reservoirs whose dikes have burst, 320 reservoirs for which the threat level is high and another 1991 reservoirs whose threat level is secondary. With respect to hydropower, the earthquake zone is the location of a significant concentration of hydropower plants in China's west.

China's Bio-Mass Energy and Bio-Fuels Industries

The city of Anshan, Liaoning Province will be building fifty facilities that will convert biomass into gas in order to supply gas to approximately 32,500 farm households. Since 2000 Anshan has built a total of 24 facilities that convert agricultural waste to gas;

in total this project has allowed 13,000 households to do away with the practice of burning wood to make a fire for cooking.

Other Alternative Energy

At a Sino-German Environmental Forum held on May 11, 2008 there was a discussion about using wastewater sludge to generate power. Presently, in China, the rate at which waste sludge is treated to make it harmless is very low. Less than 1/4th of all wastewater plants do not have the facilities to render wastewater sludge harmless. Because of the high cost of such facilities, even in relatively developed cities in China, the rate at which sludge is treated is only 20-25%. Presently Chinese wastewater treatment plants mostly bury the sludge, use it as fertilizer or burn it after it is dried out. The common method of producing power from wastewater is for the sludge to go through an anaerobic fermentation process, which will produce methane gas and for the methane gas to be burned to run a turbine to produce electric power. Because it is a renewable energy the wastewater treatment plant can sell the power for more than the 0.25 Yuan/kwh that coal fired power can charge in China. In addition, the power that the wastewater treatment plant sells is exempt from income taxes and the VAT.

International Cooperation in Renewable Energy Initiatives

A report issued by the United Nations Asia--Pacific Economic and Social Commission concludes that renewable energy development and energy conservation efforts will result in savings for Asia-Pacific countries of \$700 billion U.S.D. by 2030. According to the report, if the Asia-Pacific region doesn't implement energy management reforms, energy infrastructure construction in the Asia-Pacific region will cost \$9 trillion U.S.D., which burden poorer nations in the region will be unable to shoulder. The UN report suggests that countries in the Asia-Pacific region jointly develop energy infrastructure and commonly construct energy use standards; at the same time each country in the region should reform its tax policies to encourage the use of ecologically friendly energy resources. The report also predicts that if development in the Asia-Pacific region proceeds that the current pace, by 2030, the Asia-Pacific region's energy consumption will account for 50% of world demand.

The International Science and Technology Cooperation Plan for Renewable Energy and New Energy, a document recently issued jointly by the Ministry of Science and Technology and the National Development and Reform Commission, establishes a number of goal with respect to the international aspects of renewable energy development in China, including attracting foreign investment and technology, supporting Chinese companies to sell advanced technology around the world, fostering the development of a cadre of well educated Chinese whose focus is renewable energy, establishing a group of demonstration projects and attracting capital from foreign governments, international agencies, multi-national companies and private capital.

Assistant Secretary of Commerce David Bohigian will lead a Clean Energy and Environment Trade Mission September 1 through September 12, 2008. The trade

mission is part of the Asia-Pacific Partnership on Clean Development and Climate -- a public-private partnership among the United States, Australia, Canada, China, India, Japan and South Korea. This will be an opportunity for U.S. companies to negotiate deals for energy and environmental goods and services that the companies participating would like to sell to China. The U.S. firms will meet with potential partners, distributors, licensors and retailers in each country. China plans to invest \$175 billion in water treatment, air pollution control and other environmental technologies during the next five years. According to China's 11th Five Year Plan, China is striving to cut energy consumption per unit of GDP by 2010 by 20% compared with the first year of the 22th Five Year Plan.

Construction and Renewable Energy

Shijiazhuang, Hebei Province will be promoting the use of solar power, shallow grade geothermal, heat pumps fueled by waste water and other renewable technologies to be integrated into new construction. The city of Shijiazhuang will also request residential buildings, hospitals, schools, hotels, swimming pools and other facilities that use a lot of hot water, to utilize solar collector hot water technology to provide hot water. With respect to construction that does not satisfy standards for energy conservation and have not undergone the required energy conservation design work, the city of Shijiazhuang will not process the required documentation necessary for a project to begin construction and will not allow the units to be sold. Where there have been violations in the regulations governing the design and construction of energy conservation-integrated construction and the violation is found to be egregious, the highest fine that can be meted out is 500,000 Yuan (~\$72,000 U.S.). According to the {Energy Conservation Law of the People's Republic of China}, which went into effect as of April 1, 2008 fines for violation of energy conservation standards in construction range from 200,000 Yuan to 500,000 Yuan.

Developments in Environmental Protection and Energy Conservation in China

China discards more than 50 million lead-acid batteries each year; in Beijing alone the number of lead-acid batteries that are discarded is approximately 2.2 million/year. To the extent that there is greater refurbishing and reuse of lead-acid batteries, this will mean less consumption of lead and less environmental pollution from the smelting process.

China's Energy Production and Consumption

In 2006 the total installed capacity of nuclear power in China was 6850 MW. With the addition of the two-unit Tian Bay Nuclear Power Plant in 2007, total installed capacity of nuclear power as of the end of 2007 had increased to 8850 MW. This year the Hongyan River Nuclear Power Plant has gone into operation.

The earthquake in Sichuan Province has also damaged power plants and transmission lines, interrupting normal power service; it is estimated that those

disruptions amount to ~1% of China's power generating capacity. In addition to western Sichuan, power plants and transformers were damaged in neighboring Shaanxi Province. As a result of these disruptions, it is expected that demand for power will decrease as a consequence of the earthquake.

According to a BP analysis Sichuan Province's reserves of natural gas account for 40% of China's reserves of natural gas. In 2006 the natural gas that Sichuan province shipped east accounted for 22% of China's natural gas usage. It is too early to tell what the full extent of the impact of the Sichuan earthquake on energy supplies and the large state owned energy companies that manage that supply.

In 2007 China's consumption of non-renewable energy totaled 2.65 billion MT of coal equivalents, making China's energy consumption the second largest in the world. Over the period 1979-2006, China's energy consumption grew on average 5.4%/year. China relies on coal for its energy needs to a much larger extent than the world at large. At present coal accounts for 70-75% of China's non-renewable energy consumption; this amount is much larger than the world average of 30%. China's heavy reliance on coal as a fuel not only causes damage to China's environment, but also increases the pressure on China to respond to worldwide climate change. China imports approximately 50% of the crude oil that it consumes. Presently renewable energy accounts for approximately 7.5% of total energy consumption in China; by 2010 that amount is expected to rise to 10% and by 2015 to 15%.

In the first four months of 2008 China imported a total of 12.68 million MT of refined oil with a value of \$8.68 billion U.S.D., increases, respectively, of 9.2% and 78.6%. In 2007 China's reliance on foreign oil was 44% of total oil consumption. In the first quarter of 2008 China's reliance on foreign oil jumped to 51.5% of China's oil consumption for that period. All expectations are that China's reliance on foreign oil will continue to increase until 2040.

The Tibet Electric Power Commission has announced an effort to extend further the electric power network within 32 counties, cities and districts in Tibet in areas that are presently not served by the power grid; this effort will span the last three years of the 11th Five Year Plan (2008-2010). The government estimates that the Tibet Electric Power Co., Ltd. will spend 863 million Yuan on this effort over the next three years to reach an additional 37,000 households and 174,000 persons. At present in these 32 counties, cities and districts, there are a total of 205 townships and 1385 villages where the power grid extends to 207,000 households with nearly 900,000 persons. By the end of 2010 the number of townships that are served will total 261, an increase of 56 and the number of administrative villages will increase by 643 to a total 2028. When this project is completed the number of households that will have electricity will increase to 300,000 and the number of persons that will then have access to electricity will increase to 1.4 million people.