

## **People's Republic of China**

*Population:* 1,330,000,000 (2009 estimate)

*Area:* 9,826,630 square kilometers (several border areas in dispute)

*Gross domestic product:* \$7.8 trillion (2008 estimate)

*Greenhouse gas emissions:* 6.1 billion metric tons (carbon dioxide equivalent)

*Kyoto Protocol status:* Ratified, 2002

### **Historical and Political Context**

The major factor in the production of climate change gases and general environmental degradation is the massive growth in the world human population, and China is a substantial portion of that population.

From a population of 400 million before World War II, China's population has grown to over 1.3 billion. Following the establishment of the People's Republic of China in 1949, the initial efforts of the government focused on rebuilding the nation and growing the population. In the face of Mao's philosophy of controlling and shaping the environment to serve a new generation, it was difficult for population scientists to convince the government that there was a need to constrain growth. When it was obvious that progress in literacy, food production, and modernization was undermined by uncontrolled population growth, Mao agreed to first a two-child policy and then a one-child policy. This was—and still is—enforced only for the Han Chinese; minorities have never been limited in their number of children. It is estimated that without the one-child policy, China would currently have over 300 million more people, a number equal to the whole United States population. This would have meant a dramatically lower standard of living and severe stress on food supplies, living conditions, and energy in China, and would have added over one billion tons of CO<sub>2</sub> to worldwide emissions.

Management of environmental issues in China has modified and expanded since the first National Environmental Protection Meeting in 1973. The Ministry of Urban and Rural Construction and Environmental Protection was established in 1982. The State Environmental Protection Administration (SEPA) was established in 1988, and upgraded to ministry level in 1998. The current Ministry of Environmental Protection (MEP) was established in 2008. In March 28 of 2008, China's MEP established five regional inspection offices and total staff numbered under 2600, compared with the U.S. E.P.A. with over 17,000 personnel.

The State Council of the People's Republic of China issued the *China National Environmental Protection Plan in the Eleventh Five-Years (2006-2010)*. That 5-year plan stated a goal of achieving 20 percent better energy efficiency and a 10 percent decrease in pollutants.

China's officials acknowledge that the need for sustaining economic growth can take precedence and weaken enforcement. Lu Xuedu, deputy director of the Chinese Office of Global Environmental Affairs, explains that "You cannot tell people who are struggling to earn enough to eat that they need to reduce their emissions." Economic arguments are not restricted to China. Because coal is much cheaper than oil and natural gas, Japan and Europe are also returning to greater use of coal.

While the economic health of the population takes center stage, China's officials are not hesitant to address the problems of climate change. *China's National Assessment Report on Climate Change (I)* (2007) notes that sea levels have risen 2.5mm annually over past 50 years. Glaciers have retreated and air temperatures have increased 0.5-0.8 C over last century, mostly in the last 50 years. The report predicts rural agricultural output will drop by 5-10 percent by 2030.

*China's Scientific & Technological Actions on Climate Change* further details that from 1986 to 2006, "China experienced 21 warm winters nationwide in succession." China is putting together large-scale observation networks and has laid out targets for very aggressive research in emission controls.

### **Impact of China's Policies on Climate Change**

The "China National Environmental Protection Plan in the Eleventh Five-Years (2006-2010)" by the State Council of the People's Republic of China has directed over one percent of GDP to environmental protection, but considers the environmental situation "still grave." It laments that there were no breakthroughs in issues that should have been addressed before, and directly blames lack of observation of laws, minimal punishments for lawbreakers, and poor law enforcement of environmental law. The most successful controls have been in the area of cutting high levels of sulfur emissions which ironically reflected sunlight back into space and were therefore counter-greenhouse gases. Thus in decreasing acid rain, they have increased the greenhouse effect.

In contrast to recent American trends, China has avoided the rush to develop corn ethanol and other biofuels that would in any way displace foodstuffs for human consumption. China has concerns over "food security" dating from a not-to-distant memory of hunger and famine. Biofuels from non-food plants, oilseeds and an experimental *Jatropha curcas* plant, are being considered, but with close concern for erosion and replacement of food crops.

China recently completed the world's largest hydroelectric dam, a classic source of clean energy. Its 26 generators produce 700 megawatts each. The total 18,200 megawatts is equal to the power of 15 of the largest nuclear-power plants. It was designed to generate up to 10 percent of the country's power needs at the time of construction, but China's energy needs are pulling away. Despite refusal of the World Bank to fund it, and an American-led boycott of bank funding, China continued alone to build the massive dam based on the need to control devastating floods, generate clean power, and also bring ocean freighters to the interior industrial city of Chongqing.

China has provided subsidies to companies producing solar photovoltaic systems. Photovoltaics, or solar panels, are (aside from their production) carbon neutral. However, as a source of electrical generating power, cost has not yet dropped to a level where they can compete with natural gas or coal, a point called "grid parity" in China, and many solar units are shipped to Germany and other countries. General estimates are that solar power would have to drop to 14 cents per kilowatt hour to be economical in China. Current costs run near 40 cents per kilowatt hour. The 2008 surge in oil prices provided the expectation that the cost of such alternative fuels would soon come close to competing with fossil fuels. However the subsequent global economic downturn also dramatically reduced the price of fossil fuels. The point at which solar power would become as cheap, once optimistically thought to be as early as 2012, was deferred.

Many companies that make photovoltaics are located in China not only for cheaper labor but also for cheaper land and materials. New buildings in Guangdong and other developed areas are being designed to use solar panels to provide their complete energy needs, the main markets for Chinese solar panel production is in Europe, where regulations and subsidies promote the use of the more expensive power source. China itself remains cost-conscious and is not ready to substitute more expensive power sources for cheaper coal plants. The need to serve the poorer population in the less developed countryside takes precedence.

Silicon, a central ingredient in solar cells is also critical to the semiconductor industry. The solar industry now exceeds the semiconductor industry in its use of silicon. China has provided various electrical engineers with millions of dollars in start-up funds to establish state-of-the-art solar photovoltaic system factories in Wuxi and several other cities. Research has reduced the silicon needed to produce solar cells. The economic downturn has also decreased the costs of silicon. Improved technology, much conducted in China, is increasing the efficiency of electricity production from silicon.

China was the first developing country to establish a national policy for addressing global warming, releasing its “National Action Plan on Climate Change” in June 2007.

### **China as a Greenhouse Gas Emitter**

According to the International Energy Agency, China surpassed the United States in carbon dioxide emissions in 2009. China’s dramatic economic expansion since 1980 has pulled 400 million of its citizens out of poverty. But it has likewise increased per capita use of energy, especially visible in their rapid adoption of automobiles. The increase in energy demand in their developed regions has required them to enter the global market as a major player, negotiating purchase of major shares of oil from Kazakhstan and other nearby fields.

According to the *World Energy Outlook 2008* produced by the OECD/IEA, China’s energy demand by 2030 is expected to grow to an extent that it will produce double the emissions of India and over triple the emissions of other developed economic regions, due to the huge market size of China as well as its strong economic growth.

While China is the second largest consumer of oil at 7 million barrels a day, the United States leads at 21 mbd. Similar to the U.S., China has limited and rapidly declining domestic oil reserves. Oil imports are currently 40% of consumption. By comparison, 60% of the U.S. 21 mbd is imported.

With substantial coal reserves, China has used many smaller power plants located near population centers in order to deliver power locally with less lost to transmission. China is now requiring that larger plants be built that are more efficient and use less coal per kilowatt-hour produced.

Similar to North America, China’s main strategic energy reserve is coal. China’s energy consumption is so large that it also imports coal from Canada and Australia.

While newer scrubber technology reduces some emissions, burning coal is still a major CO<sub>2</sub>

generator. China has begun 30 large scale Coal-to-Liquid (CTL) projects. This “Fischer-Tropsch process” produces an end-user methanol. China has committed to substantial use of methanol in 2011-2013. Methanol is added to gasoline to produce a cleaner-burning fuel. When oil prices are above US\$35 per barrel, coal-derived methanol is cost-effective for automobile fuel. This would produce the methanol equivalent to 20% of its current oil consumption although with consumption doubling, this would amount to about 10% of future needs. The largest joint venture with Royal Dutch/Shell is a project in Ningxia that would produce 70,000 oil barrels equivalent per day. The first step was to set standards for CTL methanol, a duty of China’s National Development and Reform Commission. China is the only country in the world developing methanol as an alternative fuel. Oxygenated gasification, a process developed with some U.S. government funding in earlier years, allows the isolation of CO<sub>2</sub>. This allows China to either sequester the CO<sub>2</sub> or use it to increase oil production from older wells.

A growing source of carbon emissions is the increase in cars. In the last decades, government policy has promoted car production and encouraged the growing middle class to buy cars. The initial rationale was that the production, repair and maintenance of cars would provide economic growth to pull poor people out of poverty; pollution control could come later. However, China has now established fuel-economy requirements for new car production that are more rigorous than the United States.

Compared to over-the-road trucking, rail is far more efficient for moving products on a cost-per-mile and carbon emission basis. China has 45,000 miles of rail network compared to 142,000 miles still operable in the U.S. China is investing US\$242 billion by the year 2020 in modernizing its railroad infrastructure, expanding the rail network and separating passenger and freight transport.

### **Summary and Foresight**

China’s rapid economic growth has generated concern that the energy demands of such a huge population, if it grew to the per capita usage of an American consumer, would be an ecological disaster in terms of both pollution and emissions of global warming gases. However, the lifestyle of the new middle class Chinese retains a conservation ethic that prevents runaway consumption. China uses passive solar water heaters and has a long history of public transportation, bicycles and electric bicycles use that combines economy and conservation of energy. In addition, the crowding of a large population requires severe limitations on pollution and provides a public awareness of the need to conserve and protect the environment. As a result, the government has switched to an aggressive recognition of the problems of global warming in its most recent policies. China’s ability to implement the policies is tempered by the need to pull half of its population, primarily in the countryside, out of poverty.

At the international level, under the Kyoto Protocol, the People’s Republic of China is considered a developing country and therefore not required to meet emission timetables and targets. However, it can earn credits by emission-reduction activities under the Clean Development Mechanism. China’s admission to the World Trade Organization and its leading role as a major nation have moved it to the position of needing to provide leadership in controlling greenhouse gases.

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### **Further Reading**

China National Environmental Protection Plan in the Eleventh Five-Years (2006-2010) by the State Council of the People's Republic of China. Document #39 of the State Council, 2005. 41 pages. China sets goals for all governmental issues in "five-year plans." This official report details the failure to achieve major targets under the previous "10<sup>th</sup> Five-Year Plan for National Environmental Protection" and the necessity to provide an emphasis on environmental protection that is equal to the economic goals. In expanding nuclear energy usage, China is likewise constructing disposal facilities for low and medium level radioactive wastes.

China's Scientific & Technological Actions on Climate Change Jointly Issued by the Ministry of Science and Technology, National Development and Reform Commission, Ministry of Foreign Affairs, Ministry of Education, Ministry of Finance, Ministry of Water Resources, Ministry of Agriculture, State Environmental Protection Administration, State Forestry Administration, National Natural Science Foundation, State Oceanic Administration and China Association for Science and Technology. June, 2007. 10 pages. An official state overview, this report is up front about the severity of climate change in China and the need to set strident targets.

Ding Yihui, Ren Guoyu, Shi Gaungyu, Gong Peng, Zheng Xunhua, Zhai Panmao, Zhang De'er, Zhao

Zongci, Wang Huijun, Luo Yong, Chen Deliang, Gao Xuejie, and Dai Xiaosu. China's National Assessment Report on Climate Change (I) *Advances in Climate Change Research* 2007, 3 (Supplement): 1-5.

Economy, Elizabeth C. 2004. *The River Runs Black: The Environmental Challenge to China's Future*. Cornell University Press; Ithaca, NY. 337 pages. This Council on Foreign Relations Book examines the extent China's spectacular commercial advancement has depleted resources and challenged governmental regulatory agencies at all levels. Her discussion extends to health problems, migration, economics, and social stability.

Shapiro, Judith. 2001. *Mao's War Against Nature: Politics and the Environment in Revolutionary China*. Cambridge University Press, New York. 287 pages. This summary of the early years of the People's Republic under Mao provides a negative view of the environmental degradation that accompanied the restructuring of society immediately after 1949.