total of 37 GW. Official plans see the national capacity rising to 200 to 240 GW by 2020.

The justification for these dams is premised on the need for flood control and, on occasions, for improved navigation for waterborne traffic, in addition to the requirement for additional energy supplies. More recently, the argument has been that this form of energy production contributes much less to the production of greenhouse gases than thermal power generation.

The construction of large dams has long been controversial in China, as it has been around the world. The arguments against the dams range from the financial and technical to the environmental and social. Three of these arguments are particularly important in China. First, the contribution of these dams to the power supply can vary from year to year depending on water flows, and fluctuates throughout the year with the seasons. As a result, China's overall load factor for its hydroelectricity industry is just 0.37, well below that of Brazil and Canada, which are 0.56 and 0.59 respectively. Secondly, the commercial viability is also diminished in China because many dams are far from the centers of demand for power.

Finally, the high population density in much of China, especially near large rivers, has exacerbated the problems of forced migration and safety. It has been estimated that by the early 1990s some ten million people had been displaced by such projects. The new Three Gorges Dam has resulted in the displacement of more than one million people. In addition, China used to have a poor record in dam safety, and many dams have collapsed. The most notorious of these was the Banqiao Dam in Henan Province, which failed during a freak flood in 1975, causing the deaths of 170,000 people and affecting eleven million. While the construction standards for the largest dams have certainly improved since then, collapses of smaller dams are reported frequently.

As a result of these and other concerns, the level of protests being voiced at newly planned dams is increasing. This may slow the rate of construction at a time when the government wishes to enhance the role of clean energy. In addition, fears exist that climate change is reducing snowfall in the Himalayas, which in turn will cause the flow of water in some of China's large rivers to decline.

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WIND POWER

China has substantial wind resources, mainly located in the coastal southeastern provinces and in the northwest and northeast of the country. As part of the government's strategy to rapidly enhance the proportion of renewables in the energy supply, it has been actively promoting the development of wind power. Installed capacity has doubled each year since 2003. In 2006, 2.6 gigawatts (GW) of new capacity were installed, and a further 3.4 GW were installed in 2007, bringing the total to 6 GW. This gives China the fifth largest wind-power sector in the world, behind India. Wind power now accounts for nearly 1 percent of installed power-generating capacity. In addition to these plants that are connected to the grid, the country has more than 200,000 stand-alone turbines for local energy supply, totalling some 50 megawatts (MW).

The current national energy strategy and climate-change policy has resulted in ambitious targets being set for the expansion of wind power. Yet the industry has already exceeded the target of 5 GW set for 2010. The official target of 30 GW set for 2020 is also likely to be exceeded, and by 2030 installed capacity will probably be in the range 50 to 100 GW, accounting for 2 to 3 percent of total electricity supply.

More than forty Chinese manufacturers are active in wind power, and they provide more than 50 percent of the market. They have mainly delivered turbines with capacities of less than 1 MW, but they are rapidly scaling up. The main manufacturers are Gold Wind with 33 percent market share in 2006, Zhejiang Yuanda, Sinovel, and East Turbine. Their competitive position with respect to foreign manufacturers is helped by the legal requirement that 50 percent of the equipment in the first phase of a project must be made in China, and this rises to 70 percent in later phases. The leading foreign manufacturers are GE, Vestas, and Gamesa. The major Chinese developers are the large national power companies, which are obliged to invest in renewables: National Power Group, Huaneng, Guohua, Datang, and China Power Investment.

The Renewable Energy Law passed in 2005 requires grid companies to connect all renewable plants and to purchase all electrical power generated by these plants. Incentives for research and development were also provided to encourage the domestic manufacturing of the required technologies. Despite these positive components, the law did not provide for a feed-in tariff. Rather, the tariff for new large projects is set by competitive bidding. This has resulted in the state-owned power companies driving prices down to levels below what most would estimate to be commercially viable, and private-sector investors, both domestic and foreign, have failed to gain significant opportunities recently.

For projects not included in this bidding process, prices are set by the local pricing bureaus, also at a relatively low level but higher than that for thermal power. As a result of insufficient financial incentives and poor planning, developers have been slow to build contracted capacity, and the grid companies have been slow to connect and dispatch completed new wind-power capacity.

An added potential incentive for the construction of renewable energy capacity is the Clean Development Mechanism. By the end of 2007, seventeen wind-power projects in China had been registered under the Clean Development Mechanism, but administrative obstacles and policy ambiguity have prevented more rapid implementation.

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NUCLEAR POWER

Chinese efforts to develop commercial nuclear energy began in the 1970s, but developed slowly because of government concerns about cost and safety. A dramatic rise in the demand for electricity, the increased cost of fossil fuels, the environmental consequences of heavy reliance on coal, and increased domestic industrial capacity and technical expertise have made investments in nuclear energy more attractive to China's current planners.

In 2007 China operated eleven commercial nuclear reactors providing 62.86 billion kilowatt-hours of electricity, or about 2.3 percent of China's total electrical-energy output. Scheduled to be completed by 2020 are an additional twenty-two reactors, which will increase China's nuclear generating capacity to 40 gigawatts-electric, or 4 percent of projected national electrical-energy production. China's National Development and Reform Commission announced a target of 160 gigawatts-electric for nuclear-generation capacity by 2030. Proposals to build nineteen additional nuclear plants are currently under review, and an additional eighty-six plants have been proposed.

A leading Chinese nuclear engineer described China's initial set of eleven operating nuclear-power plants as the "United Nations of nuclear reactors." They include four French pressurized water reactors at Daya Bay and Lingao in Guangzhou, two Russian AES-91 pressurized water reactors at Tianwan in Jiangsu Provence, two Canadian CANDU 6 pressurized heavy-water reactors at Qinshan in Zhejiang Provence, and three indigenous Chinese CNP-600 pressurized water reactors at the same Qinshan site. Going forward, Chinese planning documents call for reliance on Chinese domestic design and production, with limited foreign cooperation when necessary. Only six of the next twenty-two reactors scheduled to be completed by 2020 will be of foreign design. Westinghouse signed contracts with China for four of their as yet untested third-generation AP1000, and Areva NP signed contracts for two of their advanced European pressurized water reactors. All of China's planned projects for constructing nuclear-power plants will involve a high degree of international participation with countries such as Finland, Germany, Japan, and South Korea all supplying key components.

China has six operating uranium mines producing approximately 840 metric tons per year, which is not quite sufficient to satisfy current demand. The balance is met with modest imports from Russia and Kazakhstan while China expands domestic production. China's known reserves stand at approximately 70,000 metric tons of uranium, which are sufficient to meet China's projected short-term demand. Concerns about long-term supply are expressed in Chinese efforts to acquire commercial spent-fuel reprocessing facilities. In November 2007 an agreement was concluded between the French company Areva and the China National Nuclear Corporation to conduct a feasibility study on constructing a facility for fabricating mixed-oxide fuel in China. This follows an attempt by the China National Nuclear Corporation to purchase a similar facility from Germany in 2003.

Looking toward the future, China has a comparatively vigorous research program on energy from nuclear fusion. China currently operates five experimental Tokamak fusion devices and is constructing a new experimental advanced superconducting Tokamak at the Institute of Plasma Physics in Hefei. The new Chinese Tokamak is similar to the International Thermonuclear Experimental Reactor (ITER) being built in France by an international consortium that includes China.

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