

## China Embraces Nuclear Future

Optimism Mixes With Concern as Dozens Of Plants Go Up

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YUMEN, [China](#)

Not far from the old Silk Road, Chinese government scientists have begun boring holes deep into granite in the first steps toward building what could become the world's largest tomb for nuclear waste.

As governments worldwide look at nuclear power as a possible answer to global warming, China has embarked on a nuclear-plant construction binge that eventually could exceed the one the [United States](#) undertook during the technology's heyday in the 1960s.

Under plans already announced, China intends to spend \$50 billion to build 32 nuclear plants by 2020. Some analysts say the country will build 300 more by the middle of the century. That's not much less than the generating power of all the nuclear plants in the world today.

By that point, the Chinese economy is expected to be the world's largest, and the idea that it may get most of its electricity from nuclear fission is being met with both optimism and concern. Nuclear power plants, unlike those that run on fossil fuels, release few greenhouse gases. But they produce waste that can be dangerously radioactive for thousands of years.

China's plans already have been felt in world markets. Chinese Premier Wen Jiabao has been traveling the world to secure contracts for the uranium needed to power nuclear reactors, striking deals recently with [Australia](#) and [Niger](#). Higher worldwide demand and a fear of future shortages have driven the price of processed uranium ore from \$10 a pound in 2003 to \$120 this month.

A big reason [Toshiba](#) of [Japan](#) spent \$5.4 billion last year to acquire Westinghouse Electric of [Pennsylvania](#) is expectations that China will buy into the company's nuclear technology in a big way over the next 20 to 30 years.

Even by the standards of China, where economic growth has been running at blistering double-digit-percentage rates for four years, the nuclear plans are ambitious. The country derives only 2.3 percent of its electricity from nuclear power, compared with about 20 percent in the United States and nearly 80 percent in [France](#). Nine countries get 40 percent or more of their electricity from nuclear power, but worldwide, it supplies only 17 percent of the total.

To satisfy exploding demand for electricity, Chinese local governments and entrepreneurs have for years been throwing up rattletrap coal-fired power plants. They are so inefficient and dirty -- spewing greenhouse gases, soot and toxins including mercury into the air -- that the central government has been trying to limit construction of new ones, with limited success.

"Our irrational energy structure is causing serious pollution and greenhouse problems," said Gu Zhongmao, a professor at the China Institute of Atomic Energy, a government-affiliated research center. The situation provoked years of internal debate about nuclear power as an answer, he said, before the country's leaders finally came to a consensus.

In the Chinese context, he said, "nuclear power is regarded as a clean energy."

Yet environmental advocacy groups and outside safety experts are less than sanguine about the idea of hundreds of new nuclear plants being constructed by a secretive Communist government. The Chinese government has a poor public-safety record on issues far simpler than nuclear power, such as food and drug purity.

Another communist state, the [Soviet Union](#), seized on nuclear power in the 1970s and '80s as an answer to its energy

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problems, putting up about a dozen poorly designed plants. That culminated in the [Chernobyl](#) disaster of 1986, which spread radiation across [Europe](#) in the world's worst nuclear accident.

"The safety issue is simply not something the Chinese government can afford to overlook," said Ailun Yang, climate and energy campaign manager for Greenpeace China. "The situation in China is that there will be huge populations around. What will happen if there is a Chernobyl in China?"

The Chinese government has emphasized a commitment to safety and is relying heavily on Western contractors such as Westinghouse to teach its engineers to build and operate plants.

China has nine working nuclear power plants, most on the coast. Two other plants were recently completed and will be hooked up to the electricity grid later this year. Dozens more are in the planning stage.

A [Massachusetts Institute of Technology](#) report said China may have to add as many as 200 nuclear power plants by 2050 to meet its needs. Academics from China's leading technical university, Tsinghua University, said the country might need more, equivalent to the output of 300 plants.

In comparison, the United States has just more than 100 operating nuclear plants. Nuclear power has effectively been on hold in the United States since the 1979 accident at Three Mile Island in Pennsylvania, but, with encouragement from the Bush administration, companies are thinking about ordering new plants.

Leon Reiter, a former member of the U.S. Nuclear, said countries are converging on the same conclusion as the world's supply of energy resources such as coal and oil grow scarcer and costlier.

"It is hard to imagine any way for us to come up with the energy we need without nuclear power," Reiter said.

China is talking about addressing the safety issue with a cookie-cutter plant of its own design that would be built in dozens of places. As in the United States, engineers in China want to build a plant whose fuel core cannot melt down and release radioactivity into the environment. Groundbreaking for an experimental \$416 million Chinese plant is scheduled for 2009.

Even if the safety issue in China is solved, the country will confront a problem that has bedeviled nuclear power everywhere: what to do with the radioactive waste.

In a conventional power plant, fossil fuels that have been trapped underground for millions of years are burned, generating heat that can be used to run electricity-generating turbines. The burning releases carbon dioxide into the atmosphere. Scientists have concluded that the gas, by trapping extra heat from the sun, is warming the Earth and is likely to create severe environmental problems.

Nuclear plants generate heat by splitting atoms of uranium. They give off no greenhouse gases, but as the nuclear reaction proceeds, the uranium is transformed into other elements, some of which remain radioactive for many centuries.

As a rule, the spent fuel is stored temporarily in water-filled tanks near nuclear plants. In democratic countries, the question of final disposal has provoked huge, seemingly endless fights, including one in the United States over whether to dispose of the spent fuel at an underground site at Yucca Mountain in Nevada.

The idea behind a disposal site is simple: Stick the waste in a sealed container, place it deep underground, and leave it there until the radiation goes away. But in practice, finding appropriate sites has been difficult because of worries about earthquakes or ground water spreading the radiation.

In the desert of [Central Asia](#), China is planning its own version of Yucca Mountain, albeit without serious opposition. Some local leaders have protested the Beishan Mountain disposal project, but their concerns have been muted.

The Beishan Mountains are a lonely outpost, with the closest permanent residents more than 60 miles away. The only people who venture here are nomadic Mongolian herdsmen with goats and camels. They move from one small oasis to another in what is otherwise a desolate, gray desert for hundreds of miles around. The only signs of the nuclear waste site to come are the dark tents that scientists put up and take down as they test rock layers to find the best place for disposal.

Chinese officials have not announced specifics of the Beishan waste disposal site, but Wang Ju, head of the waste repository project for the Beijing Research Institute of Uranium Geology of the state-run China National Nuclear Corp.,


said the schedule for construction had been sped up to match the country's increasing use of nuclear power.

Xu Mingqi, deputy director of the Institute of World Economy at the Shanghai Academy of Social Sciences, who researches energy issues, said the Chinese government is well aware of the stakes.

"If we do not bury it properly," Xu said, " it could be an even bigger problem than the pollution problem we have now."

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