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In Brief

Guangzhou may have no potable water soon. Pollution is threatening the city's drinking water supplies. Of the nine water plants which can provide a total daily supply of 3.82 million cubic meters, only two met Grade II water quality standards or better; all others are below Grade III. Currently, the cost of water per thousand cubic meters is 182 yuan. Over the last ten years, the use of water purifying agents has tripled.

Six villages and towns in ***Anshan***, Liaoning Province are suffering from pollution caused by mining magnesium. Each year, 8.7 billion cubic meters of waste gas is emitted into the air, in addition to more than 20,000 tons of smoke and dust, 100,000 tons of powdered dust, and 5,000 tons of SO_2. Local residents pay a high price. Nearly 700 hectares (ha) of high quality arable land has been seriously contaminated. The concentration of magnesium in the soil is as high as 0.0012 and the soil's pH value is as high as 10 in some areas. Local agricultural productivity has shrunk dramatically.

Guangdong Province is planning to invest as much as 20 billion yuan to protect its drinking water sources. In its clean water plan, the province plans to establish drinking-water conservation reserves and control drinking-water pollution by the year 2000. By 2005, 98 percent of the province's drinking water is expected to reach standard levels.

Beijing is undertaking a set of environmental improvement projects funded by the Asian Development Bank. The projects include a natural gas pipeline from Shaanxi and Gansu to Beijing, a thermal power plant in Gaobeidian, the protection of drinking water and the prevention of mud flow in the Miyuan Huairou Reservoir, and the renovation and relocation of Beijing Third Chemical Plant.

China Environment News, the only national newspaper specializing in the environment and development of China, published a list on July 19th of all the polluting enterprises that discharge over 100 tons of wastewater per day along the Huai River in Henan, Anhui, Jiangsu and Shandong

provinces. This was a major negative exposure for those polluters,

Shanghai opened the first online network in China on environmental information. Please visit: http//www.envir/online.sh.cn.

Guangzhou will begin its phase-out of leaded gasoline starting this October 1. The city now has 907,000 vehicles, which consume nearly one million tons of gasoline and emit as much as 303 tons of lead each year. One recent survey shows that the blood lead level among policemen is in excess of 11.6 ug. Among pupils in schools and women cashiers close to busy roads, the levels are up to 16.7 ug and 9.4 ug, respectively. Guangzhou is now the most polluted city in Guangdong Province.

Urumqi, capital city of Xingjiang, now has its first sewage treatment plant. With a total investment of more than 244 million yuan, the plant has a daily capacity of 200,000 tons.

Early this summer, Changtu County in Tianlin of Liaoning Province suffered tremendous losses of more than 2,330 ha of rice fields (one third of the total) due to pollution caused by the herbicide Atraxine. Total economic losses were estimated at 360 million yuan.

Highlights of *State of the Environment*, Continued

These summaries began in the July 30th edition of CER.

Guangdong

Guangdong achieved some progress in improving its environmental quality in 1996. Emissions of wastewater and waste gas were down compared with last year, while production of solid wastes remained constant. Air quality improved slightly and the frequency of acid rain declined. Urban ambient noise level also dropped. In general, however, environmental challenges are still very tough. Pollution along major river sections increased. Of the 38 river sections monitored, almost half had increases in total pollution. Some sections had much more serious pollution. Drinking water sources were universally contaminated. Guangzhou suffered the most, followed by Shenzhen and Huizhou. Environmental pollution and ecological destruction in the province are restricting its economic growth and the public's health. (CEN, 7/12/97)

Xinjiang

The air quality in this autonomous region did not change much in 1996. Groundwater contamination remained at various levels, and surface water quality remained good. Urban noise was a serious problem. Environmental pollution in rural areas got worse with the further development of township and village industrial enterprises. In 1996, a total of 169 million tons of industrial wastewater was discharged, around 90 percent of which was pretreated before being discharged. More than 5.6 million tons of solid wastes were produced, with 2.52 million tons disposed of and 47.3 percent recycled. Of the industrial waste gas emitted, 85.6 percent was treated, which is an increase over 1995. Urban ambient TSP daily averages exceeded the State-prescribed standard 37 percent of the time, a reduction from the previous year. Daily average levels of SO_2 and NO_x were 25 ug/cubic meters and 31 ug/cubic meters, respectively, not much different from last year. Surface water quality was in good shape, but most groundwater suffered from "hardness". There were 58 water pollution accidents in 1996, which caused a total of 8 million yuan in economic losses. (CEN, 7/12/97)

Tianjin

While achieving strong economic growth, Tianjin's overall environmental quality has managed to improve on some fronts. During the Eighth Five-Year Plan Period, ambient SO_2 and TSP levels were still above the standard, especially during winter. This was despite the fact that major air quality indices were under control. Pollution in the Haihe River became more serious, as well as in the coastal areas along the Bohai Bay, especially at Beitangkou and Dagukou. Urban household and traffic noise was still serious. There was some progress in nature conservancy with the establishment of nine nature reserves by the end of 1996. (CEN, 7/10/97)

Fujian

Though the environment in part of the province has improved, the overall situation was still worrisome. River quality and the environmental quality in some cities and villages improved. However, natural resource waste, environmental pollution and ecological destruction remained serious. Compared to 1995, the expansion of environmental pollution in cities to rural areas has gotten worse. Dust and acid rain were the two major air pollution problems in 1996. Of the nine cities monitored for acid rain, Xiamen and Fuzhou had the most frequent occurrence at 83.5 and 58.5 percent, respectively. All major rivers were contaminated to various degrees, with sections running through cities and

towns the worst. Inner city lakes and urban surface water were seriously polluted and continued to worsen. Ambient noise pollution at night in most cities was a serious problem. With the development of TVIEs, pollution extended to rural areas. Since last year, the province has lost 9,215 ha of arable land, up 83.5 percent compared to last year. The province has the highest forest cover in the country at 57.3 percent. Environmental pollution adversely affected human health. Liver cancer mortality was the highest among other causes of death. Urban cancer mortality rates were much higher than rural areas. (CEN, 7/10)

Jilin

Surface water pollution has become the primary source of concern for the province, followed by the problems of urban smoke and dust pollution. The report showed that 80 percent of the surface water in Jilin was contaminated to various degrees; the most seriously damaged were river sections running through cities. Most of the rivers and lakes have water quality short of Grade III standards. Dust and TSP were the two major air pollutants, generated primarily from coal burning. Pollution was worse in the winter heating seasons. Ambient TSP concentrations for Changchun and the other ten major cities were at the range of 211-546 ug/cubic meter, averaging 365 ug/cubic meter. Vehicular pollution was getting worse with ambient NO_x concentration showing an upswing. Emissions of industrial waste gas were up 5.8 percent from the previous year, though industrial wastewater and solid wastes discharge was reduced by 7 and 30 percentage points, respectively. Household garbage disposal has become serious. Most urban household garbage was not disposed of and it was stockpiled around cities. Despite these setbacks, certain progress was achieved in ecological protection. Almost 640,000 ha of trees were planted. A new province-level nature reserve was established for Changbai cold-water fish. So far, the province has 14 nature reserves at province and state levels, with a total area of 1.82 million ha, 17,000 ha more than the previous year. (CEN, 7/10/97)

Anhui

Acid rain frequency was down but pollution in the Huai River and the Chao Lake remain serious problems. Total emissions of industrial waste gas rose 1.5 percent from the previous year. Nitrogen oxide pollution got worse. Around 87.7 percent of smoke and dust was removed from waste gas, up 3.9 percentage points from 1995. Some cities have better air quality while others have worse. The discharge of industrial wastewater was reduced by 9.3 percent, with 78.3 percent now treated, up 6 percentage points from 1995. Around 51 percent of wastewater reached standard, up 4.5 percentage points from the previous year. The main section of the Huai River remained at Grade IV and Grade V water quality, while the major tributaries were worse than Grade V. The total nitrogen and phosphorus averages were down, but still exceeded standards 88.5 and 100 percent of the time, respectively. The Nanfei River, the main input to the Chao Lake, is among the worst polluted river sections in China. (CEN, 7/15/97)

Hebei

River water quality was severely polluted but the sources of water pollution in the province have shifted. Of the 130 river sections monitored in 39 rivers, only 13.8 percent reached Grade III standard. More than 66 percent of the river sections were among the most seriously polluted. Groundwater in cities was universally contaminated, exceeding standards more than 57 percent of the time. Statistics show that industrial wastewater discharge from county and above-county levels was 932 million tons. The province's TVIEs discharged 587 million tons of wastewater, while the amount of total urban sewage was 430 million tons. The total from these two was higher than the industrial sources and has become the major source of water pollution. Urban noise pollution from households and traffic was serious. Among the 11 cities monitored for urban air quality, ambient TSP concentration ranged from 264 to 486 ug/cubic meter, SO_2 from 37 to 180 ug/cubic meters, and NO_x from 18 to 71 ug/cubic meters. All were in excess of state-prescribed standards. (CEN, 7/15/97)

Hubei

The province's overall environmental quality has improved, but it is getting worse in some areas. Not many changes occurred among the 31 cities where air quality was monitored. The ambient SO_2 and TSP levels were down slightly, but NO_x and dust remained at the same levels. NO_x in cities was down but up in counties. Acid rain was still a problem in some cities, especially Wuhan, Huangshi and five other cities. Surface water quality remained the same as the previous year. The main sections of major rivers had good quality, while many tributaries and river sections running through cities were in serious trouble. All the lakes were in bad shape, but reservior water quality improved from the previous year. Water bodies in cities were universally bad. (CEN, 7/19/97)

Shanxi

Air and surface water pollution was very serious in the province, but urban environmental quality stabilized. Dust and SO_2 were the two major air pollutants mainly from coal-

burning. There were 17 cities that exceeded Class II TSP standards. All the major water pollutants, including COD, BOD, ammonia nitrogen, volatile phenol, petroleum and suspended matters, were in excess of Grade V standards, with ammonia nitrogen and COD the worst. Groundwater quality had not changed much, though in some cities, it was getting worse. (CEN, 7/19/97)

Clinton Security Advisor Visits China

The Associated Press reported that US National Security Adviser Samuel Berger visited PRC President Jiang Zemin in Beidaihe, a seaside resort where PRC leaders have gathered to prepare for a congress of the Communist Party this fall. Berger told Jiang that the Clinton administration was looking forward to his October visit to Washington, which both sides have hailed as evidence of improving relations despite tensions over human rights and trade, and recent rough exchanges of rhetoric. Berger also met Premier Li Peng and Foreign Minister Qian Qichen, who described Berger's visit as "a very important moment in Sino-U.S. relations." The PRC's official Xinhua News Agency reported that on Monday Berger and PRC officials agreed to coordinate work on environmental protection, preventing nuclear proliferation and other strategic issues. (Reuters, 8/12)

Shanghai to Sell Only Lead-Free Gasoline Starting in October

Gasoline stations in Shanghai will begin selling only lead-free gasoline as of October 1, the state-run news agency Xinhua said recently.

Of the 1.1 million metric tons of gasoline consumed in the city each year, 99% contains lead, Xinhua said, adding that Shanghai recorded 744,000 motor vehicles at the end of 1996.

The move is part of the local government's efforts to protect the urban environment, where vehicle exhaust fumes have become a major source of pollutants in Shanghai, Xinhua said. The municipal government will also install special equipment for controlling motor vehicle emissions. (AP-Dow Jones News, 8/5)

Lanzhou Dwellers Hope Moving Mountain Will Clear Air

Zhu Qihua clambers onto a silty ledge overlooking a broad valley and points into the filthy haze. "There," he says, "is my hometown, and when I'm through, you'll be able to see it."

That will take some doing. About 20 miles away lies Lanzhou, a railway hub surrounded by mountains; four decades of unplanned industrialization have turned it into one of the world's worst smog traps. Mr. Zhu outgrew the place 15 years ago and left for the coast to make serious money. Now, armed with $12 million and with an eye to posterity, the 53-year-old has returned to save Lanzhou. His project: level the mountain he is standing on so fresh air can sweep the valley clean.

If only it works. Mr. Zhu's plan to remove Big Green Mountain, which looms 900 feet above the city, has aroused national attention, local hopes and professional skepticism. "There isn't just one mountain blocking the wind's path to Lanzhou," says the city's environmental director, Yu Xionghou, "There are rows and rows of mountains. You remove one mountain, and you've just linked Lanzhou with another valley. It's not that easy to solve our environmental problem." Many people want to believe that it is. Across China, people are choking on the exhaust of economic growth.

Campus groups investigate environmental disasters, residents protest poisoned waters, while even China's tightly censored newspapers issue hard-hitting reports on illegal polluters. Many cities are bowing to the public pressure, releasing air-pollution reports that show they are among the most polluted places in the world.

Few are worse than Lanzhou. One survey found the metropolis to be the dirtiest in China, with twice the air particles of China's grimy capital, Beijing. So gritty is the air that the U.S. Environmental Protection Agency is collecting data from two Lanzhou schools to study the effects of extreme air pollution on children's lung capacity. Says Wang Mei, who hawks handmade noodles on the street: "In the winter, the coal dust is so bad no one wants to sit outside to eat. If removing that mountain can do the trick, then get rid of the mountain.

Get rid of them all." But how? Folk wisdom, says Mr. Zhu. Water is being used to erode the mountain. It is pumped up from the Yellow River below, creating a sluice that carries the powdery soil down into the valleys. Dozens of men with

picks and shovels stand on the summit feeding dirt into the stream. So far, they have lowered the peak by 20 feet.

It's little wonder, then, that Lanzhou's 2.8 million residents consider Mr. Zhu a savior, the man who will allow them to glimpse the blue sky that statistics suggest is blocked by smog 250 days a year. Before Mr. Zhu came along, visionaries had proposed building a big fan on top of one of the mountains that ring the city, or hanging a fan from a helium balloon. But no one had acted on any of those schemes. More down-to-earth antipollution measures like switching from burning coal to natural gas are just in the talking stage.

Mr. Zhu's role as environmental entrepreneur began last autumn, when the soccer coach turned electronics importer returned to his hometown to attend a trade fair.

A group of local officials from a poor county nearby asked him to finance a new high-tech industrial park, but Lanzhou already has one huge industrial park and the government had banned new ones. How to get permission? He took a walk outdoors, started coughing and had a flash: Level Big Green Mountain, build an industrial park on the newly flattened land and package it all as a green, poverty-alleviation project. He envisions tripling his mountain-moving investment in three years by selling leases, which he has been granted the right to do, in the 500-acre industrial park.

Flush with cash and eager to proceed, Mr. Zhu quickly won local approval, using his environmental angle to get an exemption from the construction ban and the right to pump scarce water from the Yellow River up the mountain. Eager to show that progress was being made in the fight against pollution, local and national propaganda organs touted the removal of Big Green Mountain as a "blue sky project" that would significantly increase the quality of life. By May of this year, just eight months after Mr. Zhu's coughing fit, work had started and the mountain began shrinking.

10,000 gallons of water a day flows up and down the mountain. First, the water is pumped up a steel tube and stored in an irrigation pool that farmers once used to water crops on the terraced mountain. The water is released in a small stream about a yard wide that zigzags its way across what is left of the summit. Nearby, a dozen workers wearing wide straw hats against the withering sun hack at the crumbly soil, allowing it to fall into the water and be carried away.

When a 20-foot pillar of loessial soil -- the remainder of the mountain peak -- breaks off and falls into the stream, temporarily damming it, workers rush over and push the dirt downstream, where it flows away. Under Mr. Zhu's watchful eye, the workers move quickly. Many are poor farmers from the far side of the mountain who hope that removing this obstacle will end their isolation and enrich them, too.

In his Two-year plan, Mr. Zhu adds more men each month and sends more of the mountain into the valley, which it will fill up and turn into a plain. By his calculations, a quart of water can carry 1.3 cubic yards of dirt down the slope at a cost of 20 cents -- a fraction of what it would cost to move 3.9 million cubic yards of mountain by truck. "As long as we keep the water full of soil, we'll be on schedule and on budget," he says. He promises that within two years the mountain will be gone and fresh air will flow into Lanzhou.

Skeptics remain. But city officials have been loath to interfere because work has started and, as the environmental department's Mr. Yu says, "the public is enthused by it. We just don't want to raise expectations and see them dashed. But maybe it'll help."

"The locals love this project," Mr. Zhu says, clapping a sweaty worker on the back. Mr. Zhu's only worry is economic cycles. If China's economy slows down, his industrial park might not sell so well. "If China can just stay stable," he says, "then I'll get rich."

And the air? "Sure, it'll improve, too. Getting wealthy makes everything better." *(Wall Street Journal*, 8/7)

Chinese Leaders Warn of Ecological Problems

According to recently published remarks, China's top leaders are sounding alarm bells over the country's growing environmental problems, according to Reuters and the Xinhua News Agency.

The report quoted President Jiang Zemin as saying, overpopulation, coupled with breakneck economic growth, has caused serious environmental damage and said China needed to improve a legal framework to help protect the nation's ecology. "The environmental situation is rather stern, which means we have a lot to accomplish," Jiang told a March 8 meeting of the Chinese Communist Party central committee.

"Any relaxation in our efforts to protect the environment would lead to an increase in the volume of discharged pollutants and in the scale of ecosystem damage," he said. At the same meeting, Premier Li Peng warned that environmental damage was worsening. "Despite efforts and

good results in curbing pollution and waste, the general environmental quality has continued to deteriorate, for the public's environmental awareness is still weak," he said. Li stated that in the five years to 2000, China would allocate 450 billion yuan (S$80.82
billion) for environmental protection. Jiang said that government plans set the goals of containing pollution and ecological damage by 2000 and bringing about "a fundamental reverse" by 2010. (*Asia-Pacific Trade, Environment, and Development Monitor*, August 7, 1997)

Chinese Expert Predicts Record El Nino

The "El Nino" phenomenon is expected to be stronger by the end of the year, perhaps the strongest in this century, Chinese environment watchers warn.

"El Nino" refers to a rapid rise in temperature in tropical parts of the central and eastern Pacific Ocean, usually lasting about one to two years, followed by severe flooding or droughts the next year.

Although further research is needed to understand this process, it can trigger abnormal tropical atmospheric conditions and result in various natural calamities.

According to the State Marine Environmental Prediction Center, this year's "El Nino" began in March and was formed in May.

"Its strength and formation were so rapid that they are unusual," said Song Xuejia, deputy director of the Center.

Its strength is equal to one that occurred in 1982, the strongest this century, and it is expected to grow stronger by the end of this year, Song said.

Sea water temperature in the eastern Pacific, one of the most important indicators, has been rising steadily from minus 0.2 degree Celsius in February to 2.7 degree Celsius in July.

Song says that the violent movement of the sea and atmospheric temperatures indicate that this year is probably the worst this century.

When the "El Nino" happens, the number of tornados formed in the western Pacific and those landing on China's mainland will decrease than normal, and the date of the first tornado hitting the mainland this year was August 2, one day earlier than the previously recorded date of August 3, Zhao Zhenguo, researcher of the National Climate Center, said.

"El Nino" is one of the most important factors affecting global climate, causing frequent heavy rains and storms in central and eastern parts of the Pacific, and droughts in the west of the ocean," said Zhao.

"Under its influence, the distribution of precipitation on the Chinese mainland during the summer and autumn will appear to have an imbalance between the north and south, with the north getting less rain and the south more than needed.

"El Nino" occurs once every two to seven years, the number of its emergence has amounted to 13 since 1950, and they have come more frequently since the beginning of the 1990s. (August 18, CBNet)

Foundation Promotes Environmental-friendly Enterprises

The China Environmental Protection Foundation (CEPF) has initiated special funds for promoting the development of enterprises producing environmentally-friendly products in the country.

This was disclosed by Qu Geping, president of CEPF's board of directors in Beijing on Monday.

Qu, who is also chairman of the National People's Congress (NPC) Environmental and Resources Protection Committee, said at a special ceremony in the Great Hall of the People that the Chinese government had attached great importance to environmental conservation and had gained remarkable achievements in controlling pollution and curbing the environmental deterioration in certain areas over the past years.

One of the biggest problems with China's environmental protection cause is shortage in funds, which needs efforts from the whole society for solution, according to Qu.

Qu praised the Jiangsu Banshen Co. LTD for its donation of 1 million yuan ($120,400) to CEPF to support the funds of promoting the development of enterprises producing environmentally-friendly products.

Qu urged the enterprises and other social units across the country to follow suit in aiding in the environmental protection cause.

The Banshen Co. is also engaged in developing products taking advantage of clean energy such as solar energy and wind.

The CEPF was established in April of 1993, and is the first non-governmental foundation dedicated to environmental conservation and for no profit in the country.

CEPF is targeted at promoting management, scientific research, publicity and education, personnel training and academic exchanges on environmental protection, as well as the development of environmental industry, through sponsoring and commending individuals and organizations which have made outstanding contribution to China's environmental undertakings.

CEPF accepts donations from organizations and individuals both at home and abroad.

It has carried out and is conducting seven major projects on environmental conservation, including holding campaigns to protect the source area of the Yangtze River, and publishing a series of guide books on monitoring water and waste water. (CBNet, 8/5)

UNDP Funds China's Water, Environmental Projects

The UN Development Program (UNDP) is joining China's efforts to reform water management and improve the environment.

The UN agency and China International Center for Economic and Technical Exchanges recently signed agreements on three new projects into which the UNDP will put in more than two million US dollars in grant assistance, said UNDP's China Office.

The projects are 21st Century Urban Water Management in China, Capacity Building for Environmental Education in Primary and Middle Schools through the Production of Interactive Teaching Materials, and Capacity Development for Improving Traffic Pollution Control in Beijing, according to Thursday's China Daily.

The urban water management project is expected to start next month and last for two and half years. It aims to achieve sustainable water use in urban areas, said Hou Xi'an with UNDP's China Office.

The project will assist the Ministry of Construction in improving water and waste water management by developing and demonstrating an effective process for institutional reform and implementation of a water demand management strategy.

Pilot activities will be carried out in Shijiazhuang, capital of Hebei Province, to determine the most appropriate methodology.

An institutional reform strategy and an action plan will be developed for a revised tariff structure to establish self-financing water supply and waste water companies in the pilot city. The results will be disseminated to other cities throughout the country.

The China/UNDP environmental education project will last until July 2000. It is designed to strengthen environmental awareness and compliance by promoting interactive environmental education to children.

The traffic pollution control project in Beijing aims to reduce adverse social, environmental and economic consequences of traffic-related air pollution in the capital city.

The two-year project, starting this month, will strengthen the existing air pollution monitoring system in Beijing and collect key data on vehicle emissions. (CBNet, 8/4)

Food Contamination Is Threatening People’s Lives

Eating in China has been among the few most enjoyable things. China has a tremendous variety of foods, but the quality is now worrisome. Food contamination has become a major killer, which affects nearly everyone's life.

Uncontrollable discharge of wastewater into seas has contaminated seafood. Each year, China discharges into the ocean 4 billion tons of industrial wastewater, more than 200,000 tons of sewage, and 43 billion tons of wastewater from shrimp ponds. Experts recently pointed out that the threshold of Bohai to receive wastewater is about to be surpassed. Once the line is broken, fish, shrimp and other life in the entire Bohai region will die. The outbreak of hepatitis A in 1988 was an example of seafood contamination. Another example is the more frequent occurrence of red tide in some parts of the seas, which threatens shellfish production and the shellfish eaters' health.

The corresponding health situation in China is causing much concern. Surveys show that one out of every ten Chinese is either a hepatitis victim or a hepatitis virus carrier. Seafood contamination has become more dangerous than other foods to human health.

China's opening up to the outside world has rapidly brought into its markets foreign-made foods. Shenyang did an inspection of the quality of a few dozens of foreign-made foods. They found 131 imported foods had expired dates and 95 with no production and expiration dates. One gum imported from Japan had an effective period of 18 months. But the lab test showed the production date was 1973. Sleeping in storeroom for more than 20 years, they were exported to China with the import date changed.

In order to satisfy the demand for milk, China once bought 332 tons of dry butter, which would be mixed with fresh milk and powdered milk. When the butter arrived, it was covered with mould and was not edible. The food examination department in one city found that among the 1,600 batches of imported foods, 67 failed to meet sanitation standards. Nearly 22 percent of all frozen foods had pollution germs in excess of standards. Of the powdered curry, 90 percent contained mould. This last summer, one food import firm imported some canned fruits and found that most of them were rotten.

Many people suffer sicknesses due to pesticide- and fertilizer-contaminated food and vegetables in China. Statistics shows that more than 200,000 people have been poisoned by contaminated vegetables since 1990. The Shanghai Academy of Agricultural Sciences examined some vegetables and found that 100 percent of the vegetables contain pesticide in excess of sanitation standards. Guangzhou found that 59.2 percent of market vegetables were contaminated and 71.9 percent of vegetables may contain a highly toxic pesticide-- methamidophos--which can cause acute poisoning. Scientific research has shown that pesticides accumulate within the human body and long-term eating of contaminated vegetables may also cause chronic poisoning.

Recent research from environmental departments shows that around 100 million mu of farmland in China are severely affected by industrial wastes. Each year, more than 200,000 tons of pesticides are used for agricultural purposes. One investigation reported that some farmers sold their vegetables in the market the day after pesticides were used. A plant once bought 50 kg of vegetables from a farmer. That night, a few dozens workers in that plant were poisoned. Medical tests show it was due to the contaminated vegetables.

Chinese eat lots of pork. In recent years, the illegal sale of pork from dead and sick pigs has spiraled out of control. The same thing is happening to beef and lamb. Though responsible departments have done whatever they could to stop these illegal activities, so far they have not been very effective. The result is that the public's health is under tremendous threat. *(By Changhua Wu)*

China's Natural Gas Potential

OVERVIEW

Although natural gas currently accounts for less than 2 percent of the Chinese primary energy mix, the country stands on the brink of dramatically boosting consumption. Gas consumption, currently at about 20 billion cubic meters per year (BCMY), is conservatively projected to triple by 2010 to 60 BCMY and further rise to 115 BCMY by 2015. A combination of technological, economic, political and environmental drivers could raise these figures much higher. For every BCMY of natural gas used to replace an equivalent amount of coal-fired electricity (approximately equal to the output from a 1 GW plant), China would reduce annual SO_2 and CO_2 emissions by 61,300 tons and 2.9 million tons, respectively.

NATURAL GAS RESOURCE BASE

The natural gas resource base is an estimate of the amount of natural gas available. It is based on proven reserves (the inventory of natural gas volumes that have already been discovered and are readily available for production and delivery), and economically recoverable resources (those additional volumes that have not yet been discovered, but are estimated to be discoverable given current technology and economics). Difficult geology, remote locations, and incomplete surveying have traditionally made it difficult to accurately estimate China's natural gas resource base. Until now, it has been a great mystery why China's natural gas resources are apparently so poor in comparison to oil and coal, since the formation processes are interrelated.

Proven reserves of Chinese natural gas are estimated at 1.7 trillion cubic meters (TCM), about 1 percent of the world's total. At today's consumption rate of 20 BCMY, there is enough gas to fuel the country for 85 years. Economically recoverable resources are currently estimated at 38 TCM, almost 9 percent of the world's total. Reserves and resources are dynamic numbers and expected to grow rapidly in China as greater efforts and technologies are used in exploration and development both on and off shore.

In the recent past, Sichuan has accounted for over 40 percent of China's natural gas production. Most of this gas is not

associated with oil production. Natural gas output in Shaanxi, Gansu, Ningxia and Xinjiang, on the other hand, results from gas associated with oil production and accounts for most of the remaining on-shore production. Output in these provinces is expected to drive most of the future on-shore growth. Off-shore, the South China Sea and Donghai regions produce the remainder of China's output. Production here is also expected to increase rapidly.

Coalbed Methane

In recent years, China has gone from viewing coalbed methane (CBM) as a safety hazard to acknowledging it as a major source of clean, new energy. As the world's largest producer of coal, it's natural for China to take interest in coalbed methane. Although currently recovered volumes amount to only about 500 million cubic meters per year (MCMY), which is about 2.5% of natural gas production, reserves are tallied at 35 TCM.

Coalbed methane use in China would be particularly welcome. This greenhouse gas has 20-times more heat-trapping potential than carbon dioxide and would otherwise be vented into the atmosphere. Both the Global Environmental Facility and the Asia-Pacific Economic Cooperation (APEC) are funding CBM projects in China.

GAS TRADE

China currently does not engage foreign countries in trade of natural gas. There are no international pipelines (since Hong Kong reunited with the mainland) crossing China's borders, nor does China trade liquefied natural gas.

LNG Imports

One way of transporting large volumes of natural gas is to lower the temperature to -162 degrees Celsius until it becomes a liquid. On an energy equivalency basis, LNG occupies 1/600th of the volume it does as a gas. It can be shipped by boat or rail and regasified. International prices for LNG are about $3.5/MMBtu (1996$). The current technology for producing and transporting LNG is capital intensive and relies on economies of scale.

China has yet to begin importing LNG despite relatively strong potential demand in Guangdong, Fujian, Jiangsu, Zhejiang and Shanghai. Imports to Japan, on the other hand, account for over 60 percent of the world's trade in LNG and fuel over 25 percent of Japan's electricity generation. Southeastern China is well-suited for LNG imports since large cities in that region are far from coal and hydropower resources and demand for high quality energy is relatively well developed. In southern China, the levelized cost of LNG derived power and coal-fired power with desulfurization equipment is about the same. Compared to coal-fired plants, LNG fueled plants would operate at much higher efficiencies, require half the initial capital costs, and create a fraction of the other environmental damages. As part of the Ninth Five-Year Plan, China began scoping studies to build three LNG terminals in Southern China. The terminals would begin operation in the 2002-2005 timeframe.

Pipeline Trade

Lack of a pipeline infrastructure has hindered commercialization of natural gas in China. In 1994, almost two-thirds of the nation's pipelines were in Sichuan Province and the average age was 15-20 years. Several new lines are being constructed, including a line from Shaanxi to Beijing with a capacity of 1 BCMY that should be complete in late 1997.

Importing natural gas to China via pipeline has achieved heightened attention over the past few years. With proved reserves of over 56 TCM, countries of the former Soviet Union (FSU) are a logical first choice of supply. The gas bearing Sakha Basin in Siberia lies only some 2,500 kilometers from Beijing, although discussions are also underway regarding a pipeline from Kazakhstan that would travel over 6,000 km to China's eastern coast. A 1996 World Bank study on natural gas trade estimates that the fuel can be brought from Central Asia to China at $3.00/MMBtu at the rate of 27.6 BCM per year. Over a distance of 7,600 km, the delivered price would rise to $3.89/MMBtu.

There are many barriers to overcome before pipeline projects of the scale mentioned above could be implemented. Financing is probably the most difficult hurdle since even short pipelines (from Siberia or Irkutsk, for example) could require $10 billion to construct. A large number of partners must reach agreement on risky political and economic issues.

DRIVERS OF GREATER NATURAL GAS USE

While none of the developments mentioned thus far appear remarkable alone, several circumstances in China now favor a move towards rapid expansion of the natural gas energy supply. These events include expanding oil imports, continued energy shortages, new power generation technologies, and environmental benefits. A brief description of each of these drivers follows.

Expanding Oil Import

Rapid economic development combined with stagnating oil production forced China to began importing oil in 1994. By 2000, forecasters predict the country will be importing nearly 1 million barrels of oil a day. This figure could rise to 3 million barrels a day by 2010. The central government is uncomfortable depending on the outside world for energy and

would prefer to use the foreign exchange for other purchases. Greater reliance on natural gas could help ease these petroleum imports. While China does not use oil to generate electricity, a family of fuel cell technologies which use natural gas as an input will be commercialized within 10. These fuel cells will generate electricity, power automobiles, and provide heat and power to buildings. They could also run on gasified coal.

Energy Imbalance

China's economy is expected to continue expanding rapidly. While the People's Republic has achieved an energy income elasticity of approximately 0.5 since 1979 (meaning that energy consumption has grown at half the level of economic growth), the country is still experiencing an imbalance of energy supply and demand. To meet the intense demand, over 17 GW of annual electricity capacity additions are planned through the first decade of the new century. Coal is unable to fully satisfy this demand and produces severe ecological damage. Natural gas can help close the gap between energy supply and demand.

Power Generation Technologies Using Natural Gas

A new generation of gas turbines and combined cycle gas turbines (CCGT) offer well-suited advantages over coal in China. First, capital costs for these technologies are generally half that of coal-based technologies. Coal-fired steam cycle turbines generally cost between $600-900/kW in China. Adding desulfurization equipment increases the price to approximately $1000/kW. Gas turbine and combined cycle systems are available for between $250-600/kW. The time needed to construct gas-fired plants is about 2 years compared to 4 years for a similar coal-fired unit, an important consideration in power hungry China. Third, using gas to generate power will allow the country to reserve the railroads to transport people and freight instead of coal. Fourth, the current generation of CCGT systems operate at 50 percent efficiency and the next generation will be closer to 60 percent. This is twice the efficiency of China's current vintage of pulverized coal plants. Finally, there are many environmental benefits in using gas over coal to generate power.

Environmental Benefits

Regardless of the combustion method, natural gas emits virtually no sulfur and particulate emissions. Low-sulfur Chinese coal (1.2 percent sulfur), on the other hand, emits about 10 grams of sulfur dioxide and 50 grams of total suspended particles per kilowatt-hour of electricity generated. A 1000 MW steam-cycle coal plant would produce, annually, 61,300 and 365,000 tons of sulfur dioxide and solid wastes. The same size combined cycle gas turbine plant would produce none. Nitrous oxide emissions would also decline by about two-thirds. Carbon dioxide emissions in CCGT plants are about half as much as coal-fired plants. The total reduction of carbon dioxide emissions for this natural gas plant would result in almost 3 million tons per year and waste heat would decline by 25 percent.

Barriers

Expanding the use of natural gas in China is complicated by a number of issues:

Weak image. Natural gas lost credibility during the Cultural Revolution when some of the immense reserves "discovered" in Sichuan failed to materialize. Since then, the feeling that natural gas is an untrustworthy source of energy has propagated itself through the collective psyche of the Chinese bureaucracy. Natural gas also competes against the coal industry which employees millions of people and commands large resources. Only recently have Chinese planners begun putting their confidence back in gas. More champions of natural gas are needed in the Chinese government.

Technology. While Chinese gas researchers and technicians are well respected around the world, the country still relies on relatively outdated technology. New methods and equipment, such as three-dimensional seismic imaging and horizontal drilling, have helped produce more gas at lower prices in many Western countries. The China National Petroleum Corporation recently signed a production sharing agreement with a large American gas company to use cutting-edge technologies and methods in reworking several existing wells in Sichuan Province.

Price control. Natural gas prices are generally set well below their market value, removing the incentive to explore and produce gas. Prices are set between $1.50 and $2.00 per MMBtu to subsidize fertilizer production and other selected industries. On an energy basis, natural gas is priced much lower than crude oil.

Bureaucracy. Too many different government ministries and state-owned corporations are responsible for the exploration and production of natural gas. The number of government bodies involved in the exploration, development, production, transmission, distribution and imports of natural gas is too great. As a result, delay, uncertainty and corruption often result. Especially for natural gas, there is no clear authority and champion to promote its use.

Conclusion

China has a much larger potential for using natural gas than currently exists. Domestic production could be pushed to 150 BCMY by 2015. Pipeline imports from FSU countries could add another 150 BCMY, while coalbed methane and

liquefied natural gas could contribute at least 50 BCMY. This would raise gas from it's current 2 percent of the Chinese energy mix to about 15 percent of the projected 2015 usage, much closer to the world's average.

By championing greater use of natural gas, China could lower the tremendous ecological damage caused by a heavy reliance on coal. The country could also leapfrog over many developed countries by creating a modern economy based on efficient gas consumption. More than anything else, the Chinese government must recognize the potential of natural gas and actively push for its development. (*By Jeffrey Logan*)