



The China Sustainable Energy Program
中国可持续能源项目

C H I N A C L I P P I N G S

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Topping this issue, the Chinese government recently gave the green light to the 0CFC-Free Energy-Efficient Refrigerator Project⁰ which will encourage China's refrigerator manufacturers to produce more efficient, chlorofluorocarbon-free units, thereby displacing the need to develop coal-fired electricity and cutting over 100 million tons of carbon dioxide emissions over the next 15 years. Four Chinese companies recently launched a US\$120 million venture capital investment fund that will focus on energy, environmental protection, and high-tech projects. In August 1999, the State Council issued a circular announcing that energy consumption in newly constructed housing must be reduced 50 percent below 1981 levels by 2005. Starting January 1, 2000, China begins electric utility industry reforms by separating power generation from transmission grids in several pilot demonstrations in order to foster competition in electricity markets. Also in January, China begins requiring all new domestically-produced vehicles to be equipped with catalytic converters and run on unleaded gas. China's first electric car is expected to roll off the production line in June 2000.

What's Inside . . .

ENERGY EFFICIENCY

Refrigeration Revolution Poised to Hit Chinese Market	2
Promoting CFC-free Refrigerators.....	3
Energy Saving Tops Agenda	4
US Adds Strength to Energy Project	5
New US\$120 Mln Energy Venture Capital Fund.....	5
Fund Created to Finance Environmental Projects	6
New Considerations in Urban Planning.....	6

ELECTRIC UTILITIES

Reforms Set for China's Power Industry.....	7
Power Industry Expects More Investment	7
China Urges Closure of Coal-Fired Power Plants.....	8
Japan Bank Funds CHP Plant.....	8

TRANSPORTATION

China to Rollout First Electric Car Next Year.....	9
Top Chinese Trade Official Says WTO will Challenge China's Auto Industry	9
Beijing Outlines Future of Auto Production.....	12
Efforts to Curb Vehicle Emissions in Shanghai and Guangzhou	12
Pact to Curb Pollution	13
China to Sell Cleaner Mogas.....	13
HK to Phase Out Diesel-Powered Taxis By 2005.....	14
Gungho HK Firm Unveils Electric Bus.....	14

AIR QUALITY

China Coal Cuts Announced as Environmental Advisors Meet to Discuss 5 Year Plan	15
Blue Skies Promised for Winter.....	16
Shanghai Plans Natural Gas to Cut Pollution	16
Study Shows China is the Top Sulfur Emitter	17
New Spending and Changes to <i>the Air Pollution Prevention and Control Law</i>	18
Beijing Gets Serious About Air Quality	18

GENERAL

Denmark Joint Ventures with China	21
Beijing Opens First Environmental Hotline	21
Environmentalism Takes Center Stage	21
Environmentalist Says Western Lifestyle Not Right for China	22
Experts Differ on Environmental Effect in WTO	23
China EPA Head Discusses Challenges, Priorities.....	23
SOE Sector Shrinks 14%.....	25
Global Economy Slowly Cuts Use of High-Carbon Energy 26	

NEWS BRIEFS

.....	29
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The David and Lucile Packard Foundation in partnership with The Energy Foundation

旧金山办公室 San Francisco Office:

Presidio Building 1012, 2nd Floor, Torney Avenue • P.O. Box 29905 • San Francisco, CA 94129-0905, U.S.A.
 电话 Tel: (415) 561-6700 • 传真 Fax: (415) 561-6709 • 电子邮件 Email: china@ef.org • 网站 Web: www.efchina.org

北京办公室 Beijing Office:

中国北京市建国门外大街19号国际大厦2403室 ¥ 邮编: 100004
 CITIC Building, Room 2403, No. 19, Jianguomenwai Dajie • Beijing 100004, P.R. China
 电话 Tel: (86-10) 6525-3765 • 传真 Fax: (86-10) 6525-3764 • 电子邮件 Email: china@ef.org • 网站 Web: www.efchina.org



Refrigeration Revolution Poised to Hit Chinese Market

Environment News Service, 8 December 1999

BERKELEY, California – An internationally funded, award winning project to encourage the production and consumption of CFC free, energy efficient refrigerators in China has received a green light from the Chinese government.

The five-year program - the CFC Free Energy Efficient Refrigerator Project - is a series of market oriented measures for manufacturers and consumers. It is set to start in the next few days.

One effect of the increasing affluence in China is that refrigerators are growing in size and consuming more energy. China's refrigerator industry is the largest in the world now that three out of every four urban households has a fridge.

As a result, China emits a significant and growing share of ozone depleting chlorofluorocarbons (CFCs) into the environment.

The Earth's ozone layer high in the atmosphere protects life below from the harmful ultraviolet radiation from the Sun that can damage DNA molecules, leading to skin cancers.

The international treaty known as the Montreal Protocol on Substances that Deplete the Ozone Layer was adopted in 1987. Under the Protocol, developed countries pledged to reduce CFC production and consumption by 1999, while developing countries such as China were allowed to increase CFC use before taking on commitments. As part of its CFC phase out plan, China is putting these market based measures in place.

Refrigerator production in China jumped from 1.4 million units in 1985 to 10.6 million in 1998, according to David Fridley, a researcher in the Department of Energy's Lawrence Berkeley National Laboratory, and manager of the refrigerator project.

In 1985, only seven percent of urban households had refrigerators. By 1998, 76 percent had them, a 21 percent annual growth rate.

The refrigerator project is also expected to reduce heat trapping greenhouse gas emissions from China by a total of over 100 million tons of carbon dioxide

from 20 million households over the 15-year lifetime of the new refrigerators.

Because 80 percent of China's electricity is generated by coal burning power plants, the more energy efficient refrigerators will avoid emissions of other air pollutants as well.

The average Chinese refrigerator currently uses 2.5 kilowatt-hours per liter of volume per year, compared to 1.5 kWh/l for European refrigerators, said Fridley.

The Global Environmental Facility, through the United Nations Development Program, has decided to fund \$9.3 million of the \$40 million program to help the government of China transform its market for refrigerators.



New refrigerators manufactured by Kelon Appliances which is based in Guangdong, China (Photo courtesy Kelon)

Berkeley Lab has been involved in the project since 1995 through the U.S. Environmental Protection Agency (EPA), developing the market transformation program based on the success of the first phase of the project, which involved designing and testing CFC

free, energy efficient refrigerators. Fridley says that beyond his technical supervisory role, the Laboratory will be involved in training and working with the State Bureau of Technical Supervision as the new efficiency standards are developed.

“Market transformation,” Fridley explains, “is the process of shifting consumer demand for a product, in this case to a more energy efficient, environmentally benign product through voluntary, market based means such as technical assistance and training for manufacturers, consumer education, and financial incentives to manufacture and sell the more efficient product.”

“Collectively, we developed a technical training program for Chinese refrigerator manufacturers interested in developing CFC free, efficient refrigerators; a financial incentive program to motivate manufacturers to build the most efficient refrigerator possible; a dealer incentive program to convince dealers to stock the new refrigerators; and a mass purchasing program for Chinese government agencies that acquire refrigerators in bulk,” Fridley says.

Other new project activities will include a recycling buy-back pilot program, revision of existing refrigerator efficiency standards, an energy-efficiency labeling system, and an extensive nationwide consumer education campaign.

In 1998, the refrigerator project was awarded an International Climate Protection Award by the EPA.

“It is not widely known in the United States, but China has had an energy efficiency policy in place since the early 1980s,” says Mark Levine, Environmental Energy Technologies Division director and an advisor to the Chinese government on

energy efficiency. “The government of China is committed to using energy more efficiently, and this has allowed the economy to grow at nearly twice the rate of energy consumption.

“The Energy-Efficient Refrigerator Project will have a significant, direct effect on reducing greenhouse gas and pollutant emissions. We at Berkeley Lab are grateful to have the chance to work with the people and government of China on this project, as well as on our other projects in energy data analysis, appliance efficiency standards, and technical advice on cogeneration plants,” adds Levine.

The refrigerator project began in 1989 when the EPA signed an agreement with the government of China to assist in the elimination of CFCs from refrigerators. Under the Montreal Protocol, most nations of the world agreed to phase out the use of CFCs to protect the Earth’s ozone layer. The success of the design phase of the project, in which a prototype model of 40 percent greater efficiency was produced and tested, led to eventual multilateral support for the new phase.

Major Chinese participants in the project have included the China State Environmental Protection Administration, the State Administration for Light Industry, the Household Electric Appliance Research Institute, and domestic refrigerator manufacturers.

Major U.S. participants have included the EPA, the University of Maryland Center for Environmental Energy Engineering, Underwriters Laboratories, and Berkeley Lab.

Berkeley Lab is a U.S. Department of Energy national laboratory located in Berkeley, California. It conducts unclassified research and is managed by the University of California.

Promoting CFC-Free Refrigerators

China Daily, 14 December 1999

China launched a multi-million dollar project yesterday to promote widespread use of energy efficient CFC-free refrigerators, sources said.

The project was created to provide technical assistance to compressor and refrigerator manufacturers. It also aims to remove barriers to consumer and dealers' acceptance of energy-efficient refrigerators in China, the world's second largest generator of carbon dioxide.

The five-year project, scheduled to conclude on July 2003, is expected to cost US\$40.6 million. Of that, US\$9.6 million is coming from the multilateral fund

Global Environment Facility (GEF) and the rest will be supplied by the Chinese Government.

Implementation of the massive investment, which will be executed by the State Environmental Protection Administration (SEPA) with technical support from the United Nations' Department of Economic and Social Affairs and the State Light Industry Bureau, is expected to cut energy consumption by refrigerators in the coming 15 years in China by an average of 20 per cent, saving at least 10 billion yuan (US\$1.2 billion) and reducing carbon dioxide by 100 million tons.

Liu Yi, deputy director of the SEPA's foreign economic co-operation office, said the higher retail

October-December 1999

prices of new refrigerators due to technical upgrades, could be offset by benefits from less energy use.

The number of refrigerators has been surging in recent years in China. However, local-made refrigerators are 25-30 per cent more energy-consuming than advanced products used in other parts of the world, Li said.

The project provides "a rare opportunity" for China to upgrade its refrigerator industry. It also helps promote commercialization of energy efficient CFC-free refrigerators.

Among the project's challenges, one is the lack of awareness among both producers and consumers of the importance of reducing CFCs and increasing energy efficiency, he said.

Dennis Fenton, chief representative of United Nations' Development Programme China Office, is to

supervize the implementation of the project. Fenton said the UN will help compressor manufactures upgrade products and help refrigerator manufactures build up capacity to design and produce energy-efficient CFC-free refrigerators.

The selected refrigerator manufacturers will receive incentive programme awards through competitive bidding.

The project will also strengthen energy-efficient standards and use International Standardization Organization methodology to measure, test and calculate energy consumption.

An education programme will be organized to raise consumer awareness and introduce a nationally certified energy label that will enable consumers to easily identify energy-efficient refrigerators, Fenton said.

Energy Saving Tops Agenda

*By Tian Ying
China Daily, 23 November 1999*

A list of the top 100 energy-saving measures is being compiled to help the nation's enterprises save money and protect the environment.

The State Economic and Trade Commission aims to complete the list by 2003. The commission's Energy Conservation Information Dissemination Centre - an important part of the World Bank/Global Energy Funds (GEF) China Energy Conversation Project - is supporting the project.

Set up with US\$35 million grants from GEF and US\$65 million loans from the World Bank, the project aims to select technology that will bring good economic benefits, reduce pollution and save energy.

The information will be made into booklets and sent to enterprises. The results will also be published through the media and the Internet.

Director of the commission's Energy Conservation Information Dissemination Centre Zuo Liming said they were concentrating on high energy industries in the metallurgical, petrochemical, building materials and power sectors.

So far the centre has published five energy-saving items, mainly for the renovation of industrial boilers, steam pipelines, electrical machinery, lighting installation and construction equipment.

The technology used in the renovation of burners in boilers has been adopted by Guangzhou Huangpu China Clippings

Power Plant and is expected to save 2,055 tons of heavy oil a year.

The investment should be recouped within seven months. The same technology is also expected to be introduced into porcelain factories and to building materials projects.

A frequency conversion and speed adjustment system has been adopted by the Lido Holiday Inn in Beijing, to control its air blowers and water pumps. The changes has proved effective at saving energy on air conditioning system.

The same system is also being installed in the Beijing Shuang'an Department Store.

Enterprises which are interested in the technology can contact the centre or the manufacturer for information.

The centre will also act as a bridge to help enterprises secure funding for their energy-saving projects.

Along with the list of the top 100 measures, the centre also plans to publish investment guides for banks and enterprises. These will show clearly the economic efficiency and market potential of the energy-saving measures and will help guarantee loan safety.

US Adds Strength to Energy Projects

By Meng Yan

China Daily, 18 November 1999

Experts from the United States are helping Chinese enterprises become more energy efficient.

A delegation from the United States Department of Energy (DOE) is working with the State Development and Planning Commission (SDPC) of China to improve energy efficiency in Chinese administrations and enterprises.

The project may bring large energy and maintenance savings, according to Gunnar Hovstadius, director of technology with the US-based ITT Fluid Technology, and a member of the delegation.

"We worked with two showcases in the United States where we increased energy efficiency by 23 per cent with one and 43 per cent with the other," he said. "The overall operation cost was also lowered for both." He added that the project usually had a payback term of about two years.

"We try to achieve better energy efficiency through optimizing the system and improving the components," he said.

Based on their success so far, the DOE worked out a deal with the SDPC in 1996 to co-operate on energy efficiency.

The two have been exchanging information and discussing achievements in the field ever since.

The delegation toured China recently to look for plants that may serve as showcases for their project in China.

They have visited several places including Jiujiang of Jiangxi Province, Shanghai and Beijing, which had been picked out by the China Energy Conservation Investment Corp (CECIC).

A former affiliate of SDPC, CECIC is now responsible for the allocation and application of funds from external sources such as foreign governments and international organizations.

The Shanghai Municipal Raw Water Co Ltd promises to be a good showcase for China, according to Hovstadius.

"We are very impressed with the people there," he said. "What they are doing at present is just ideal for the project."

As well as providing daily water supplies, Shanghai Municipal Raw Water Co Ltd is involved in two projects - to divert water from the upper reaches of the Huangpu River and to purify water from the Yangtze River for use in factories and urban households.

With the encouragement of the Shanghai municipal government, it is also trying to improve the quality and increase the amount of water it supplies. The plant is now waiting for the examination and approval of the SDPC to become the project's showcase in China.

SDPC grants funding for such programmes through the CECIC, industry experts said.

New US\$120 Million Energy Venture Capital Fund In China

ChinaOnline, 3 November 1999

This week, a new US\$120 million venture capital investment fund was launched in China that will focus on funding energy-saving companies and companies geared toward environmental protection, the Nov. 2 Zhongguo Gaige Bao (China Reform News) reported.

The fund was jointly initiated by four companies: the China Energy-Saving Investment Corp., China International Trust and Investment Corp. (CITIC), Haitong Securities Ltd. and Liaoning Energy Corporation.

The companies will pool RMB 1 billion (US\$ 120.1 million) in funding for seed-money in energy-saving and environmental protection projects and high-tech firms, the newspaper reported.

Reportedly, it will be the largest private investment fund focusing on energy and environmental protection industry ever formed in China.

The country's only venture capital firm focused on energy and environmental protection, China Energy-Saving Investment Corp, initiated the start-up investment fund.

Fund Created to Finance Environmental Projects

By Meng Yan
China Daily, 14 November 1999

An industrial investment fund is being created to assist the energy conservation and environmental protection industry in China.

Eighty per cent of the available funds are expected to be invested in high-tech projects in the environmental industry, according to a spokesman with the fund.

The fund is expected to inject new vitality into China's rapidly growing energy conservation and environmental protection industry, he said.

New products with a high technological content, great market potential and promise of high returns to investment have emerged in China's energy conservation and environmental protection industry in recent years.

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Reform Set For China's Power Industry

Xinhua, October 25, 1999

China is expected to restructure its power industry by dividing its power generating plants and transmission grids into two independent systems.

China Daily Business Weekly reported today that the decision aims to help foster power markets and establish a new pricing mechanism.

Power production and distribution were formerly established without regard to market functions under the planned economy, the English-language newspaper said.

Competitive mechanisms are expected to be introduced among the country's provincial subsidiaries next year.

Yu Weiguo, an official with the State Power Corporation of China, was quoted as saying that the new power management system will first be put into operation in Shanghai municipality, and Shandong and Zhejiang provinces on January 1, next year.

According to the reform's rules, a province should have no less than five to six independent power generators, each occupying no more than 20 percent of the electricity market, or within one-fifth of the province's total installed generating capacity, so that monopolies can be curbed.

The generators will bid with each other for access to power networks.

Transmission companies will purchase low-priced electricity and sell it to consumers.

In order to avoid market fluctuations, which could result from the reform, some provincial subsidiaries will sign five-year agreements with provincial power generators confirming that 80 percent of their generation will be purchased at last year's prices so as to ensure the profits of the generators.

The rest will be priced completely in line with market fluctuations. The interconnection of national and regional networks is being planned.

Power Industry Expects More Investment

China Business Weekly, 28 November 1999

Foreign investments in China's power industry are expected to increase next year, a source with the State Power Corporation said.

Foreign investment contracts valued at nearly US\$600 million are expected to be completed next year, a bit more than this year, said Li Yong, an official with the Planning, Investment and Financing Department of the corporation.

Investments are expected to be in the form of foreign loans.

About US\$400 million in foreign investment was utilized this year, he said.

In an interview with Business Weekly last week, Li said that more foreign investment will be used for the construction of power networks by power generators.

"China's power market has been plagued by insufficient construction of transmission and distribution networks for a long time," he said.

The corporation will provide preferential policies to increase foreign investment in power projects which are designed to use new and clean energy resources

including hydropower and wind power, because of the protection of environment, he said.

However, foreign investment in large-scale hydropower projects is expected to be minimized because of their long development and construction periods and because of resettlement problems.

Thermal power projects have won the lion's share of foreign investment in recent years.

"There are also some problems with foreign investment utilization," Li said.

Excess foreign investment stemming from international bidding on power projects and the use of more domestic-made equipment has lain idle in recent years, he said.

The corporation in August began clearing these accounts in an effort to make full use of them, he said.

Enhancing the efficiency of foreign investment utilization is a main priority of the corporation, he said.

"The corporation is also developing regulations concerning the management of foreign investment utilization," he said.

China began using foreign investment in the power industry in 1984.

Foreign investment accounts for 10 per cent to 20 per cent of the industry's total investment, he said.

The industry has absorbed total contracted foreign loans of US\$12.44 billion, he said.

About 90 per cent of the loans were made by the World Bank, the Asian Development Bank or the Japan Bank for International Co-operation, he said.

The corporation had used US\$6 billion in direct foreign investment by the end of last year.

Sixteen joint venture producers were established with a total installed capacity of 14.37 million kilowatts.

Along with the foreign investment, many advanced foreign technologies and pieces of equipment also flowed into China, boosting industrial development considerably, he said.

Foreign investment began to decline in 1997 because of lower interest rates encountered in domestic investments.

China Urges Closure of Old Coal-Fired Power Plants

Reuters, 20 October 1999

BEIJING - China has urged cities to shut down old coal-fired plants and industries to restrict sulphur dioxide emissions, which causes acid rain, the official China Daily reported yesterday.

Authorities may close small coal plants which have been running for more than 25 years and unlicensed coal mines. Mines producing high-sulphur coal would be restricted, it quoted a State Environment Protection Administration official as saying.

Some 80 percent of major industrial firms would have to reduce sulphur dioxide emissions to meet state standards, the official said.

Cities would be required to renovate industries and map out pollution control programmes before 2000, the official added.

Coal accounts for around 75 percent of China's energy production and is the main cause of sulphur dioxide emissions, which causes acid rain to fall on 40 percent of China. Acid rain ruins crops, forests and buildings, the newspaper said.

China would take measures to replace coal with cleaner fuels, including natural gas, the official said.

Japan Bank Funds CHP Plant in Hangzhou

China Daily, 20 October 1999

Japan's Bank for International Cooperation will provide a \$65 million loan for a combined heat and power plant in Hangzhou, capital of Zhejiang province. Sichuan-based Dongfang Boiler Company won the competitive bid for the manufacturing of the equipment. The total investment for construction of the plant amounts to approximately 1.3 billion yuan (US\$156 million). The plant will be established in

June 2001 with an installed capacity of 100 megawatts for its initial stage. It will provide Hangzhou with a central heating system, which is expected to alleviate the city's heating shortage dilemma. The plant, with three circulating fluidized bed boilers, will save 200,000 tons of coal per year. It will also improve the city's environment by reducing the amount of sulfur dioxide and particulate emissions. Upon completion of the plant, dozens of the city's small industrial boilers will be eliminated.

China To Roll Out First Electric Car Next Year

ChinaOnline, 19 November 1999

Shanghai Qiche Bao

*Guidebook on Key Technologies and
Commercialization of the Clean Automobiles.*

Top Chinese Trade Official Says WTO Will Challenge China's Auto Industry

ChinaOnline, 10 December 1999

Zhongguo Waizi

**China's WTO Membership: Opportunities And
Challenges For Auto Industry**

Conclusion

Beijing Outlines Future of Auto Production in China

ChinaOnline, 29 December 1999

*Guidelines for
the Adjustment of the Product Structure of the
Machinery Industry*

Zhongguo Qiche Bao

Zhongguo Qiche Bao

Zhongguo Qiche Bao

Efforts to Curb Vehicle Emissions in Shanghai and Guangzhou

*Environmental Health & Safety Review,
December 1999*

*Shanghai Municipal Plan for Vehicle
Emissions Prevention and Control*

Pact to Curb Pollution

*By Chang Weimin
China Daily, 15 November 1999*

China to Sell Cleaner Mogas in Key Cities in 2000

Reuters, 8 December 1999

Hong Kong To Phase Out Diesel-Powered Taxis By 2005

ChinaOnline, 20 October 1999

Gungho HK Firm Unveils Electric Bus

*By Tan Ee Lyn
Reuters, 6 October 1999*

Coal Cuts Announced as Environmental Advisors Meet to Discuss 5-Year Plan

Edie News, 22 October 1999

As Chinese officials formulate the country's 10th Five-Year Plan environmental advisors from around the world suggest ways to co-ordinate economic growth with environmental protection.



The city of Xi'an is to shift its main fuel source from coal to gas

During the same week that the China Council for International Co-operation on Environment and Development (CCICED) met to advise China on environmental policy for the years 2000-2005, the State Environmental Protection Administration (SEPA) announced new measures to restrict coal use as a way of reducing sulphur dioxide emissions.

SEPA has asked Chinese cities with significant sulphur dioxide pollution problems to create control programmes and to renovate industries. Small coal-fired power stations that have been in operation for more than 25 years will be shut down, according to SEPA regulations. Mines, both licensed and unlicensed, that continue to produce high-sulphur coal must stop doing so this year.

SEPA has also committed itself to enforcing reductions in domestic use of high-sulphur coal.

Some cities have already begun tackling the problem of coal-related pollution. Beijing has embarked on the third phase of its air pollution improvement plans with the goal of improving air quality during the "heating season" year on year. Measures to tackle industrial air pollution in Beijing were included for

the first time when the third phase of the air quality improvement programme was launched on 1 October.

The price of low-sulphur coal has been lowered in Beijing and Wang Guangtao, Beijing vice-mayor, said he hoped that would encourage people to switch voluntarily. "It was mainly because of this new kind of coal that we realised a record nine months' continuous decrease in the sulphur dioxide density in the atmosphere this year," he said, as reported in *China Daily*.

Meanwhile Xi'an, the ancient Chinese capital and home to the Qin Dynasty Terracotta Warriors, has announced plans to shift the city's main fuel source from coal to natural gas. The city's mayor has banned coal burning within the downtown area from 1 November. Xi'an, the capital of the Shaanxi province, has seen its air pollution composite index improve in recent years, thanks to environmental control measures, but city leaders want to improve it further. Tourism is an important component to Xi'an's economy and improved air quality is expected to add to the city's ability to attract more visitors.

On a national level, SEPA's anti-coal measures are seen as part of a larger trend to spend more money on environmental improvements and the implementation of previous recommendations made by CCICED. According to Wen Jiabo, China's vice-premier, 43% more was spent on pollution treatment in 1998 than in 1997. Among CCICED's many 1998 recommendations, China's dependence on coal was specifically mentioned. "Current methods of generating energy have caused many of China's worst environmental problems. Given China's current and likely future dependence on coal, the introduction of new and cleaner techniques for using coal is essential," the recommendations stated.

As a result of a focus on air quality, nuclear energy is officially seen as a clean energy. On 21 October, work on the Tianwan Nuclear Power Station, a joint venture between China and Russia, began in the coastal city of Lianyungang. At the ceremony to mark the construction's beginning, Wu Bangguo, Chinese vice-premier, stated that nuclear power is a safe and clean energy. The *People's Daily* reported that Wu described the development of the nuclear power industry as providing environmental benefits.

Blue Skies Promised for Winter

*By Tang Min
China Daily, 15 November 1999*

An overnight winter rain finally washed clear the pervading dim sky of Beijing yesterday morning, and according to the municipal government there will be more clear skies during the winter.

Zhong Liangxi, an official with the Beijing Municipal Environmental Protection Bureau, promised on behalf of the bureau that Beijingers would have more chances this winter to see a beautiful blue sky.

He said the city's air seemed to be getting worse as the air pollution level lowered to fifth-class at the beginning of the month. The National Ambient Air Quality Standards defines the air quality for five levels, and the fifth is the worst.

Zhong explained: "The fact is that Beijing has never seen a continuous decrease in the sulphur dioxide density of its air for 10 months until now, and it is no surprise for people to find the indexes jump back as soon as the weather conditions get better."

However, he regrets that Beijing still needs several years to avoid sharply worsening air quality due to weather changes.

"What we can promise our citizens at this very moment is that they can expect to enjoy more blue skies this winter," Zhong said.

Today is the official start of Beijing's annual heating season, and the Chinese capital faces the most challenging moment in its fight against air pollution this year, with the fat and slender, tall and short chimneys across the city begin to breathe again.

Because the city has only a roughly 45-day margin left for fulfilling this year's goal that no more than 30 per cent of the year should have fourth or fifth-class air.

While coal burning is generally responsible for 90 per cent sulphur dioxide, 50 per cent nitrogen oxide, and 40 per cent floating particles in Beijing's air, things get worse in heating seasons, for 70 per cent of the thickly dotted heating systems within the city's third ring road need to be fueled by coal.

Beijing burnt off 8 million tons of coal last winter.

Shanghai plans natural gas to cut pollution

Reuters, 25 October 1999

SHANGHAI - In a bid to stem air pollution, Shanghai plans to spend 400 million yuan (\$48 million) to pipe natural gas into 2.5 million households by 2010, the official Shanghai Daily said.

Some 100,000 homes in the Pudong development zone would be the first to benefit from conversions from traditional coal gas to natural gas by the end of this year, the newspaper said.

Some residential buildings in the downtown districts of Huangpu and Nanshi would be refitted by October

2000, when 1.2 million cubic metres (42.38 million cu ft) of natural gas would be piped from the East China Sea daily, the newspaper said.

Shanghai recently built a liquified natural gas station near the East China Sea, it said.

In addition, the central government planned to build a natural gas transportation station in the central province of Hunan to pipe natural gas from neighbouring Sichuan province to Shanghai and other parts of eastern China, it said.

Study Shows China is the Top Sulfur Emitter in World

EarthVision Reports, 30 November 1999

ST. LOUIS, MO, November 30, 1999 - While many countries around the world are seeing emissions of sulfur leveling off or dropping, the trend in China is just the opposite and a new study shows that China now leads the world in the dubious distinction of most sulfur emissions produced in a country. The study, coming out of the Washington University in St. Louis, points the finger at coal consumption for this trend. Other activities taken into account in the analysis were metal smelting and oil consumption.

The data were gathered for the time period of 1850-1990 and analyzed by Rudolf B. Husar, Ph.D., professor of mechanical engineering and director of the Center for Air Pollution Impact, Trends and Analysis (CAPITA), the world's largest private library of air pollution statistics. The study was published in the 1999 fall issue of Atmospheric Environment with co-authors Janja D. Husar, Ph.D., research associate in CAPITA, and Allen S. Lefohn, Ph.D., of A.S.L. and Associates in Helena, Montana.

The key to the findings says Husar was each country's fuel consumption records. "And it is relatively easy to get because most countries have kept track of their consumption," he says. The researchers estimated yearly emissions for 234 countries based on net fuel production, which is production plus imports minus exports. Sulfur content and sulfur retention information based on the individual country's activities also figured into the estimates.

"The stabilizing US and Soviet Union sulfur emissions have occurred in part by switches in the United States from high- to low-sulfur coals and tighter environmental controls," says Husar. "In the former Soviet Union, there has been a greater reliance on natural gas, which is abundant in Russia.

"In the United States, alternative fuels such as natural gas and nuclear power have made an impact. In both countries, but particularly the United States, the shift from a smokestack economy to a service-oriented economy also has made a difference, as have the use of scrubbers and desulfurization techniques in coal-driven power plants.

China however, has a huge and growing population and an equally large and growing industrial economy to go with it. Couple that with the large reserves of

soft coal, which contains higher sulfur levels, and the sulfur emissions picture comes into focus.

"It makes economic sense for them to burn coal because it is so abundant," says Husar. "We've begun to see more acid rain complaints in Indochina, Japan and Korea, mostly from Chinese sulfur emissions. So, in the broad sense, as we begin a new century, that big problem of the '70s and '80s has now shifted more toward the East."

According to the study China, the US and the former Soviet Union account for 53 percent of global sulfur emissions. The European community was next, followed by Japan. Although Husar says that global fuel consumption over the past 50 years actually has gone up, emissions have stabilized in most parts of the world because of cleaner fuels and cleaner consumption methods.

"One of the reasons that emissions haven't really gone up exponentially over the past 100 years in the United States is because of the fact that now perhaps two-thirds of the energy is supplied by relatively clean fuels," he says. "Also, particularly in the past 40 years or so, pollution controls have reduced the amount of emissions released into the atmosphere. If not for cleaner fuels and emissions controls, the amount of sulfur emissions today would easily be three or four times what they are now."

According to Husar's estimates, in 1850 global sulfur emissions were at 1.2 million metric tons. By 1990 sulfur emissions climbed to 71.5 million metric tons. But recently - meaning since 1970 - US emissions show a general decline, coinciding with the passage of the Clean Air Act in 1977 and the 1990 amendments that target power plant emissions.

So what does it mean for China that sulfur emissions are rising? Since sulfur emissions are the prime ingredient in the creation of acid rain, Husar says the news is not good but the country has recognized a problem exists.

"The same cycle that characterized the industrial areas of North America and Europe in the '70s and '80s is well under way in Asia now, particularly mainland China," Husar points out. "The Asian countries realize something must be done to control acid rain, and they are beginning to address the problem."

New Spending and Changes to the Air Pollution Prevention and Control Law

*Environmental Health & Safety Review,
September 1999*

At the 11th session of the Standing Committee of the National People's Congress (NPC) at the end of August, officials made enormous commitments to combating air pollution. Plans discussed regarding the amendments to the *Air Pollution Prevention and Control Law* indicated between 120 billion RMB (US\$14.5 billion) and 150 billion RMB (US\$18.1 billion) will be spent with the goal of combating air pollution in 34 major cities. The target for Shanghai was set at about 30 billion RMB (US\$3.6 billion), and approximately 180 billion RMB (US\$21.7 billion) will be allocated to target areas seriously suffering from acid rain and sulfur dioxide, with the goal of reducing the total amount by of sulfur dioxide by in the air by to 10 million tons by the year 2010. Although these spending numbers seem extremely high, and despite the fact that it is nearly impossible to differentiate between what might be considered "environmental" spending from ordinary investments, the Chinese government leadership at the highest levels is well intentioned regarding these efforts. Control of the expenditures and the equally important task of enforcement are both, however, largely dependent upon the capabilities and intentions of local officials, and as such, are more susceptible to abuse and corruption. Air pollution is an obvious and major problem, and water supply and treatment is not far behind. In order to solve problems of this scale, the government will probably continue to increase spending programs like this which also help stimulate the economy, elevate regulations to Western standards and encourage the development of large

environmental protection enterprises that will be able to tackle problems on a municipal and countywide basis. According to Qu Geping, Chairman of the Natural Resources and Environmental Protection Committee of the NPC, on average, each city needs 18 billion RMB per year which is nearly 5 percent of its Gross Domestic Product (GDP). For each city to meet compliance emissions standards for vehicles, nearly 0.3 to 0.7 its GDP is needed and to control dust in construction projects, approximately 0.15 to 0.35 of the total project budget is needed.

Regarding the *Air Pollution Prevention and Control Law* (originally adopted in 1987 and amended for the first time as recently as 1995) according to Qu, the amendments will focus on the following:

- Urban air pollution control, especially in municipalities, provincial capital cities, economic zones, and coastal and tourist cities;
- Vehicle emissions control, covering manufacturing, use and maintenance, fuel quality, supervision and inspection;
- Dust control in urban areas;
- Compliance discharge and any discharge exceeding standards should be seen as violation of legal requirements, rather than seen as only paying fines for excessive discharge;
- Mass loading pollution control targets and permits;
- A discharge levy system to replace the existing system based on concentration control; and
- Legal liability to make enforcement more operational.

Beijing Gets Serious About Air Quality

An October 1999 report from U.S. Embassy Beijing

As the winter coal-burning season approaches, Beijing environmental authorities are enacting tougher measures to alleviate the city's chronic air pollution. Newly announced measures focus on strengthening monitoring and enforcement and accelerating the conversion to cleaner fuels — primarily lower-sulfur coal and natural gas. The new measures reflect a top-down, command-and-control approach. Penalties are drastic. Targets may be overly ambitious. Authorities may be forced to revise them downward as deadlines approach, causing the program to lose credibility. But official statistics show that air quality is beginning to improve.

Clean-air campaign enters third stage

Beijing Vice Mayor Wang Guangtao held a press conference October 14 to announce the beginning of stage three of the city's year-old clean-air campaign. The third stage will run from October 1 through next March 31. He said the municipal government had issued 22 new pollution control measures, on top of the 46 measures adopted during the first two six-month stages. The new measures were published in the local press October 16. Premier Zhu Rongji conducted a personal inspection of city environmental efforts September 28 to underscore high-level support for the campaign.

Beijing's air, among the most polluted in the world, is particularly acid in winter, when people use crude coal furnaces to heat their homes. Sulfur dioxide (SO₂) pollution is nearly six times higher in heating season (November-March). Measured nitrogen oxides (NO_x) and carbon monoxide (CO) also increase significantly, total suspended particulates

(TSP) less so (see table below). Officials are predicting cleaner air this winter as more homes and businesses convert to cleaner coal and natural gas. However, the fastest-growing source of pollution is automobile exhaust. The number of vehicles has been doubling every five years, and a typical Chinese car generates six times as much pollution as a Japanese or American car, according to Chinese experts.

Average Daily Pollutant Concentrations in Central Beijing in 1998

	TSP	SO ₂	NO _x	CO
Heating season	431	252	201	4,400
Non-heating season	348	42	122	2,600
National standard	300	150	100	4,000

Source: Beijing 1998 Environmental Situation Report
Units are micrograms per cubic meter; benchmark is China level II standard.

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Achievements of Stages One and Two

Wang and other senior officials recently have claimed the measures adopted since last October have brought SO₂ concentrations in Beijing to their lowest level in a decade. This may have been largely due to extraordinary, temporary measures adopted in September to assure clear skies for the October 1 National Day parade. However, official statistics show SO₂ fell in nine consecutive months through September 1999 by an average of 25 percent compared with the same month of 1998. CO was down an average 11 percent. NO_x remained flat, despite rising motor-vehicle traffic, and TSP was up slightly. Through September, there were 61 days with air pollution of level IV (serious pollution) or worse on China's unique five-level scale (China's pollution reporting scale is explained elsewhere on this website). This exceeded the target of 70 percent of days with level III air quality or better. However, Beijing air still fails to meet national standards.

Goals for the Third Stage

Authorities have set the following specific goals for stage three:

- 90 percent of industrial enterprises in the city should meet national air emissions standards by the end of this year (all must meet the standard by the end of next year or be closed, according to the national environmental law);
- 80 percent of days next year should have air quality no worse than level III (moderate pollution);

Tepped-up enforcement

The new measures are replete with tough words about dealing strictly with wrongdoers. The municipal government is to conduct two comprehensive inspections between October 1 and

December 31 during which city agencies will be required to report what they have done to implement the 28 stage two measures. Administrative punishments will be meted out to those found not to have fully implemented them. But although the regulations identify specific departments responsible for assuring compliance with specific measures, it is not clear that new enforcement resources have been provided.

Technical monitoring capability is being beefed up, however. The stage three plan calls for preparatory work to be completed for four additional air-quality monitoring stations (there are currently 16) as well as for purchases of imported vehicle emissions monitoring equipment. Beijing has recently begun reporting data for NO₂ and fine particulates (PM-10). But comprehensive, internationally comparable data are still sparse. On-line monitoring devices are to be installed on large coal-fired boilers (more than 20 tons of steam output per hour). Authorities are admonished to collect SO₂ emission fees from factories and power plants more diligently, with proceeds to be used for pollution control. The local SO₂ charge is RMB 1,200 (US\$15) a ton – six times the national level. There is a preferential rate for low-sulfur coal.

But Also a Few Carrots

The municipal government will subsidize interest for firms upgrading old coal boilers to reduce emissions. Certain city infrastructure fees will be deferred for firms switching from coal to electric boilers and waived altogether for those switching to natural gas. The Electricity Supply Administration will experiment with variable rates to smooth out demand. The price of low-sulfur coal has been lowered to equal that of normal coal.

Reducing Coal Smoke

The stage three measures call for 3.5 million tons of high-quality coal to be consumed in Beijing during the coming heating season. This would be about one-eighth of total annual coal consumption and about 40 percent of the coal used for winter heating in the city. High-quality coal is defined as having a sulfur content of less than 0.5 percent, compared with 1.1 percent for the average coal burned in the city; ash content less than 10 percent, compared with 20-25 percent; and heat value of 6,800 kilocalories per kg, versus 5,500. Officials of outlying counties are to inspect coal coming into the city to assure it meets Beijing standards.

Small scale coal boilers (less than 1 ton per hour) within Beijing's fourth ring road (roughly equivalent to Washington's beltway) are to be converted to cleaner fuel (electricity or gas). Boilers with 1-20 ton

capacities that do not convert to clean fuel are to use low-sulfur coal and install high-efficiency dust removers. Boilers above 20 tons must have high-efficiency dust removers, on-line monitoring equipment, and, as of next March, low-NOx burners.

Expanding Use of Natural Gas

China National Petroleum Corp. (CNPC) expects daily consumption of natural gas in Beijing this winter to double to 6.8 million cubic meters. China's largest gas-fired power plant went on line in Beijing this year. A pipeline has been built to carry gas to the city from Dagang, near Tianjin, and a compression station is expected to go into operation in Shaanxi province November 15, after which the city will begin providing district gas heat. Beijing expects to have 2,800 buses running on liquefied petroleum gas (LPG) and compressed natural gas (CNG) by the end of this year, as well as 14,000 LPG/CNG or hybrid-fueled taxis. Another 3,000 taxis are to be added by March 2000 and 10,000 by the end of next year. Ten LPG/CNG fueling stations are to be built during stage three. Currently, there are eight LPG stations and three CNG stations. Beijing EPB expects total annual gas use to rise from 700 million cubic meters this year to 1 billion next year and 1.8 billion by 2002 enough to replace 5 million tons of coal.

China's domestic sources of natural gas are limited, however. In September, CNPC signed an agreement with Shell to provide 3 billion cubic meters of natural gas to Beijing via Changbei. There are also plans to build a pipeline from Irkutsk, Russia, and to import liquefied natural gas through Guangdong.

Other Stage-Three Measures

Other specific measures to be implemented during stage three include the following:

- By the end of 1999, prepare a plan to transfer all diesel-powered public buses to the suburbs;
- Reduce number of diesel police and traffic administration vehicles operating inside the city;
- Adopt new emission standards for heavy vehicles by January 1;
- Adopt a standard for SO₂ emissions from power plants by the end of 1999;
- Require businesses in single-story buildings inside the fourth ring road to convert to clean-energy heating by November 15;
- Prohibit residential burning of wood and lump coal (as opposed to briquettes);
- Prohibit outdoor barbecues and outdoor burning of trash, leaves and grass;
- Traffic police will visually inspect tailpipe emissions of passing vehicles and may suspend licenses and registrations for one month for those exceeding standards;

- Gasoline and diesel fuel must meet national standards, and stations exceeding standard for volatile organic compounds must reformulate their fuel;
- Require construction and demolition companies to take measures to control dust; land that is left barren for three months after a building is torn down may be confiscated;
- By the end of 1999 complete preliminary work to use treated water from the Gao Bei Dian sewage plant (capacity 500,000 tons a day) to clean streets and water green areas to control dust; by March 2000 construct a pump station and 26 distribution stations and acquire 20 watering trucks and 20 cleaning trucks;
- Eliminate dirt roads and exposed trash heaps in the urban area and conduct survey of bare soil areas in the suburban fringe.

Beijing also recently announced plans to move more factories out of the central city. Currently there are 783 factories occupying 28.3 million square meters of land inside the fourth ring road, according to city officials. The city aims to reduce the area occupied by factories by 8 million square meters over the next five years.

Comment

Although official statistics tell us Beijing's air is getting better, our eyes and noses tell us it still has a long way to go. Favorable atmospheric conditions have produced some clear blue days so far in November. But when the wind doesn't blow right, the smog can be nearly asphyxiating. The stage three measures set some ambitious goals. But although they include a few market-based incentives, for the most part they reflect a command-and-control, central planning mentality. Factories must either comply or be shut down. There are no incremental rewards/punishments for partial compliance. Few believe Beijing will really shut down large, polluting state-owned firms like Capital Iron and Steel (Shougang). Shougang is widely acknowledged to be the city's worst polluter. Its temporary closure in late September was given the lion's share of the credit for cleaning up the air for National Day. But it employs 170,000 city residents and also provides social services such as healthcare and schooling neither the city nor the Central Government is in a fiscal position to absorb. Shougang and other large firms may therefore opt to call the city's bluff rather than reduce emissions. Effective enforcement against smaller businesses and households will require substantial resources. Shifting to natural gas is more promising. But it will take time to develop adequate supplies and infrastructure. In the meantime, those of us who live and breathe in Beijing have little option but to pray for a favorable wind.

Denmark Joint Ventures with China to Improve Energy Efficiency and Environmental Protection

Chinese officials emphasised their desire for further ventures in the energy and environment sectors with Danish companies during a visit to China by Danish Environment and Energy Minister Svend Auken.

A tour by Danish business executives culminated in a two-day Sino-Danish Business Conference on Environmental and Energy Co-operation. Speaking at the conference, Xie Zhenhua, an environmental protection official, reaffirmed China's interest in working with Danish companies on cleaner energy

schemes, particularly as many Chinese cities are working on sulphur dioxide emission reduction programmes in an effort to curb acid rain and air pollution.

About 16 Danish firms specialising in the environment and energy sectors currently work in China.

In November, a seminar on energy-efficient home heating systems will be held in Beijing with Danish firm Danfoss featuring. Participants from Canada, Poland, Russia and Denmark are expected.

Beijing Opens First Environmental Protection Hotline

The first non-governmental environmental protection organization in Beijing has opened the first hotline in the city on November 21 to offer information and legal aid to victims of pollution.

Up to now, more than 120 residents have called 6226-7459 for consultation on environmental protection regulations since the line went into service on November 1, said Prof. Wang Canfa, head of the center and a noted environmental law expert at the China University of Political Science and Laws

The center recently decided to pay the suing fare for a fruit farmer in Chifeng City in the neighboring Inner Mongolia Autonomous Region. A large area of the farmer's apple trees died from the pollution of a nearby copper factory.

All the workers in the center are volunteers, including legal experts and professors, and students from Beijing and Qinghua universities, and the China University of Political Science and Law (CUS), said Wang.

Environmentalism Takes Centre Stage

NANJING (Xinhua) - Chinese Vice-Premier Li Lanqing said yesterday that the government has devoted itself to environmental protection in the face of increasing pressures from the rising population and rapid economic development.

Li made the remark at the opening ceremony of the 99' Asia-Kyushu Regional Exchanges Summit in Jiangsu Province focusing on economic development and environmental protection.

To reach the goal of sustained economic growth, Li said that China has been adhering to the following guiding principles and policies:

- Pollution prevention and control shall be further intensified, the policy of birth control must continue to be upheld, and economic structure should be readjusted to be environmentally friendly;
- Prevention of pollution should top all priorities to eliminate new source of pollutants;

- The waste of resources should be reduced to the minimum when using natural resources;
- Scientific progress and technological innovations should be used to reduce energy consumption and spread the use of cleaner fuel with the ultimate goal of environmental protection;
- Government control and market mechanisms should be taken advantage of and environmental legislation shall be further advanced;
- Public media and education institutions should be mobilized to enhance public awareness of the urgency of environmental protection; and
- Foreign exchanges and co-operation in this field should be increased to attract more expertise and funds.

Li also promised that the implementation of China's policy of sustained economic development will provide a vast field of opportunities for overseas co-operation in the industries of electric power, oil, gas and petroleum, the prevention of soil erosion, and many other environment-related industries.

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Edie News Summaries, 22 October 1999

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People's Daily, 22 November 1999

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China Daily, 11 October 1999

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is highest in the east (48.8 percent) and lowest in the west (23.5 percent). Major cities, provincial capitals and tourist areas must meet air quality standards by the same date. To date, only Shenzhen has been given a passing grade (others may be in compliance but have not been evaluated by SEPA yet). This policy has been dubbed shuang da biao (reach two targets). Xie mentioned the following as the environmental problems requiring most urgent attention:

- Water pollution, particularly in the so-called "three key rivers" – the Huai, the Hai and the Liao (SEPA has also designated three key lakes: the Taihu, the Chachu and the Dianchi).
- Marine pollution in Bohai Bay;
- Urban air pollution and acid rain, mostly from power plants and home furnaces;
- Municipal waste water and organic waste from paper mills, breweries, etc.
- Runoff of agricultural chemicals into rivers and lakes;
- Growing pollution from automobiles.

Since most air pollution is energy-related, Xie said China must shift its energy structure from the current heavy reliance on coal more toward oil and gas while at the same time burning its coal more cleanly and efficiently. He said desulfurization of coal had proven to be cost-effective. Reducing total energy use through conservation is also essential, he said, noting specifically that more energy-efficient building materials could have a major impact.

Environmental Minister Xie Zhenhua: China Has Good Environmental Legislation, Inadequate Enforcement

Xie observed that, while China may have adequate environmental legislation in place, enforcement is another matter altogether. The two greatest obstacles, he said, are funding and technology. In a September 23 article in the English-language China Daily, unnamed SEPA officials noted that reform of China's state-owned enterprises (SOEs) presented a third major obstacle to implementing environmental regulations. Large, financially weak SOEs are among China's worst polluters. Their equipment is outdated and they don't have the resources to modernize or implement pollution controls. The SEPA officials said some local officials have not given adequate support to SEPA's work, fearing that cracking down on SOE polluters will hamper economic growth and affect social stability by causing large-scale layoffs. It is no surprise, then, that Shenzhen – a free-market special economic zone (SEZ) bordering Hong Kong with few if any SOEs – is the only Chinese city to meet air quality standards to date. Shenzhen is one of 11 "model" cities that are to meet the standards a year ahead of schedule (i.e. by the end of 1999). Other coastal SEZs, such as Xiamen in Fujian Province and

Zhuhai in Guangdong Province, are also among the model cities.

Xie said that all levels of the Chinese Government recognized the imperative for sustainable development. He said total environmental spending by enterprises and all levels of government now surpassed 1 percent of GDP, reaching RMB 100 billion (US\$ 12 billion). To put this number in perspective, the World Bank estimates China needs to spend 2 percent of GDP annually over the next 20 years just to improve its air quality to the level that prevailed in the United States in the early 1980s.

Twenty Percent of Economic Stimulus Package Devoted to the Environment

Xie said 20 percent of this year's special economic stimulus package was being devoted to environmental projects. He was apparently referring to a RMB 60 billion Chinese Treasury bond issue intended to stimulate demand through public works spending. However, the September 16 China Environment News (Huanjing Bao) quoted State Development Planning Commission Vice Chairman Li Rongrong as saying RMB 6.7 billion – or 11 percent – of that bond issue was being spent on environmental projects. Li added, however, that 93 percent of a separate RMB 34.3 billion bond issue for basic infrastructure construction would be devoted to completing already-initiated urban transit, water supply, gas supply, waste-water treatment, solid-waste management and other such projects that could be considered environment-related. Also, Li said at least part of a RMB 15.3 billion bond issue to subsidize interest rates for technological upgrades at SOEs would allow those firms to produce urban rail and environmental protection equipment that China currently must import. Li added that RMB 2 billion (US\$ 242 million) would be spent this year on 123 projects to treat waste water going into the three key rivers and three key lakes, raising the total water-treatment capacity in those watersheds to 11.4 million tons per day.

Xie told the Idaho delegation that Beijing was converting part of its bus and taxi fleets to run on compressed natural gas (CNG) or liquefied petroleum gas (LPG) to reduce emissions. But he said construction of fueling stations for them was proceeding slowly. According to Embassy sources, Beijing expects to have 14,000 CNG/LPG-powered taxis and 3,000 buses on its roads by the end of this year.

Environmental Cooperation With the United States Much Smaller Scale than With Canada, Europe and Japan

Xie noted that China already had extensive environmental cooperation with Canada, Europe and Japan, totaling about US\$ 3.3 billion. But he said

U.S. cooperation was much smaller in scale, which he attributed to the lack of U.S. Government grants and subsidized loans to support exports of U.S. environmental technology to China. Xie cajoled the U.S. government and business sectors to cooperate better. Typically, he said, when U.S. environmental delegations visit China they are either all government officials or all business people, whereas when the Swedish environment minister, for example, recently visited SEPA, 30 Swedish CEOs came along. He was pleased, however, that the Idaho delegation was an exception to this pattern.

Clearer Beijing Skies for PRC Fiftieth Anniversary Celebration

Speaking to reporters later in the day, Xie lauded Beijing's efforts to improve its air quality for the October 1 National Day celebration, marking the

50th anniversary of the founding of the People's Republic of China. Air quality has indeed improved in recent weeks, primarily because: 1) the weather has turned cool with the coming of autumn; and 2) the municipal government imposed a temporary ban on diesel-powered vehicles in the central city and ordered certain factories within the city to shut down until after the celebration. This goes to show that authorities can improve air quality at least temporarily when the political will is present. China's political leaders do not want Beijing's customary smog to obscure the view of jet fighters overflying the National Day parade or present a bad image for the international TV cameras. But Xie stressed that Beijing, while it has made a good start at controlling pollution, still does not meet national air-quality standards and is among the 10 most polluted cities in the world.

China's SOE Sector Shrinks 14% in First Eight Months of 1999

ChinaOnline, 19 October 1999

China's state-owned enterprises (SOE) sector shrunk 14% in 1999, and fewer SOEs are in the red, according to official statistics reported in the Oct. 19 China Daily.

China shut down about 7,900 large and medium-sized industrial state-owned enterprises in the first eight months of 1999.

"At the end of 1998 there were 56,100 state-owned large and medium sized industrial industries, but by the end of August this year that was cut to 48,200 through mergers, joint ventures and bankruptcies," the paper quoted Qiu Shaohua, an economist at the State Statistics Bureau, as saying.

In 1998, China had 238,000 small, medium, and large SOEs, according to the Ministry of Finance.

A total of 56% of these companies were losing money at the end of 1998, but only about half were losing money at the end of August. Moreover, at the end of August 60% of the loss-making enterprises were incurring only marginal losses, the article said.

In the first nine months of 1999, about four million employees were laid off, according to the article. A total of 6.1 million SOE workers were laid off in 1998, the article said.

Meanwhile, China's overall added industrial production value for first nine months of 1999 was up 9.3% on year to RMB 1.44 trillion (US\$ 174 billion), with added value at industrial SOEs increasing 7.7% during the nine month period, the article quoted Qiu as saying.

SOE profits were 2.3 times that of the same period last year, he said without elaborating, while losses were down by 16.1%, according to the paper.

"This basically gives us confidence that the three-year target of getting state-owned enterprises out of their stressful situation can be met," the article quoted Qiu as saying.

However, some argue that the turnaround of China's SOEs can in part be attributed to preferential government policies such as writing off bad debt and increasing subsidies for technical upgrades. China's recent crackdown on smuggling has also affected revenues in some sectors.

Meanwhile, added industrial value for foreign-funded enterprises was up 12.8%, while added industrial value for township or collective industries grew by 7.7% on year, Qiu said, according to the article.

Global Economy Slowly Cuts Use of High-Carbon Energy

The New York Times, 31 October 1999, By William K. Stevens

Even as the world's expanding population and economy increase atmospheric concentrations of carbon dioxide that scientists say are warming the earth, the global energy system is moving steadily away from the carbon-rich fuels whose combustion produces the gas.

Experts say atmospheric levels of carbon dioxide may be double that of the pre-industrial era by the end of the next century. But they also say the levels would be much higher except for a trend toward lower-carbon fuels that has been going on for more than 100 years, but has been largely unnoticed except by a small band of energy specialists.

The question now, they say, is whether the trend can be accelerated enough to stave off or lessen what many scientists believe is a potentially disruptive global warming.

For nearly a century and a half, fuels with high amounts of carbon have progressively been replaced by those containing less. First wood, which is high in carbon, was eclipsed in the late 19th century by coal, which contains less.

Then oil, with a lower carbon content still, dethroned King Coal in the 1960's. Now analysts say that natural gas, lighter still in carbon, may be entering its heyday, and that the day of hydrogen -- providing a fuel with no carbon at all, by definition -- may at last be about to dawn.

As a result, the experts estimate, the world's economy today burns less than two-thirds as much carbon per unit of energy produced as it did in 1860. In the United States, they estimate, the trend toward lower-carbon fuels combined with greater energy efficiency has, since 1950, reduced by about half the amount of carbon spewed out for each unit of economic production. But because economic growth and population growth have been so rapid over the decades, overall atmospheric concentrations of carbon dioxide have steadily risen, to the point that the concentrations may well have doubled by the year 2100. Mainstream scientists say that this much carbon dioxide could warm the earth, on average, by 3 to 5 degrees Fahrenheit. By comparison, that is

about half as much as it has warmed since the depths of the last ice age 18,000 to 20,000 years ago.

A change of this magnitude would likely have widespread consequences for the world's climate, weather and human life.

Now, as representatives of 150 governments meet in Bonn in the latest round of global talks on measures to further reduce carbon-dioxide emissions, analysts both in and out of industry say that the next quarter-century is shaping up as a period of technological and economic ferment offering a chance to accelerate the trend toward a low-carbon economy and, eventually, a no-carbon one.

In Bonn, the delegates are trying to work out the details of an agreement forged two years ago in Kyoto, Japan, that could speed up the trend. Their work is not expected to be finished for at least a year, and the Kyoto agreement still must be ratified by a sufficient number of countries after that.

However that may turn out, "the decarbonization of the energy system is the single most important fact to emerge from the last 20 years of analysis" of the system, said Dr. Jesse H. Ausubel, an expert on energy and climate at Rockefeller University in New York City. Dr. Ausubel predicts that this evolution will produce a carbon-free energy system by the end of the 21st century.

Among some recent signs of the trend are these:

The Federal Energy Information Administration reported last week that emissions of carbon dioxide by the United States had increased by an average of 1.37 percent a year in the 1990's -- only about half the 2.6-percent rate of growth in economic production. Analysts say the discrepancy is evidence that the economy is being decoupled from carbon.

The agency reported this month that the same is generally true in China, the biggest consumer and

powered partly by gasoline and partly by self-generated electricity. It is said to run at 60 miles per gallon of gasoline in town, and 71 on the highway, and to travel 600 to 700 miles on a tank of gas.

Toyota has introduced a similar "hybrid" automobile in Japan, and these cars are "literally kick-the-tires examples of the decarbonized economy," said Hal Harvey, president of the Energy Foundation, a partnership of foundations that promotes energy efficiency and renewable energy.

Other auto makers are also planning hybrids, which are being viewed as a transition, ultimately, to vehicles powered by hydrogen fuel cells that emit no carbon.

In its planning, the General Motors Corporation has "embraced fuel cells as the technology of choice," but with hybrids coming first, said John Williams, the leader of the company's internal team on global climate issues.

And while auto companies are looking down that track, some of the world's biggest energy companies are looking to provide the appropriate fuels.

Hydrogen, in particular, has attracted fresh interest.

Until recently, "the hydrogen option was seen as rather distant," said Ged R. Davis, an executive of Shell International in London who analyzes such questions for Royal Dutch/Shell, one of the world's largest energy companies. "Now it is looking closer, perhaps over the next decade or two," Davis added. "Most of the energy and car companies are looking at this rather seriously." Shell itself has established a hydrogen subsidiary.

In the nearer term, hydrogen would be used in fuel cells for cars, trucks and industrial plants, just as it already provides power for orbiting spacecraft. But ultimately, hydrogen could also provide a general carbon-free fuel.

The world energy system will not change overnight, of course, if it changes at all. And new products must ultimately stand the test of the marketplace. But some analysts say that the next two decades or so will be a time of unusual pressure for change, both for environmental and economic reasons, in which companies will be driven to compete for survival and dominance in some sort of emerging new energy system.

Whether companies are seriously pursuing new options or merely preserving them for the future, experts say there seems little doubt that the long-term trend toward decarbonization is real, and that it will most likely continue even in the absence of any shift

to hydrogen or renewable energy sources like wind and solar power.

"The future decarbonization rate is likely to be at least as high as the historical one" of about three-tenths of a percent a year, said Dr. Nebojsa Nakicenovic, an expert on energy and the environment with the International Institute for Applied Systems Analysis, a research group in Laxenburg, Austria. The institute was one of the first groups to study the question.

Oil accounts for the biggest share of global energy consumption today, followed by coal and, closely, by natural gas. In most of the world except the United States and China, said Dr. Ausubel of Rockefeller University, coal is either defunct or on the way out, and natural gas will increasingly displace it.

According to several recent analyses, Dr. Nakicenovic said, recoverable natural gas now appears far more abundant than had been previously thought. The burning of gas produces, on average, only about a third of the carbon dioxide per unit of energy of coal, and about two-thirds that of oil.

Gas not only can fuel fixed facilities like industrial plants and furnaces, it can also be processed to produce hydrogen for use in carbon-free fuel cells to power automobiles and generate electricity. In those cells, there is no combustion; instead, hydrogen reacts chemically with oxygen to produce electricity. But when hydrogen is extracted from gas, the residual carbon must somehow be disposed of, possibly by pumping it back into depleted oil and gas wells.

Dr. Ausubel predicts that natural gas will become the dominant fuel of the next 40 to 50 years. If so, that alone would be enough to continue the long-term decarbonization trend.

China, which some experts think will emerge as the biggest carbon-dioxide emitter of the 21st century, has greatly reduced its energy consumption per unit of economic output, has closed several coal mines, is seeking to modernize industrial and power plants and is moving toward natural gas, many analysts say.

Not least, they say, the Chinese are worried about the health effects of coal's air pollution. Nevertheless, the Energy Information Administration reported last week, China's coal demand is expected to double by 2020.

So while the trend toward a carbon-free economy may continue, Dr. Ausubel says, it might not move rapidly enough to assuage the fears of those who are most concerned about global warming. He says that if the trend continues to evolve more or less naturally,

GENERAL

with business as usual, it will take another century or so to decarbonize the energy system fully.

By then, he predicts, atmospheric concentrations of carbon dioxide will be around 500 parts per million, nearly double what they were before the industrial revolution. Mainstream scientists say that would be enough to change the earth's climate substantially, make droughts, heat waves and floods worse and raise the sea level to heights that would threaten many low-lying coastal areas and islands.

Some analysts say that 500 parts per million is a best-case estimate, and that business-as-usual could cause a tripling of pre-industrial carbon-dioxide levels.

Other experts think that concentrations could be held substantially below 500 parts per million if the trend toward decarbonization were to accelerate. Harvey of the Energy Foundation says "prospects are excellent" for an acceleration.

And Davis, the Shell executive, says his company's analyses suggest that if the proper incentives were in place, new energy technologies could be adopted broadly enough to bring about a peak in oil use and carbon-dioxide emissions by about 2020.

After that, there would be a decline.

One sort of incentive might lie in the Kyoto agreement, which calls for a group of 39 industrialized countries to reduce their carbon dioxide emissions by an average of 5 percent below 1990 levels over the period 2008 to 2012.

One mechanism for doing this is a system whereby a country that exceeds its reductions target can earn money by selling that extra reduction to another country that is having trouble meeting its target. A similar system, involving company-to-company trading, has been proposed for the United States.

While negotiators struggle over the terms of such arrangements and politicians wrangle over putting the Kyoto accord into effect, many energy analysts seem to agree on one thing: The ultimate goal ought to be a carbon-free economy based largely on hydrogen. Dr. Ausubel, for one, predicts that such an economy will materialize.

Many would agree with Williams of General Motors: "I think I'm on pretty solid ground in saying the long-term vision is hydrogen. But there's a lot of work between here and there."

Air Pollution Initiatives

Environmental Health & Safety Review,
October 1999

A large part of air pollution reduction initiatives in Beijing are associated with vehicles. Most Recently, as a part of Beijing's programs to celebrate the 50th anniversary of the founding of the People's Republic of China, 300 BK6111 transit buses were designed and manufactured by the Beijing Public Transportation Corporation (BJPT) using US-based Cummins Engine Company's B5.9G compressed natural gas (CNG) engines. The emissions level of the B5.9G CNG engine meets the Euro II vehicle emissions standard that Beijing Plans to adopt in 2004. Cummins has also won a contract for 50 Euro II diesel engines for transit buses in Shenzhen.

Developments in Air Emissions Control

Environmental Health & Safety Review,
September 1999

The Standing Committee of the NPC sent five groups to Beijing, Shanghai, Lanzhou, Xi'an and Shenyang to inspect their efforts at implementation of the existing *Air Pollution Prevention and Control Law*. The Shanghai group inspected local automobile manufacturers, power plants, iron plants and steel plants. The Shanghai EPB has taken measures to permanently control thick smoke from 17 iron and steel plant furnaces. So far, 15 power plants have been installed with dust removal equipment.

In response to the growing demand for clean vehicles in China, General Motors (GM) is jointly developing a medium-size Buick powered by unleaded fuel and compressed natural gas (CNG) for the Chinese market. So far, many big cities in China have started building environmentally friendly gas stations and are working to convert buses and cars to ones that use cleaner fuel. For example, Shanghai plans to equip 8,000 vehicles with devices that this year to enable them to use liquified petroleum gas (LPG) as fuel. According to Shanghai EPB Director Lu Shuping, 20 gas stations will be built to facilitate these vehicles by late July 1999. Shanghai's approximately 600,000 vehicles 300,000 motorcycles and 400,000 mopeds have made exhaust emissions a serious air pollution source.

State Stepping up Air Pollution Battle

Sinosphere, Fall 1999

A draft for an amendment to the Law on Prevention and Control of Air Pollution, enacted in 1985, was submitted to the NPC's standing committee. It seeks to appropriate 180 billion yuan (\$21.7 billion U.S.) to curb acid rain and sulfur dioxide levels. 34 cities, most of them on the coast would receive these funds. The majority of the funds, which are equal to about 1.5% of the cities' GDP, would be allocated to Beijing, Shanghai, Fuzhou in Fujian province, Shantou and Zhanjiang in Guangdong province and Suzhou in Jiangsu province. The amendment calls for limits on emissions and fines for those who exceed the limits. IN addition, car emissions and dust from construction would be targeted.

Green Gross National Product

Environmental Health & Safety Review,
November 1999

The China Academy of Sciences (CAS) promulgated its report on Sustainable Development Strategy for China 1999, which introduced a new concept, "green GNP." It suggests that environmental factors be integrated in national economic accounting in order to scientifically assess progress and to realistically reflect the quality and process of sustainable development. Because of CAS's status as an academic institution, this new concept is expected to draw attention in the economic community as well as in policy think tanks and even among higher level decision-makers. Although these discussion are largely academic, they will likely serve as a precursor to future legislative reform.

Vehicle Emissions Control in Liaoning Province

Environmental Health & Safety Review,
November 1999

According to official state media, Liaoning province has over 1.5 million vehicles, one-tenth of the total amount in the whole country, and roughly 60 percent do not meet existing emissions standards. Five measures defined by the provincial EPB to control the problem are:

- New vehicles not meeting standards will be banned;
- Illegal and small oil refineries will be shut down;
- Preferential policies will be applied to mthe research and manufacture of advanced emissions control technology;
- Strengthened enforcement of regulations; and
- Phasing out old vehicles per national regulations.

Fuel Tax Passes in Third Attempt

Agence France Presse, 1 November 1999

China's legislature has finally passed new amendments to the Highway Law which include a tax on fuel consumption to replace road tolls and fees. The amendments to the law were passed by an overwhelming majority of the standing committee of the National People's Congress, after having failed to be ratified in two previous sessions. The new tax is seen as a crucial part of the ongoing reform of China's tax system being implemented by Premier Zhu Rongji. It was not immediately clear what the tax would amount to, but earlier drafts called for a 1.5 yuan (18 US cents) tax on each liter of diesel and petrol, effectively raising gas prices by about 60 percent. The tax could have a major impact on energy use in the transport sector.

Construction Begins On Light Rail Project in Beijing

Agence France Presse, 13 December 1999

Construction has started on a U.S. \$700 million, 40 kilometer light rail system in northern Beijing. The first phase the project is expected to be completed by 2001, with the entire project scheduled to be finished by 2005. The U-shaped light rail will connect with Beijing's existing circular subway line at the Xizhimen and Dongzhimen stations, circumnavigating the northern half of the capital. A consortium of five companies under the direction of the Beijing Mass Transit Railway Company began the work on 11 December. Some 30 kilometers of the 18-station line will be above ground, seven kilometers underground, while 2.8 kilometers will include elevated tracks. The light rail is expected to greatly alleviate traffic congestion in the northern part of the city which, like the rest of Beijing, has become increasingly in gridlock due to the rapid increase in the numbers of cars and trucks over the last five years.