JPRS-CEN-88-010
30 NOVEMBER 1988

FOREIGN BROADCAST INFORMATION SERVICE

JPRS Report

Science & Technology

China: Energy

JPRS-CEN-88-010

30 NOVEMBER 1988

SCIENCE & TECHNOLOGY

CHINA: ENERGY

CONTENTS

Experts Say Energy Reform Essential, Champion Nuclear Power Plants

Urgency of Nuclear Power Development

40130017 Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 29 Sep 88 p 2

[Excerpt from speech by Li Yingxiang [2621 7751 5046], special researcher at China Nuclear Power Industry Economic Research Institute: "We Need a Sense of Urgency About Developing Nuclear Power Together With Practicable Measures"]

[Text] China's energy situation is becoming severe, many localities are experiencing severe energy shortages, and many experts agree that we must develop nuclear power. But a sense of urgency is generally lacking in nuclear power production projects and in arranging for investments. For example, some comrades believe that because the plant construction cycle is long, nuclear power is "far-off water that cannot quench an immediate thirst." It is an objective fact that the initial construction period in the development of nuclear power is long, but "a journey of a thousand miles begins with the first step." China's electric power shortage will be prolonged. If we do not make a vigorous effort now to develop new energy sources and to accelerate the development of nuclear power, we will still be unable to "quench our thirst" 10 years from now.

There are others who believe that although nuclear power should be developed, since funds are now in short supply, there is no money to develop them; but state funds are always limited, and the key factor is how we choose our investment orientation and how we assure that the key areas are guaranteed so that the limited funds are used rationally. Energy construction is a strategic focus of economic development, and nuclear power construction should be accorded its proper appropriate place. But nuclear power construction investments have not yet been included in the general state budget.

Still others believe that China does not have abundant uranium ores and that the potential for developing nuclear power production is therefore limited and inadequate to solve our major problems. This is incorrect. Compared with other countries, China has rather abundant uranium ore: proved reserves of uranium ore can fully meet the needs of nuclear power development, and if we continue to develop breeder reactors, the resource utilization rate can be increased by a factor of 60 to 70. Consequently, there will be no problem in

providing the resources for the development of nuclear power over the next few hundred years.

The problem of how far nuclear power should be developed and to what extent it can solve the energy problem requires specific analysis. China has abundant coal reserves, and coal will be our main energy resource for a rather long period in the future. But certain provinces and municipalities that lack coal and hydropower will focus on developing nuclear power, which eventually is likely to become their main energy source.

In addition to a sense of urgency, we need workable measures. We must have a comprehensive, authoritative nuclear power development program. Nuclear power construction is an immense systems engineering project which involves the mechanical, electric power and nuclear engineering industries and many other departments; if there is no comprehensive program, the various departments will be unable to proceed in coordinated fashion. In addition, we must arrange for the funds: I suggest that the state establish a nuclear power development fund. Nuclear power is a field that requires rather large one-time investments, without which no output can be obtained. Even if we can eventually make the nuclear industry self-supporting, foreign experience indicates that government support is needed for the first steps, and that output will exceed expenditures only after a certain scale is achieved. Third, we must have clear construction guidelines and adhere persistently to the principal of "Chinese-foreign cooperation with a predominant Chinese role"; after importing foreign technology and strengthening self-reliant development research, we must accelerate Chinese mastery of the technology and strive to decrease the costs of constructing nuclear power plants. Fourth, we must establish a highly efficient management system. During the breakthroughs on the atomic and hydrogen bombs, a special committee in the central government exercised centralized, unified leadership, and all departments and localities cooperated vigorously, so that high efficiency and rapid progress were achieved. But now progress in nuclear power construction is painful and slow: one important reason is red tape and a burgeoning bureaucracy, with no effective centralized and unified management system. To summarize, strengthening leadership, establishing a clear development program, and guaranteeing the necessary funds are the prerequisites for smooth progress in nuclear power.

Key Role of Nuclear Power

40130017 Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 29 Sep 88 p 2

[Extract from speech by Guo Xingqu [6753 2502 3255], assistant research fellow, China Nuclear Power Industry Economic Research Institute: "Energy Constitutes One of China's Two Key Problems"]

[Text] Some experts believe that population, the environment, transport and resources are China's current key development problems. Actually, our environmental, transport and resource problems are primarily related to the energy problem. The increased erosion, and the flooding and droughts resulting from excessive cutting of China's forests are also related to the

energy problem. Consequently, population and energy are the two key problems affecting China's attainment of its strategic development objectives. Other problems either are of lesser importance or arise out of these two major problems.

In the next 30 or 40 years coal will be China's major energy resource. But the disadvantages of making coal the major energy resource are already becoming clear: backup reserves are insufficient, there is a shortage of transport, and coal causes serious pollution and has deep-seated, long-range effects on global climate. As a consequence, changes in China's energy structure are unavoidable.

Because China's total energy consumption will be increasing rapidly, because economically recoverable reserves of hydropower, petroleum, and natural gas are limited, and because the energy flux of solar energy is too low and the supply is unstable, the only large-scale industrial energy source that can replace coal is nuclear power. The principal advantage of nuclear power is its high energy density.

In 1980, 13 years after France constructed a 300,000 kW pressurized-water reactor in 1967, nuclear power plants with a capacity of more than 6 million kW were put into operation, constituting more than a tenth of France's total installed electric power generation capacity. Subsequently, several regions developed very rapidly. If we assume the same rate as in France, after China completes construction of the 300,000 kW Qinshan Nuclear Power Plant in 1990, the capacity that is put into operation in the year 2003 should be close to 30 million kW. But owing to problems with funding and the industrial-technical base, in 2003 China's cumulative installed power generation capacity is likely to be about 10 million kW. Consequently, in the next 20 or 30 years nuclear power will be only a supplementary energy source. But as a result of the accumulation of technical capabilities for a few decades, before the middle of the next century nuclear power may well become the principal energy source.

Since the war, the development of high-technology industries worldwide has involved four strategies: leading the way, advancing neck and neck, keeping pace by concentrating on strong points, and reverse engineering. As a developing country, China must adopt the approach of keeping pace by concentrating on its strong points, supplemented by reverse engineering. Foreign experience indicates that this approach yields the best economic benefits. In the past, partly owing to the idea that we must have both what other countries have and what they lack, and partly owing to systemic factors, even though China had limited funds and insufficient technological capabilities, we generally made all-out efforts to catch up with the world state of the art in broad technical areas. The result of this approach, to quote Marx, was that "dispersed efforts resulted in common failure."

A single reactor type involves a particular industrial system. Since 1983, China has learned this lesson and has determined to start with pressurized-water reactors. In the future we must adhere strictly to a technological approach based on a single reactor type, master the type as rapidly as possible, and pave the way for nuclear power development in the next century.

Undesirable Environmental Effects of Coal

40130017 Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 29 Sep 88 p 2

[Excerpts from speech by Wang Hanchen [3769 3352 5256], chief of the State Environmental Protection Office: "Large-Scale Burning of Coal Is the Main Cause of Environmental Pollution"]

[Text] China has serious air pollution. Monitoring data on a group of cities throughout the country indicate that 89.4 percent of them have concentrations of particulate matter exceeding national standards. Chongqing, Guiyang, Changsha, and Nanchang are experiencing acid-rain pollution, which is indicative of future trends. From 1980 to 1984, among the 40 cities monitored by the world environmental monitoring system, while Kuwait, in the Middle East, was first in terms of atmospheric particulate matter, the Chinese cities of Shenyang, Xi'an, Beijing, Shanghai, and Guangzhou were respectively second, third, fifth, ninth, and tenth. China is among the countries with the worst air pollution. Benxi City in Liaoning Province has a visibility of only 30 to 50 meters for nearly half the year as a result of atmospheric pollution.

China's coal-centered energy structure is the main cause of atmospheric pollution. The percentage of China's energy provided by coal is 2.5 times the world average, 3.3 times the figure for the United States, 4 times that for Japan, and 7.6 times that for France. Coal is a worse polluter of the environment than hydropower, nuclear power and petroleum and natural gas. A 1 million kW coal-fired power plant emits 1 million tons of flyash, more than 60,000 tons of sulfur dioxide, and more than 630 kilograms of the potent carcinogen benz(a)pyrene every year. In addition, China's coal processing and conversion technology is outmoded, and 66 percent of coal consumption consists of raw coal burned in dispersed facilities, with low combustion efficiency, which not only wastes energy but increases pollution. Some 73 percent of the flyash and 90 percent of the sulfur dioxide that China discharges into the atmosphere come from the combustion of coal. Some experts predict that by the years 2015, 2030, and 2050, China's energy requirements will increase to respectively 2.2, 3.1, and 5 billion tons of standard coal. If coal continues to be our main energy source, the amounts of flyash and harmful gases produced by its combustion will increase many-fold, with the result that environmental pollution will reach unbearable levels.

Priority should be given to the development of hydropower. But because it will not be possible to use solar power industrially on a large scale in the next few decades, and because hydropower resources are limited, nuclear power is a promising, clean energy resource for large-scale replacement of coal. Currently, most of China's coal-fired power plants lack sulfur removal facilities. Sulfur removal would increase investment by about a quarter. The environmental effects that would result from the development of nuclear power would partially compensate the disadvantage of high initial investments in its development.

Increasing coal utilization efficiency and making use of coal washing and conversion are important topics that must be given consideration. But for the long term, gradually replacing fossil fuels with nuclear power is the way to fundamentally alleviate air pollution.

Scenario for China's Nuclear Power

40130017 Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 29 Sep 88 p 2

[Excerpt from speech by Niu Weiqiang [3662 4850 1730], deputy director of Policy Research Office, China Nuclear Industry Corporation: "We Must Quickly and Vigorously Develop Nuclear Power"]

[Text] Nuclear power already provides more than 16 percent of total world electric power output, and it already constitutes more than 50 percent of output in France, Belgium and Sweden. Nuclear power generation costs abroad are everywhere lower than those of fossil-fired power production. The Soviet Union, Eastern Europe, Japan and South Korea are continuing to develop it at a high rate, and U.S. nuclear power production has recently experienced a resurgence. Owing to excessively rapid growth in the number of nuclear power plant construction starts in the United States during the 1970's and also to a surplus of electric power, in recent years nuclear power development in the United States had stagnated. Recently, hot weather has resulted in excessive power loads in the United States; while signing a law, President Reagan expressed the opinion that "For the country to continue to prosper, we must make full use of the potential of nuclear power," and that "We must therefore proceed toward a new era of safe, economical, clean nuclear power."

Starting in the 1950's, China established a nuclear industry system that had great accomplishments in the development of nuclear weapons. But because of doubts regarding the uncritical optimism about nuclear power and suspicion regarding the safety and economic benefits of nuclear power stations, in combination with insufficiently vigorous efforts by the nuclear industry itself, the transition to civilian use was not made in timely fashion, and China long had "a nuclear industry but no power," which was quite inconsistent with China's international position and economic development. When we suddenly realized the situation, there was also a feeling that the benefits of nuclear power were too remote to meet present needs. But a thousand-mile journey begins with the first step, and if we do not make a vigorous effort now we will regret it later.

The Chinese-designed, Chinese-built 300,000 kW Qinshan Nuclear Power Plant and the two imported 900,000-kW units at Dayawan in Guangdong are under construction. The project for the two 600,000 kW stage 2 units at Qinshan has already been approved and preliminary preparations are under way. The current task is to construct and manage these three power plants well. But this will by no means be sufficient to meet our needs.

Based on China's real capabilities, during the present century we must use the approach of Chinese-foreign cooperation with a predominant Chinese role

and proceed vigorously with the construction of nuclear power plants in economically developed, energy-poor regions; we must take advantage of the construction of these power plants to master the design, construction, operation and management of 300,000 kW and 600,000 kW pressurized-water power plants, making these into fully Chinese-assimilated, standardized engineering products so as to build them more extensively in areas of the country that need them and that have suitable conditions and in addition, where possible, to organize their export. As regards 1 million kW nuclear power plants, where possible we should import and partially assimilate the technology in order to lay a good foundation for development in the next century.

The 21st century will be a period in which nuclear power develops on a large scale, leading to a diversified energy structure in which the coal-hydropower-nuclear power tripod is the mainstay, supplemented by other energy sources. In order to make full use of nuclear fuel, a vigorous effort should also be made to introduce breeder reactors.

Strategy, Policy for Promoting Nuclear Power Development Discussed

40130018b Beijing ZHONGGUO KEJI LUNTAN [FORUM OF SCIENCE AND TECHNOLOGY IN CHINA] in Chinese No 4, 1988 pp 24-26

[Article by Bao Yunjiao [7637 0061 2884], Zhang Wenqing [1728 2429 7230], Chen Shuyun [7115 2579 0061], and Shi Liang [0670 0081]: "Strategy and Policy for China's Nuclear Development"]

[Text] The construction of China's Daya Wan and Qinshan nuclear power plants is proceeding according to plan, indicating that China's nuclear power development has already made an excellent start. With the joint efforts of all parties involved, the state has already made the vigorous, focused, steady development of nuclear power on China's southeastern coast and in its energy-deficient areas into a national policy, a step that is quite correct.

We believe that in dealing with the question of whether China should develop nuclear power we should elevate it to the status of long-term energy development strategy and should weigh the advantages and disadvantages of nuclear power and coal-fired power in terms of systems analysis, using solid scientific data to draft a general plan for China's development of nuclear power. In this paper we attempt an objective evaluation of the state of world nuclear power development, a realistic analysis of the major problems in China's nuclear power development, and a rough comparison of the comparative economic effectiveness of nuclear and fossil-fired power; finally, we make some suggestions regarding policy and measures for development of nuclear power in China.

I. Developing Nuclear Power Is the Trend of the Times

Nuclear power technology was born in the 1950's. From the late 1960's to the early 1970's many countries, particularly industrialized countries, realized that developing it was of major importance and boldly chose nuclear power as an important means of solving their energy problems and improving their energy structure. A wave of nuclear power development arose throughout the world and developed with astonishing rapidity. From the time that the world's first nuclear power plant was connected into the power grid and began generating electricity to the time when the total installed nuclear generating capacity surpassed 100 million kW, only slightly over 20 years

elapsed, while it had taken more than 100 years for conventional power plants to reach this level.

The economic superiority of nuclear power is the main impetus for its development. The history of nuclear power plant operation worldwide proves that it has excellent economic characteristics. According to surveys by the International Atomic Energy Agency and official announcements by some countries, in 1982 nuclear power generating costs for Europe as a whole and for Japan were 20-50 percent below those for coal-fired power generation. Nuclear power generation costs were clearly lower than those of fossil-fired power generation in Canada; they were about 11 percent lower than for coal-fired plants in the United States, nearly 15 percent lower in India, and 8 percent lower in South Korea. In 1985 nuclear power costs in France, Belgium, Holland, Italy and the FRG were respectively 41.4, 34.7, 19.5, 25.1, 36.4 and 23-28 percent lower than coal-fired power generating costs.

The development of the world energy situation will increasingly favor nuclear power development. Population increases and economic development unavoidably result in major increases in energy needs, and world energy resources are becoming increasingly scarce, and new energy shortages will soon come into being. Under such circumstances it is unwise to discard any promising energy source. Energy diversification is the trend worldwide, and nuclear power is the main energy source that is currently competitive with fossil fuels. The serious environmental pollution and the greenhouse effect produced by the combustion of fossil fuels have already caused major concern in world scientific circles. It is universally believed that nuclear power, as a clean, highly efficient energy source, will play an increasingly important role in future social development.

Nuclear accidents and antinuclear power forces have failed to shake the resolve of most countries to stay on the reasonable course and continue developing nuclear power; shortly after the Chernobyl nuclear accident in the Soviet Union, many countries and organizations issued statements of their intention to continue developing nuclear power.

According to predictions by international energy organizations and the International Atomic Energy Agency, total installed nuclear power generating capacity will reach 427 million kW in 1995, 497-646 million kW in the year 2000, and 875 million to 2.16 billion kW in 2025.

Like the other countries of the world, China will require large amounts of energy for its modernization. By the year 2000 China's commercial energy requirement will be 1.4 billion tons of standard coal, and the figure will increase to about 3.5 billion tons by the year 2030. But China not only has relatively low per-capita energy resources, but their geographical distribution is extremely nonuniform. Nearly 80 percent of the country's coal reserves are in the north, and 69 percent of proved reserves are in Shanxi, Nei Monggol, Shaanxi, and Ningxia; 76 percent of unutilized reserves are in the above four provinces, and only 2 percent are in the eight provinces south of the Yangtze River. More than 70 percent of the country's hydropower resources are in the southwest, and the provinces of Xizang, Yunnan, and

Sichuan account for about 65.3 percent of all exploitable hydroelectric power capacity, but developing this hydropower will be rather difficult. The energy reserves of the eight provinces south of the Yangtze, together with those of Shandong, Hebei, Liaoning, Jilin, and Henan, are only 13 percent of the national total, but these provinces have 63 percent of the country's population and account for 65 percent of its energy consumption. In particular, the area south of the Yangtze has serious energy shortages, leading to the irrational situation in which China's economic center of gravity is to the east, while its energy center of gravity is to the west.

Even though the state is making major efforts on all aspects of the problem, energy is in extremely short supply in China's coastal region and northeast, with their concentrated population and rather highly developed industry, and inadequate supplies of electric power have resulted in inability to make use of about a quarter of industrial production capabilities. Energy supply problems and shortages have already become a major factor limiting China's economic development.

According to program requirements, by the year 2000, there will be a requirement for 890 billion kWh of coal-fired electric power alone. If the coal consumption for electric power generation is 350 grams of standard coal per kilowatt-hour, then every year about 500 million tons of raw coal will be needed. It is predicted that by the year 2000 the state will be able to provide no more than 400 million tons of power-generation coal. There is thus a need to open new paths, to vigorously develop new energy resources, to accelerate nuclear power, which is recognized throughout the world as an advanced source of power, and to strive for energy diversification. A major objective of China's current vigorous, appropriate development of nuclear power is to master the advanced technology of nuclear power construction as quickly as possible so as to train personnel for large-scale nuclear power development during the next century.

II. Circumstances and Objectives of Nuclear Power Development in China

Nuclear power construction in China has just gotten under way. Vigorous work is now under way on the main reactor construction for Chinese-designed, Chinese-developed, Chinese-built 300,000-kW pressurized-water reactor generating stations, which are scheduled to be completed and commissioned in 1990. China's first large nuclear power plant, for which all of the equipment was procured abroad, will have an output of 2 x 900,000 kW, it is scheduled to be integrated into the power grid in 1992-1993. In addition, preliminary preparations for the 2 x 600,000 kW second stage at Qinshan are under way. China now not only has the technical capabilities for developing nuclear power, but is also preparing favorable conditions for doing so.

If we can organize the development of nuclear power in accordance with the current preliminary program and continue vigorously with it, by 1995 China's total installed nuclear power generation capacity will reach 3.3 million kW and the annual power generation capacity will reach 210 billion kWh with an annual output value of up to 2 billion yuan, and with even greater social

benefits. The period from now to 1995 is the key stage in China's mastery of nuclear power technology. The construction and operation of the power plants described above will lay a solid foundation for China's subsequent design and construction of fully Chinese nuclear power plants. On this basis, China will be able to construct another group of 600,000-kW power generating units by the year 2000 and to achieve full Chinese mastery of 600,000-kW nuclear generating units. At the same time, China will assimilate large nuclear power plant technology, and it will be possible, with a vigorous effort, to build one or two 1 million-kW nuclear power plants by the end of the present century or the beginning of the next. The period from 1996 to 2005 is the stage in which China's nuclear power construction will develop steadily. In addition, China will already have the capability for focused development of Chinese-style large-scale nuclear power plants. The period from 2005 to 2015 is the stage in which China's nuclear power industry will develop on a large scale: breeder reactors will have been mastered, standardized and put into series production, and breeder reactor plants will already have made a start. Additional nuclear power plants may be built, depending on the distribution of China's economic development and its energy requirements.

Based on the above assumptions, it is planned that before the year 2000 China's total installed nuclear power generation capacity will be 6 to 7 million kW and that it will reach about 30 million kW by the year 2015. This double objective is fairly realistic and can be achieved by making an effort.

III. Comparison of the Economic Characteristics of Nuclear and Fossil-Fired Electric Power Generation

Nuclear power plant construction is technology-intensive and operation of the plants also involves latent dangers. As a result, the manufacture and installation of nuclear power equipment are subject to stringent standards, which correspondingly increases manufacturing and installation costs and lengthens the construction process. Thus, the investment in nuclear power plant construction is greater than that for coal-fired power plants; internationally, the specific investment (the construction cost per kilowatt) for nuclear power is generally about 50 percent higher than that for coal-fired power generation.

If we compare the two nuclear power plants currently under construction in China with coal-fired power plants, we find that their specific investment exceeds that for coal-fired power plants by an even greater degree. This is because the investments for the Qinshan nuclear power plant, a demonstration plant and the first Chinese-designed facility, most of whose equipment was built in China, include the cost of modernizing the plants that produce the equipment. The Daya Wan nuclear power plant, an imported project, was also built under special conditions. Furthermore, investments on fossil-fired power plants in China do not take account of environmental, shipping and other related investments. But environmental protection alone, if we add desulfuring equipment, would increase the construction cost per kilowatt by about 25 percent. The fuel transport for the two types of plants also differs

greatly: a 1 million kW nuclear power plant requires replacement of only about 30 tons of fuel a year, while a coal-fired plant of the same capacity requires long-distance haulage of 3 million tons of coal, so that the transports of nuclear power plants are negligible in comparison. As a result, we should add to the construction cost of coal-fired power plants their share in the costs for railroads, locomotives, and ports. It is obvious that if the above necessary expenditures are added to the current construction cost of coal-fired power plants, the investment will turn out to be larger, and this decreases the difference between the specific investment on nuclear and coal-fired power plants.

Another point that should be emphasized is that the Qinshan and Daya Wan nuclear plants have special characteristics: the former is a demonstration power plant, while the latter is a fully imported project built under special conditions. Neither is a model for China's long-term nuclear power development: they are simply being used to evaluate the economics of developing nuclear power. During the next few years, after the experience and lessons of world nuclear power development are investigated and a variety of comparisons and documentations are made, a project for the second stage (2 x 600,000 kW) of the Qinshan plant will be proposed. The guiding ideas for this plant will be Chinese-foreign cooperation with China taking the main role, and gradual Chinese assimilation of nuclear power production, which will greatly decrease the construction cost of nuclear power plants.

In addition to the investment in construction of nuclear power plants, there is another problem of final power production cost with which people are concerned. Power production costs generally include recovery of investment, fuel costs, transport and management cost, and maintenance costs. A large body of statistical data from China and elsewhere indicates that investment recovery accounts for 60 percent of nuclear power production costs and fuel for only 20 percent. In the case of coal-fired power plants the situation is quite the opposite: fuel costs account for 55 percent and investment recovery for only 38 percent. Thus it is evident that as the operating period of a plant becomes longer, the power production costs of nuclear power plants will show a clear decline as the investment-recovery component of production costs falls, but this will not happen in the case of coal-fired plants because fuel costs are the principal component. As a result, in terms of the average power generation cost over the economic lifetimes of the two types of plants, nuclear power is inevitably cheaper than coal-fired power. This has already been proven by operating experience in countries that have nuclear power, and there is no question that it will be the case as China develops nuclear power.

IV. Policy and Measures for China's Development of Nuclear Power

A. Include nuclear power plant construction in the state energy development plan.

The State Planning Commission should be able, in cooperation with the relevant departments, to draft both long-term and near-term nuclear power

development programs as quickly as possible and make them a part of the state energy development program.

B. China must have a consistent nuclear power development policy.

Because of the nonuniform geological distribution of China's energy resources, we must affirm the policy that nuclear power has a strategic position in a long-term stable energy supply for China.

C. Effectively coordinate and vigorously cooperate with nuclear power plant construction.

The State Council's nuclear power leadership group should strengthen its leadership and coordinating activities and make a vigorous effort to complete the final drafting and evaluation of mid- and long-term nuclear power programs. Under its leadership, the relevant departments should cooperate vigorously to complete the construction of the two nuclear power plants, assuring quality and timeliness.

D. Establish normal investment channels and adopt the self-development policy of making nuclear power self-supporting.

We suggest that in the period from 1988 to 1997 the state should allocate 8 billion yuan as nuclear power development funds for the construction of several nuclear power plants, requiring only interest payments but not repayment of capital. The marketing price of nuclear power should be the same as that of the electricity produced by the China Energy Company with pooled resources, i.e., a user price of 0.20 yuan per kilowatt-hour, deducting fuel, transport, maintenance and management costs, line losses in the power grid, and taxes, which should be retained as nuclear power development funds.

E. Find unused potential, save on investments, and increase benefits.

We must make thorough use of existing facilities in cities near nuclear power plant sites and construction nuclear power production and personnel residential bases. Bids on nuclear power plant construction projects should be solicited both domestically and abroad, and in particular we should use item-by-item requests for bids in order to choose the best organizations with which to contract.

F. Take steps to accelerate self-reliance in nuclear power plant construction and Chinese mastery of equipment supply.

Follow-on construction of nuclear power plants should rely on the domestic industrial base and real production capabilities; we should specify the percentage that should be domestically produced, and make domestic production quotas a fixed index in projects. The time schedule for Chinese mastery of the production of nuclear power plant equipment should be set scientifically with reference to the degree of technical difficulty and domestic capabilities.

Merits of Nuclear Power Argued

40130019a Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 29 Sep 88 p 3

[Article by Xu Lin [1776 2651]: "Build Nuclear Power Plants, Make the People Prosperous"]

[Text] Does China need to develop nuclear power? This is a disputed subject: some assert that we should develop it fully, while others believe that we should develop it but not to a large extent. In addition to safety considerations, the comrades who hold the latter view also have in mind the problem of economic benefits: they believe that the construction costs of nuclear power plants are too high and that, since China has abundant coal, we should focus on developing fossil-fired power plants.

To find out more about this topic, I turned to Comrade Zhao Hong [6392 1347], deputy director of the China Nuclear Industry Corporation and director of the Qinshan Nuclear Power Company, who gave me the following analysis and opinions.

He said that given the distribution of China's energy resources, exclusive reliance on fossil-fired and hydroelectric power generation would involve many problems. Although China has abundant coal resources, 60 percent of them are concentrated in north China (primarily Shanxi and Nei Monggol) and 70 percent of hydropower resources are in southwest China (primarily Sichuan, Yunnan, and Tibet), while such high-energy-consumption areas as east China, south China, and Liaoning have only slightly more than 10 percent of the country's energy resources.

This nonuniform distribution of energy resources gives rise to many problems. The first is the problem of coal transport. A fossil-fired power plant with a capacity of 1 million kW consumes 3 million tons of coal a year, or 60,000 50-ton coal cars; this places a heavy burden on rail transport, and it is said that some power plants in south China have lost generating capacity as a result of missing coal shipments. As the economy develops, requirements for coal will rise steadily, and in another 5 or 10 years this conflict will be even more acute. On the other hand, a 1 million kW nuclear power plant requires only 30 tons of fuel a year, which would greatly decrease the transport burden.

Comrade Zhao said: "As a result, China must develop its peaceful use of nuclear energy, and we should have a sense of urgency about it."

He added that developing the nuclear power industry requires the solution of two problems, namely safety and funding.

The experience of constructing the Qinshan Nuclear Power Plant convinces him that the problem of safety is soluble. He cites a most interesting fact: in the past, several international environmental groups opposed the construction of nuclear power plants out of fear of environmental pollution, but now some of them are actually advocating the construction of nuclear power plants, because experience has shown that they are cleaner than fossil-fired plants: they are concerned that accumulation of the large amounts of carbon dioxide produced by the combustion of coal may lead to a greenhouse effect, causing a rise in global air temperatures, which would result in droughts and harm human life and development. In addition, many people do not fully understand that coal too contains small amounts of radioactive substances and other harmful materials which are discharged into the atmosphere when it is burned. The amount of radioactive materials discharged by one fossil-fired power plant far exceeds that discharged by a nuclear power plant of the same capacity.

As regards funding, Comrade Zhao Hong believes that a question of accounting is involved: in terms of investment, the cost of a nuclear power plant is indeed higher than that of a fossil-fired plant. In the case of the Qinshan Nuclear Power Plant, for example, each kilowatt of generating capacity requires an investment of 4,000 yuan, while in the case of a coal-fired plant each kilowatt of capacity requires an investment of about 1,500 yuan. But in striking a balance of economic benefits, we must not exclusively consider construction costs: we must also take account of power production costs (including raw materials, buildings, depreciation, management expenses, taxes and the like). After a nuclear power plant is commissioned, it will continue in operation for at least 30 years, and its fixed maintenance, management and fuel transport costs will be very limited; in contrast, the fuel prices and transport costs of a fossil-fired power plant will be rather high. At present, nuclear power plants have lower power generation costs than fossil-fired power plants in every country.

Because the Qinshan Nuclear Power Plant is the first Chinese-designed and Chinese-built plant, rather large safety margins were provided throughout the process from design to construction, which unavoidably increased the investment. But Comrade Zhao added that we have gained experience through the construction of this first power plant, so that the construction of the next will not necessarily cost so much. Experience is now being summarized and preparations are being made to produce, in about a year, an improved project plan based on the 300,000 kW Qinshan station and to design a 350,000 kW power plant which will require a smaller investment.

"To summarize," Comrade Zhao Hong says, "China should, indeed must, develop its nuclear industry: first, because we have a great shortage of electric power, and second, because exclusive reliance on fossil-fired power

generation will not enable us to keep up with requirements, and the shortages will become increasingly large; third, the pollution produced by coal-fired power generation was hitherto neglected, but it must be taken into account in the future." He then cited data on electric power consumption in several countries: per capita consumption is more than 10,000 kWh in the United States and the United Kingdom, France, West Germany and the Soviet Union consume about 5,000 kWh per capita, while in China the figure is only slightly over 300 kWh, a tiny fraction of the figures for these other countries. Inadequate electric power has seriously retarded economic development.

Zhao Hong emphasized that we have the resources and capabilities to produce nuclear power and that we must no longer let the opportunity slip. If we look at other countries, France has developed its nuclear power rather rapidly because it lacks coal, oil and the like, and development is proceeding simultaneously at all levels. In Taiwan, nuclear power already accounts for more than 50 percent of total electric power output and its expansion is the general trend. "Because the construction period for nuclear power plants is rather long (generally 60 months), if we start now and make a vigorous 10- or 15-year effort, I believe that by the end of the century we can have constructed 5 or 6 million kW of capacity and have an additional 5 or 6 million kW under construction."

A huge banner fluttering above the Qinshan Nuclear Power Plant construction site that reads "Construct Nuclear Power and Make the People Rich" expresses the resolution of all personnel involved in the project and their desire to develop the fatherland's nuclear power industry.

Nuclear Power as Only Viable Answer to Projected Energy Needs

40130106 Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 4 Aug 88 p 2

[Article by Wen Hongjun [3306 7703 6874]: "More Discussion on Prospects for Developing Nuclear Power in China"]

[Text] RENMIN RIBAO (Overseas Edition) recently opened a discussion of the prospects for developing nuclear energy in China, and it has been very meaningful. I want to offer my own views on this issue.

I. In View of the Characteristics of China's Energy Resources, China Certainly Must Develop Nuclear Power

China's energy resources have several characteristics: 1) China is rather rich in total energy resources but not so in per capita terms. 2) Coal accounts for an especially large proportion in the structure of China's energy resources, which means that coal will continue to dominate the structure of China's primary energy resources for a long time. 3) The geographic distribution of China's energy resources is very uneven, with 78 percent of proven coal reserves being located in north and northwest China, including 56 percent in Shanxi and Inner Mongolia. In contrast, there are severe energy shortages in the economically developed coastal regions of eastern China, particularly the Chang Jiang delta and Zhu Jiang delta. Thus, China's coal must be shipped eastward and southward over long distances.

On the other hand, because only a small amount of fuel must be shipped to nuclear power plants and because they cause little environmental pollution, developing nuclear power in the economically developed areas of eastern China is an effective way to solve China's energy problems.

II. Considering a Balance Among Electric Power, Coal, and Transportation in China in the Late 20th Century, China Needs Nuclear Power Now

According to repeated calculations by the relevant experts in China and foreign countries and to analytical forecasts by actual planning and administrative departments, it will be hard to get by without primary energy resources of 1.6 billion tons of standard coal in the year 2000, given that after a major effort to develop petroleum, natural gas, and

hydropower resources, we still must produce about 1.6 billion tons of standard coal. Based on the 1.6 billion ton coal projection, we would have to build the equivalent of the Da-Qin Railway No 2 line and matching harbor. It is apparent that we will need a substantial amount of nuclear energy by the end of this century to compensate for the energy shortage mentioned above.

III. In View of a Balance Between Supply and Demand for Primary Energy Resources and Power Generation Resources in the Early 21st Century, the Need for Nuclear Power Is Even More Urgent

According to projections by relevant experts in China and foreign countries and our own forecasts, and considering technological advances and energy conservation, we will require primary energy resources of about 2.6 billion tons of standard coal in the year 2015. If we wish to maintain the primary energy resource structure at its best level in history (with coal accounting for 70 percent of primary energy resources), with no improvement, then we will need approximately 30 million kW in nuclear powered installed generating capacity in 2015. If we wish to use nuclear energy to provide one-third of increased power output in the 12 provinces and municipalities along China's eastern coast in the 21st century, the required nuclear-powered installed generating capacity in the year 2015 will be 50 to 60 million kW. It is apparent that nuclear power may develop at a substantial scale in the 21st century.

IV. In the Early 21st Century, Nuclear Power Must Develop at a Faster Pace

According to preliminary long-term forecasts for 2030 to 2050, our petroleum resources (the most optimistic estimate is 70 billion tons) will have been consumed completely before 2030 and developable hydropower resources will have been fully developed before 2030. In the mid-21st century, energy resources will rely even more on coal and nuclear power. However, transportation and the environment place restrictions on coal, so nuclear power may develop more quickly during the early 21st century.

V. The Central Task Now in the Development of Nuclear Power in China Is To Achieve Autonomous Decisionmaking and Shift to Domestic Production of Nuclear Power Equipment

The actual proportion of China's future energy resources which nuclear power will account for and the size of the role it will play in the national economy will be determined by whether or not we can stand on our own and be victorious in enabling nuclear power to compete in energy resource markets and electric power markets with other energy resources, especially coal-fired power plants. If nuclear power achieves superiority earlier, which would make its superiority even more apparent and gain true acceptance by everyone, the funds needed to develop nuclear power will be easier to raise, and it will develop faster and on a larger scale. Thus, the central task in the present stage of China's nuclear power development is to achieve autonomous decisionmaking regarding nuclear power plant construction by building certain nuclear power plants and gaining a grasp of nuclear power

technologies (including design, equipment manufacturing, construction, engineering and management, and other technologies). This means gaining the capacity for self-design, self-organization of construction, and self-management, and producing nuclear power equipment in China to reduce investments in nuclear power plant construction, reduce power generation costs, and improve nuclear power's ability to compete in the electric power market.

VI. The Ability of Nuclear Power To Compete in the Energy Resource and Electric Power Markets

At present, there are three levels of newly constructed coal-fired power plants in China, based on their economy. The first level is coal-fired power plants near coal-producing areas which have lower coal prices and power generation costs. The second level is coal-fired power plants in coastal regions of eastern China distant from coal-producing areas. Coal prices after transportation costs are added make it a fairly expensive fuel, so their power generation costs are higher than those coal-fired power plants described previously. The third level is a group of coal-fired power plants along China's east coast which are under construction and which utilize foreign investments and imported equipment because China lacks the capital and capacity to manufacture power plant equipment. The total investments and power generation costs in these power plants are higher than those for power plants at the second level.

Overall, the economy of China's nuclear power has gone through three stages. In the beginning stage, our lack of technology forced us to import equipment and technologies, our lack of administrative experience created losses, and so on, so economically it was unable to compete. In the second stage, during the process of achieving autonomous decisionmaking regarding nuclear power construction and domestic manufacture of nuclear power equipment, investments to construct nuclear power plants and the costs of power generation declined gradually. In the third stage, which runs to the end of this century, the expanded scale of nuclear power development will reduce the cost of uranium isotope separation and the cost of equipment manufacturing.

VII. China's Nuclear Resource Supply Problems Can Be Solved by Strengthening Geological Prospecting and Developing Fast Reactors

As for the question of nuclear fuel resources, according to analytical studies of the results of more than 30 years of geological exploration in China by Chinese uranium ore geology departments, there are good prospects for finding additional economically recoverable reserves in China. China is relatively well-endowed with natural uranium resources compared to other nations of the world.

According to preliminary forecasts, we can solve the nuclear resource problem simply by immediately importing fast neutron reactor nuclear power plants with better breeder performance.

Experts Urge Solid Commitment to Nuclear Power Construction

40130033 Beijing GUANGMING RIBAO in Chinese 14 Oct 88 p 1

[Text] In a conference [focusing] on China's nuclear power industry in the 1990's that concluded today, more than 90 atomic energy experts made the following appeal: The development of nuclear power should be placed at the top of the national agenda so that the role of nuclear power in the nation's overall energy picture will be felt before the end of the century.

Today, many areas of the country are experiencing a power shortage. According to estimates, because of the power shortage last year, 25 percent of the nation's industry was idled for a loss of 400 billion yuan in production value and 50 billion yuan in revenue. Moreover, the development of China's hydropower is restricted by regional and seasonal factors and thermal power suffers from insufficient coal resources and railroad haulage capacity. Thermal power also is responsible for massive environmental pollution. This leaves nuclear power as the direction in which to develop the nation's energy resources.

Today, the Chinese-designed-and-built 300,000-kilowatt Qinshan nuclear power plant is in the full-scale installation stage and is expected to go on stream in the late 1990's. The Daya Bay nuclear power plant in Guangdong, which will use two imported 900,000-kilowatt units, is now under accelerated construction. In addition, in the Ninth 5-Year Plan, China will build four 600,000-kilowatt facilities. Two of these units will be in the Qinshan second-stage project for which ground has already been broken.

The experts believe that the country should draw up mid- to long-range plans so that before the year 2000 the technology will be mastered and the foundations laid to construct a number of safe and reliable nuclear power plants. After the turn of the century, nuclear power should grow by 1.2 million kW a year, steadily replacing coal-fired power as the nation's primary energy source.

At present, funding is a major problem for nuclear power construction. The experts are of the opinion that the matter must be decided by the central authorities, local government, and the nuclear industry, so that nuclear power will enjoy consolidated management, multiple sources of funds, and joint operation.

The 300-megawatt Qinshan power plant, the experts say, employs international standards, proven technology, and is safe and reliable. In the future, based on the experience gained in the building of Qinshan, China, cooperating with foreign interests, will realize the standardization of 600-megawatt pressurized-water reactor units and domestic batch production.

Four Provinces To Cooperate in Developing Thermal, Hydropower

40130013 Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 3 Sep 88 p 3

[Text] Nanning (ZHONG XINSHE)--Under the leadership of the Ministry of Energy and the National Energy Investment Company, four provinces--Guangdong, Guizhou, Guangxi, and Yunnan--recently reached a joint agreement to build three thermal power plants and two hydropower stations.

The terms of this agreement include the following: Guangdong and Yunnan provinces will enter a joint venture with the National Energy Investment Co. to fund the construction of the 60-MW Baishui hydropower station located in Quqing County, Yunnan Province, and its 220-kV transmission line project; Guangdong and Guangxi provinces will enter a joint venture with the National Energy Investment Co. to fund the first-stage construction of the Anshun thermal power base in Guizhou Province which will have a total capacity of 2,400 MW (the first stage will have a capacity of 600 MW); Guizhou and Guangxi provinces will enter a joint venture with the National Energy Investment Co. to build the 600-MW Pan Xian thermal power plant in Guizhou Province; and Guangdong, Guizhou, and Guangxi provinces will enter a joint venture with the National Energy Investment Co. to fund the construction of the 1,600-MW first-stage hydropower station located at Tianshenqiao on the Hongshui He. In addition, the Ministry of Energy, the National Energy Investment Co., and the provinces of Guangxi, Guizhou, and Guangdong have signed a letter of intent to jointly fund the construction of the Longtan hydropower station on the Hongshui He.

The above projects will provide a total capacity of 5,240 MW. The first stage construction will provide a capacity of 3,440 MW, of which 1,800 MW will be thermal power and 1,640 MW will be hydropower. Guangdong Province will provide over half of the total investment of 7 billion yuan; only 20 percent of the funds will be provided by the State Treasury.

In the past, Guangxi, Guizhou, and Yunnan provinces were unable to develop their hydropower and coal resources due to shortage of funds; Guangdong Province, on the other hand, is extremely poor in energy resources. Therefore, all provinces are expected to benefit by pooling their financial and natural resources. According to recent reports, with the exception of the Longtan hydropower station, for which an agreement cannot be signed until its preliminary design is certified, initial preparation or actual construction for the other four projects will begin the second half of this year, and production is expected to begin over the period from 1991 to 1994.

Plans Formulated To Ensure Heating Fuel Supply

40100014c Beijing CHINA DAILY in English 18 Oct 88 p 3

[Article by Cao Yong, staff reporter]

[Text] As cold weather sets in across the northern provinces, China is making all possible efforts to tackle the country's acute coal shortage and ensure the supply of fuel for heating.

The State Planning Commission has reaffirmed a 1987 State Council decision to economize in the use of electric power, demanding that the production of non-essential goods be reduced in order to save coal for heating homes in winter, a senior commission official said.

Despite the difficulties, government departments involved in coal production, transport and supply will give top priority to electric plants and civil use, the official said.

In Beijing, the city's General Coal Corporation is now seeking more sources of coal. This winter, the supply of coal for civil use will be a little more than last year's 2.1 million tons, said Yu Jingchun, an official of the corporation.

The price of coal for civil use will remain unchanged under the government's subsidy, Yu added.

China relies on coal for 76 per cent of its energy needs. Last year's coal production stood at 925 million tons, making China the world's largest coal producer.

The first half of the year saw a 4.6 per cent increase in coal production compared with the same period last year.

In coal producing areas, there is now a stock of 23 million tons of coal, a 4-million-ton increase since the beginning of the year. Some mines even have to stop their production because of too much stockpiled coal, said Chen Honghua, an official of China General Corporation of State-run Coal Mines.

Since January, the increase in industrial consumption of coal in China has outstripped coal output by 10 per cent. This, plus inadequate railway transport capacity, has aggravated the coal shortage. In China, transportation of coal accounts for 40 per cent of the volume of freight trains.

The most affected areas are the south and east parts of China. In Jiangsu Province, 40 per cent of power generators have had to stop because of coal shortages since August.

Miners in 32 coal mines in East China are racing against time to produce 5 million tons more coal in the last quarter of this year than planned.

These coal mines are in densely populated areas and have easier access to transport. The additional coal might suffice to meet the immediate needs of these areas.

Luo Yunguang, Vice-Minister of Railways, has called a series of conferences with heads of local railway bureaus directly responsible for coal transport.

Participants in such conferences have decided to increase the number of special trains for coal transport.

Installation of Power Equipment Falls Behind Plan

40130025b Changchun JILIN RIBAO in Chinese 14 Sep 88 p 3

[Text] XINHUA--Progress in the construction of China's electric power industry has been slow. In the past 8 months, only 25 mid- to large-size generating sets with a total installed capacity of less than 4 million kilowatts have been built and have entered operation nationwide. This is less than one-half of the year's planned new capacity of 8.113 million kilowatts.

That this has not been accomplished has received attention from all quarters. On 10 September, Deputy Director of the State Planning Commission Chen Guangjian convened this year's Eighth Electric Power Management Conference. The Ministry of Energy Resources, Ministry of Machine Building and Electronics Industries, Ministry of Materials, Ministry of the Metallurgical Industry, Ministry of Railways, Ministry of Commerce, the China Energy Resources Investment Company, and Huaneng Electric Power Company, all assigned personnel to participate and discuss ways of dealing with this situation.

The attending representatives were anxious as they analyzed the reasons why electric power construction has not received first priority. Many comrades consider that investment is lacking. That many enterprises show no interest in bonds issued to support electric power construction is a major factor influencing this year's electric power project construction. According to our understanding, this year's investment in basic electric power construction fell short by 1 billion yuan. Electric power construction bonds issued last year by the Gezhouba power station, a focus of world attention, have not been completely sold. This year, 250 million yuan in new bonds were issued, while to date only one-third have been sold.

Delays in the delivery of ordered generating equipment and substandard quality both constitute important factors restricting the progress of electric power projects. Because of the above, entry into operation of the 14 generating sets and 1.943 million-kilowatt generating capacity estimated for the entire country will be delayed until December.

Insufficiency in transportation and fuel also contributes to sluggish progress on electric power engineering projects. According to the response of representatives of China Power Company, progress on China's first domestically built generating set, the 600,000-kilowatt Pingyu Number One, has been very smooth. It may be said that everything is prepared, however, the fuel supply arrangements are not workable.

August Energy Figures Released

40100014b Beijing CEI Database in English 29 Sep 88

[Text] Beijing (CEI)--Following is a chart of China's total output of primary energy production in August 1988, released by CSICSC [China Statistical Information and Consultancy Service Center]:

Item	Unit	1-8/88	8/88	Percentage compared with 1-8/1987
Total output (10,000 tons of standard coal)		60588.0	7685.0	104.44
A. Raw coal including:	10,000 tons	61002.0	7622.0	104.67
Output under unified central planning	10,000 tons	29584.0	3645.0	102.90
B. Crude oil	10,000 tons	8996.2	1145.7	102.09
C. Natural gas	100 million cubic meters	95.81	11.9	101.46
D. Hydropower	100 million kWh	716.4	110.4	113.73

World's First Hydrogen Engine Developed

40100014a Beijing CEI Database in English 23 Sep 88

[Text] Shenyang (CEI)--The first hydrolysis oxyhydrogen engine in the world was recently developed in China's northeastern province of Liaoning.

The pollution-free water-fueled engine can be installed in various types of automobiles, tractors, trains, ships and boats, and generators or generating sets.

The invention and application of the engine will change the main body of energy in the world today and usher in a new era of hydrogen energy.

The engine was invented under the supervision of Zhang Xueming, deputy director and chief engineer of the China Hydrogen Energy Research Institute and senior advisor to the Shenyang Municipal Urgan Economic and Technological Development Corporation. It was successfully trial-produced in May this year.

The invention was registered at the State Patent Bureau of China on August 17, and a prototype of the engine will be displayed at the Beijing International Inventions Exhibition in October 1988.

Japanese Urged To Invest in Energy Projects

40100010 Beijing CHINA DAILY in English 18 Oct 88 p 2

[Article by Zhang Yu'an, staff reporter]

[Excerpts] China hopes more Japanese will invest in the country, a high-ranking Chinese official said at a meeting with a Japanese delegation in Beijing yesterday.

Chen Guangjian, vice-minister of the State Planning Commission, said contracts already signed with foreigners will be carried out in line with original agreements, and more foreign investment is welcome.

The delegation consists of 86 Japanese businessmen and government officials and will stay in China until October 25.

Chen was mainly concerned with introducing delegation members to China's investment conditions and potential.

By the end of last year, he said, China had a total electricity generating capacity of about 100 million kilowatts, and could generate 500 billion kilowatt-hours of electricity. Of the total supply, coastal provinces and cities used up about 50 per cent, indicating that the supply to coastal areas is better than that of inland areas.

The country is rich in hydroelectric power resources, with about 380 million kilowatts in capacity.

But current hydroelectric power stations only use about nine per cent of total resources; the main resources are the Yangtze River, the Yellow River and the Zhujiang River, so there is huge potential for further development in this field.

The country has total deposits of 860 billion tons of coal. About 20 per cent of coal production is used for the generation of electricity.

Although coastal areas are currently short of coal supplies because of limited transport ability, the country is making great efforts to rectify the situation.

The Datong-Qinhuangdao Railway, a special coal transportation route between Shanxi Province and the coast, will soon provide an important link.

The western section of the railway will be put into use by the end of this year, and when the line is fully open, its annual coal transportation ability will be 100 million tons, Chen said.

In the long run, hydroelectric and coal-fuelled power stations will be connected into single networks; China plans to establish three such networks across the country.

In the north, the network will be based on the Yellow River and the coalfields and thermal power stations in Shaanxi, Shanxi and other eastern provinces and cities.

In the Central China, the network will draw its power from the Yangtze River and East China thermal power stations, and in the south, the third network will cover Guangdong, Guangxi, Fujian, Yunnan and Guizhou.

Chen said that China is actively developing its power industry, but not as much as it would like because of a shortage of funds.

Chen said the country is also very rich in iron ore for its iron and steel industry. Construction work is planned for Jidong Iron and Steel Works in Hebei Province, and Ningbo and Shijiusuo are suitable sites for other large iron and steel works.

Northeast Power Shortage Seen Worsening, Action Urged

40130024b Changchun JILIN RIBAO in Chinese 31 Aug 88 p 1

[Text] Because of this year's low rainfall and fuel shortage, the generating capacity of both hydroelectric and steam generating sets has decreased, creating a serious overconsumption problem. In the Northeast Power Grid a serious power shortage situation has already developed. Because of this, the Provincial Economic Planning Committee and the Provincial Bureau of Electric Power recently issued an urgent notice requiring all relevant departments and large power consumers province-wide to adopt resolute methods to control this situation, to avoid creating a collapse of the power grid.

In the first half of this year, the use of power by all enterprises increased very rapidly. Power consumption by the people in their daily lives grew even more rapidly, therefore each province in the grid greatly exceeded its planned consumption. Under circumstances of limited steam generation capability and in order to maintain the power cycle and safe operation of the grid, electric power bureaus had no alternative but to excessively increase hydroelectric generation. Nevertheless the power shortage is still worse than before. In only the first half of the year, the Northeast Power Grid restricted power to Jilin 338 times for an accumulated total reduction of 297 million kilowatt-hours. July and August were even more serious, already having been limited to 283 million kilowatt-hours. Throughout the province, this has made it impossible to rationally organize production and has brought extremely great difficulties to the lives of the people. Even more serious is the fact that Jilin's average daily consumption needs for the last 4 months of this year will be 46.7 million kilowatt-hours while only 38.25 million kilowatt-hours can be supplied. This constitutes a daily shortfall of 8.45 million kilowatt-hours. Both economic construction and power grid safety will be seriously threatened.

In the urgent notice issued by the Provincial Economic Planning Committee and the Provincial Bureau of Electric Power four requirements were advanced: 1) Management of power consumption quotas must be strictly planned. The Electrical Industry Bureau is required to take responsibility for consumption planning. No region can exceed its quota. 2) All methods must be used to accomplish the work of energy conservation. New load expansion must be strictly controlled. Beginning 1 September, except for municipal government

usage, all other increases in consumption will be temporarily stopped. All nonproductive energy consumption must be managed on a quota basis. Energy conservation measures must be implemented through promotion of high efficiency, energy-saving technology and equipment. Concerning hotels, restaurants, institutions, stores and businesses, installation of climate control equipment, e.g., air conditioning, electric heating, etc., must be strictly controlled. Residential use of electrical appliances during peak periods will be restricted. 3) Relevant departments must assist in completion of this year's new construction of generating sets to facilitate early commencement of power generation. Each self-supplying power station enterprise and transportation department must cooperate to generate more power and accelerate accumulation of fuel reserves. 4) The electric power departments must execute inspection and repair, do their best to reduce incidental inspections, and achieve steady, full power generation. Fuel transport and coordination work must be organized so that fuel delivery can be increased. Time must be put to good use in stockpiling more coal. The utilization of the potential of retired and oil-fired generators must be increased and power generation other than that which is planned must be actively organized. Power generation from reprocessed materials must be organized.

Heilongjiang Faces Power Shortage This Winter

40130026a Harbin Heilongjiang Provincial Service in Mandarin 2200 GMT 17 Oct 88

[Text] This winter and next spring, the northeast power grid will face the grimmest situation in 10 years. Affected by this situation, Heilongjiang will also have a comparatively serious power shortage. The provincial electric power departments have decided to adopt measures to ease the shortage in power supply.

Owing to the fact that the five major reservoirs have been seriously short of water, there has been a shortage of coal supply for thermal power generation, and the power consumption load continues to increase, the northeast power grid has witnessed a situation of severe shortage in power supply. It is estimated that in the fourth quarter, we will lack some 600,000 kW or more of power generation.

In this connection, the provincial electric power departments have decided to adopt measures of "two-controls and two-guarantees" on the basis of stabilizing power generation, generating more electricity, and ensuring more power supply. First, efforts will be made to control power consumption of large power-consumers and power consumption for producing products that need great power consumption and to guarantee the power supply for the light industrial market, the livelihood of city dwellers, hospitals, radio stations, tap water supply, gas supply, communications, colleges, universities, and departments in charge of confidential or important work. Second, efforts will be made to accelerate the rate of power construction and actively organize power generation from new power generating sets. Efforts will be made to strive to put into operation ahead of schedule the No 5 200,000-kW power generating set of the No 2 Fulaerji power plant and the No 2 25,000-kW power generating set of the Harbin power plant which are planned to be put into production this year. While doing a good job in fuel supply and deeply tapping potential, it is necessary to use power economically and to do a good job in easing the power shortage in an effort to alleviate the shortage in power supply.

Outlook Grim for Coal-Dependent Electric Power in Anhui

40130023 Hefei ANHUI RIBAO in Chinese 23 Sep 88 p 1

[Text] Since August, the outlook for the province's coal-dependent electric power sector has become bleaker compared to the first part of the year. This has adversely affected power generation and imperiled the safety of the power grid, and the situation is deteriorating even further.

From September to December, the province's planned output of electricity is 5.933 billion kilowatt-hours; planned transmission is 627 million kilowatt-hours; and consumption is projected at 5.506 billion kilowatt-hours. The average daily consumption is set at 45.13 million kilowatt-hours. This would indicate a reduction of 1.8 million kilowatt-hours as compared to today's usage. From September to December, the province's power sector will require some 3.3 million tons of coal but is short 608,000 tons. Added to this is low output from the mines: as of 7 September, there were only 139,200 tons of coal stockpiled for the power sector, enough for a mere 4 days. The grid has been operating at reduced voltage--between 49.22 and 49.6 Hertz--for the last several days.

On 19 August, the provincial leadership issued an urgent notice requesting all cities and electric power departments to properly organize supplies of coal for power generation. They also requested the Lianghuai and Northern Anhui mining bureaus, ports, Chang Jiang river shipping, electric power departments, fuel companies, and other units to pay strict attention to handling coal, power supply, and shipping work in order to assure a supply of electricity for the province.

Guangdong Faces Acute Power Shortage

40130029 Guangzhou NANFANG RIBAO in Chinese 16 Sep 88 p 1

[Text] Relevant provincial offices have recently revealed that in the past 4 months of this year, Guangdong's coal and electric power have remained in short supply, and stressed that the province-wide effort to conserve energy cannot be relaxed.

This year, to meet the needs of economic growth, Guangdong will consume approximately 22 million tons of coal. However, the province can supply only 8 million tons itself, providing some 5.33 million tons in the first 8 months of 1988. The state has allocated 8.83 million tons but only 4.641 million tons were supplied in the first 8 months of the year, a shortfall of more than 1.5 million tons. The electric power supply continues to be strained. Last year, although the province added more than 1 million kilowatts in installed capacity, or more than 10 million kilowatt-hours a day--30 percent greater than the original capacity--because of industrial and production growth, especially the increase in the number of large hotels with the accompanying increase in the amount of electricity needed for air conditioning, the power supply situation experienced the same "gap" as in previous years. In addition, this year many power plants were unable to operate at full capacity. The electric power output from the 700,000-kilowatt No 2 unit at the Shajiao-B power plant was reduced by 6-7 million kilowatt-hours a day. These conditions will create a fourth quarter power supply situation more severe than that experienced in the third.

Zhejiang Power Shortage Prompts Call for Conservation

40130022 Hangzhou ZHEJIANG RIBAO in Chinese 25 Aug 88 p 1

[Text] Recently, because of a critical shortage of coal used for electric power generation in the East China region, Zhejiang's electricity usage quotas have been greatly reduced. Also, at each of the province's coal-fired and hydroelectric generating facilities serious shortages of coal and water have occurred. This is causing, throughout the province, a situation of unprecedented difficulty. The provincial electric power office has adjusted and issued electric usage quotas, demanded strict control of excessive consumption of electricity, and strengthened electricity conservation measures.

Since July, Zhejiang has suffered successive natural disasters including drought, storms, and typhoons. Currently, the disaster areas are putting into effect self-help through production, and rebuilding homes. Their need for electric power is extremely critical. The provincial Bureau of Electrical Power has many times requested of the Department of Energy's East China Electrical Power Administration that a special allotment of power be made. However, because of the coal shortage in the East China region and the inspection and repair of broken-down generating units, Zhejiang's daily peak load quota was cut by 60,000 kilowatts. Apart from this, Zhejiang's reserves of coal used for power generation have abruptly decreased. The large coal-fired power plants have reported one crisis after another. Because of the excessive electrical demand created by the recent drought, reservoir water levels are 6 meters lower than during the same period last year. In order to ensure the needs of navigation and irrigation for this winter and next spring, water levels must be controlled. Most small hydropower stations are already unable to generate electricity. All of this has exacerbated Zhejiang's existing power shortage. The grid is often in low cycle operation causing a daily drain of 30,000 kilowatts, and Zhejiang's average daily power shortfall is 8 million kilowatt-hours, nearly equal to twice the daily output of the Banshan power station.

In late August the provincial electric power office had already adjusted and issued electrical consumption quotas. They required the economic committees of each municipality and area to arrange through unified planning to ensure achievement of important points and to reduce some of the less important power consumptive products, to strictly control excessive use of electricity,

and to act positively to conserve electric power. The Ministry of Energy is currently trying every possible method to obtain coal resources and oil-produced electrical power. Simultaneously, they are painstakingly maintaining the generating units to sustain normal operation and doing their utmost to generate and supply more electricity in order to avoid power rationing over large areas.

Jilin To Accelerate Power Industry Construction

40130024a Changchun JILIN RIBAO in Chinese 6 Sep 88 p 2

[Excerpts] Power industry development is a prerequisite for economic development.

The economic development experience of China and the world both confirm the necessity of giving priority to power industry development. Only through first developing the power industry can the whole national economy attain a corresponding level of development. If the power industry cannot progress, this will influence the overall situation of the national economy.

After liberation, development of China's power industry was very rapid. As of 1987, the installed generating capacity nationwide was 100 million kilowatts. This represents a 55-fold increase since 1949. Such fast-paced development still could not satisfy the requirements of developing the national economy.

The situation in Jilin is the same as that of the country as a whole, there has been a long-term shortage of electricity. During the 50's and 60's, Jilin was a large power generating center in China; there was a power surplus. Every year some of the power was exported to Liaoning and Heilongjiang. After the 70's we fell behind, falling from the among the top several out of the top 10 provinces in terms of generating capacity. Not only did we go from a power surplus to a power deficit situation, but the deficit became more serious with each year, reaching a province-wide average shortfall of 15 to 20 percent. This year the shortage is especially apparent. In the past, it was always most serious during the spring and winter seasons, moderating in summer and fall. This summer and fall there was still a drain on the limited power in the Northeast Power Grid, which affected Jilin's industrial production and day-to-day life. Each kilowatt-hour can create 2.5 yuan in production output value. Province-wide, the annual shortfall is 2 billion kilowatt-hours, or the equivalent of a 5 billion yuan loss in output value.

The cause of Jilin's power shortage is that electric power was not developed in advance. From 1979 to 1986, not one new large-scale generating set was added to Jilin's electric power system. As of last year, only two 20,000-kilowatt generating sets had entered operation.

The key to developing the power industry is acceleration of power source construction. Unless the number of power sources increases, it is impossible to greatly increase power generating capacity.

In the past few years Jilin has learned the lessons of the past and placed a priority on power source construction. During the Seventh 5-Year Plan, there will be construction of new generating sets for a province-wide increase totaling 1.2 million kilowatts. Included is a 400,000-kilowatt expansion of the Changshan power plant, a 400,000-kilowatt expansion of the Jilin thermal power plant, new construction totaling 200,000 kilowatts at the Hunchun power plant and new construction at the Changchun main thermal power station totaling 200,000 kilowatts. During the Eighth 5-Year Plan a large-scale power generating base will be built at Shuangliao in Jilin Province. The first phase of construction will result in an installed capacity of 1.2 million kilowatts. The feasibility study on this project has already passed an evaluation by national experts. They will strive for as early a start on construction as possible. Also, the Hun Jiang and Erdao Jiang power plants will also be expanded. At Siping, a thermal power plant will be built primarily to supply heat for the city. On the upper reaches of the Songhua Jiang a group of mid-sized hydropower stations will be constructed.

This year the scale of electric power construction is greater than ever before. Five mid- to large-scale power facilities on which expansion or new construction has begun simultaneously. The Provincial Electric Power Bureau is concentrating its efforts in the organization of construction. Through the struggle of large contingents of workers in every area of construction, progress has been rapid, even more rapid than planned. The second 200,000-kilowatt generating set of the Changshan thermal power plant expansion has already entered the final construction phase. It is expected to commence operation in October. Several thousand workers of the Provincial Power Company responsible for installation are working night and day. Urgent construction is also under way on the second 200,000-kilowatt generating set in the Jilin thermal power plant expansion. Operations are expected to begin in the first half of next year. Progress on the new construction projects at the Changchun thermal power plant has been rapid since the formal beginning of construction on 1 June. Work on all of this year's eight main items has begun and construction of the 180-meter smokestack is almost finished. The new construction project at the Hunchun power plant has also come along very rapidly. In October the boiler of the first 100,000-kilowatt generating set will be ignited. Construction at the Hun Jiang power plant is also progressing quickly.

The acceleration of power source construction requires the use of large generating sets. Utilizing large generating sets not only can accelerate construction progress but also is an important method of saving energy resources and increasing the profit of the enterprise. In the past, Jilin's largest generating sets only produced 100,000 kilowatts. Only last year was the first group of 200,000-kilowatt generating sets completed and put into operation. The Shuangliao power plant will utilize 300,000-kilowatt generating sets. After these large generating sets successively come

on line, the provincial power system's coal consumption will fall significantly and the industry's profit will increase by a large amount.

If power industry construction is to be accelerated, the traditional ideas on establishment of the industry which rely solely on central government investment and individual management must be changed. The central government, localities, businesses and individuals must all be mobilized. Multichanneled and multifaceted financing methods must be carried out. The above approach will pave a new road for increasing the pace of power industry construction. Construction at both the Changchun thermal power plant and the Hunchun power plant was jointly funded by Jilin Province and the central government. The expansion at Hun Jiang and the new construction at Shuangliao also will utilize cooperative funding between the locality and the central government has already changed the exclusive reliance of power industry construction on state funding methods. Local financing will play a larger role in power industry construction. However, Jilin's financial situation is difficult, so the problem of financing the power industry is greater. We must boldly reform, and further the widening of channels of investment in power industry construction. Also, conditions must be created which are conducive to attracting large amounts of foreign investment. Jilin has recently established an electric power investment company and publicly recruited a general manager. This company will soon begin its work. The company will attract investment through all kinds of channels to increase the pace of power industry construction.

The scope of power industry construction is large and a great deal is involved. Relying solely on electric power departments is not adequate. The support of the entire province is required. We are confident that under the leadership of the provincial party committee and the provincial government, with the support of the people of Jilin, we can accelerate the pace of power construction and very soon reverse the province's power shortage situation.

Sichuan Takes Steps To Promote Energy Construction

40130025a Chengdu SICHUAN RIBAO in Chinese 3 Aug 88 p 1

[Excerpt] At the first conference of the Seventh Provincial People's Congress, the tension over energy supplies was one of the "four popular topics of discussion." Some of the deputies jointly signed and submitted a proposal on this subject. How has the situation developed in the past 6 months? Yesterday (2 August) afternoon Vice Governor Ma Ling reported to the fourth conference of the Standing Committee of the Seventh Provincial People's Congress on the energy production and construction situation in Sichuan.

Reporters learned that in the first half of this year Sichuan's energy production maintained relatively good development momentum. Coal, crude oil, and natural gas production increased over the same period last year by 10.27 percent, 0.85 percent and 2.71 percent respectively. Electrical generating capacity reached 13.805 billion kilowatt-hours, an increase of 13.75 percent. The planned production amounts for coal, electric power, oil, and natural gas will all be achieved or exceeded. The power industry has already ratified capital construction planning on an overall scale of 7.35 million kilowatts. Included are the Tongjiezi, Baozhusi, Ertan, Baima, Jiangyou, Luohuang and other power stations and plants. At the same time, the province is urgently carrying out the preliminary work on two important new construction projects. First, they are striving to obtain state ratification to begin construction next year on the Huangjuezhuang power plant. Second, they are trying to get state ratification to change the Yunlian mining district from a preparatory project in the Seventh 5-Year Plan, to a construction project.

This report also indicates that in order to accelerate the pace of Sichuan's energy construction the provincial government has already taken the following specific steps: 1) Fund raising through many departments, levels, and channels and using the method of involving many parties in energy management. Relevant departments will give a green light to, and support an early start on individual or cooperative investment projects which are completely self-funded and have workable external conditions. Channels for funding important construction projects, apart from obtaining more state funding, can be expanded through the sale of user rights, the imposition of energy development fees or surtaxes and issuance of construction bonds and stocks.

2) Formulate economic policies which benefit energy development. The provincial government has already decided that beginning 1 July, the coal mines will collect from consumers (excluding the people) a coal development fee. Request the government to increase investment through allocation of interest-free loans and reduce taxes to support development of the natural gas industry. 3) Take the electric power supply situation as the main standard in ordering projects under construction. 4) Adjust the utilization of natural gas. The structure of consumption should be improved to increase the economic benefit extracted from each unit of natural gas. Based on what has been learned, it is of primary importance to guarantee the supplies of natural gas to be used as an industrial chemical. Its use as a general fuel can be restricted. 5) Further strengthen energy conservation work, and raise efficient energy utilization rate. 6) Reform energy management systems.

Hebei Power Output Ranks Third in Nation

40130026b Shijiazhuang HEBEI RIBAO in Chinese 2 Oct 88 p 1

[Text] Our province's power industry has developed rapidly. From January to September this year, the province's power output was approximately 26 billion kilowatt-hours which was equivalent to more than 200 percent of the province's annual power output in 1977.

Over the past few years, Hebei has run power projects in various ways. In the forms of state investment, joint investment by state and the localities, local collective investment, and Sino-foreign investment, we have built and expanded the Douhe, Xiahuayuan, Matou, and Xingtai thermal power plants and the Panjiakou hydropower station. Over the past 10 years, the province's total installed power capacity increased by 2.35 million kW, which was 38.4 percent of the province's total installed capacity during the 29 years before the 11th CPC Central Committee's 3d Plenary Session. The construction of the Shangan power plant, which is built jointly with investments by our province and the Huaneng Company, is now making headway. The 350,000-kW power-generating unit of the first-phase project has already entered the installation stage and will soon be put into production. The three 200,000-kW power-generating units of the Xingtai power plant, which was a joint investment by our province and the state, were one by one put into production in recent years. The construction of the fourth 200,000-kW power-generating unit is in full swing.

At present, the total installed capacity of Hebei's power-generating units is more than 5.5 million kW, ranking sixth in the whole country, and total annual power output reached 31.127 billion kilowatt-hours, ranking third in the country.

Cascade Development Plan of Ou Jiang River Basin

40130030 Beijing SHUILI FADIAN [WATER POWER] in Chinese No 9, 12 Sep 88 pp 15-16, 5

[Summary] The Ou Jiang is located in the southeast portion of Zhejiang and is that province's second largest river system. The river basin covers an area of 18,000 square kilometers and its main stream has a length of 388 kilometers and a drop of some 600 meters. A survey and regional planning review made in 1986 indicated a reserve of hydraulic resources of 2.09 million kilowatts for a yearly output of 12.5 billion kilowatt-hours. Of this, 1.65 million kilowatts could be developed (for an annual output of 5.5 billion kilowatt-hours).

The main stream of the Ou Jiang is called the Da Xi, with the Xiao Xi, Songyin Xi, Hao Xi, and Nan Xi as the chief tributaries; the river empties into the sea at Wenzhou. Some 80 percent of the basin's area lies within a mountainous region and the remaining 20 percent in flatlands; 4.63 million people live in the basin and there are 3.18 million mu under cultivation. Rainfall is abundant--an average of 1,766 mm a year--and the average annual flow is 458 M^3/s; total annual volume is 14.5 billion cubic meters.

Planning for the Ou Jiang river basin began in 1956, and in 1958 the decision was made to make the high dam at Qingtian (on the main stream of the Ou Jiang) the principal hydroelectric power station. Work on the first stage of Qingtian began that same year. The Qingtian hydropower station was to have an installed capacity of 1.125 million kilowatts for an annual power output of 3.15 billion kilowatt-hours.

But later, because the loss from inundation would be too great (200,000 mu of land would be submerged and 300,000 people would have to be resettled), and because of insufficient funds for investment, the project was halted in 1961, after more than 40 million yuan had been spent. When construction on Qingtian was halted, the diversion tunnel had been cut, the dam-top highway completed, and most of the powerhouse work on the left bank finished. When work was resumed in 1973, two plans were evolved. One retained the Qingtian high dam as the main cascade hydropower station while the other plan called for a low dam at Huangpu on the main stream with high dams to be built on the tributaries. The latter plan prevailed.

The Ou Jiang river basin plan is for the primary purpose of power generation but also includes the development of navigation and flood control. The plan calls for the construction of the Huangpu hydropower station on the main stream of the Ou Jiang, the Jinshuitan and Shitang hydropower stations on the Da Xi, and Dachi and Tankeng on the Xiao Xi. The five large and medium-scale hydroelectric power stations of the Ou Jiang river basin have several outstanding advantages:

1) Five cascade power stations will have an installed capacity of 1.363 million kilowatts and an annual output of 3.06 billion kilowatt-hours;

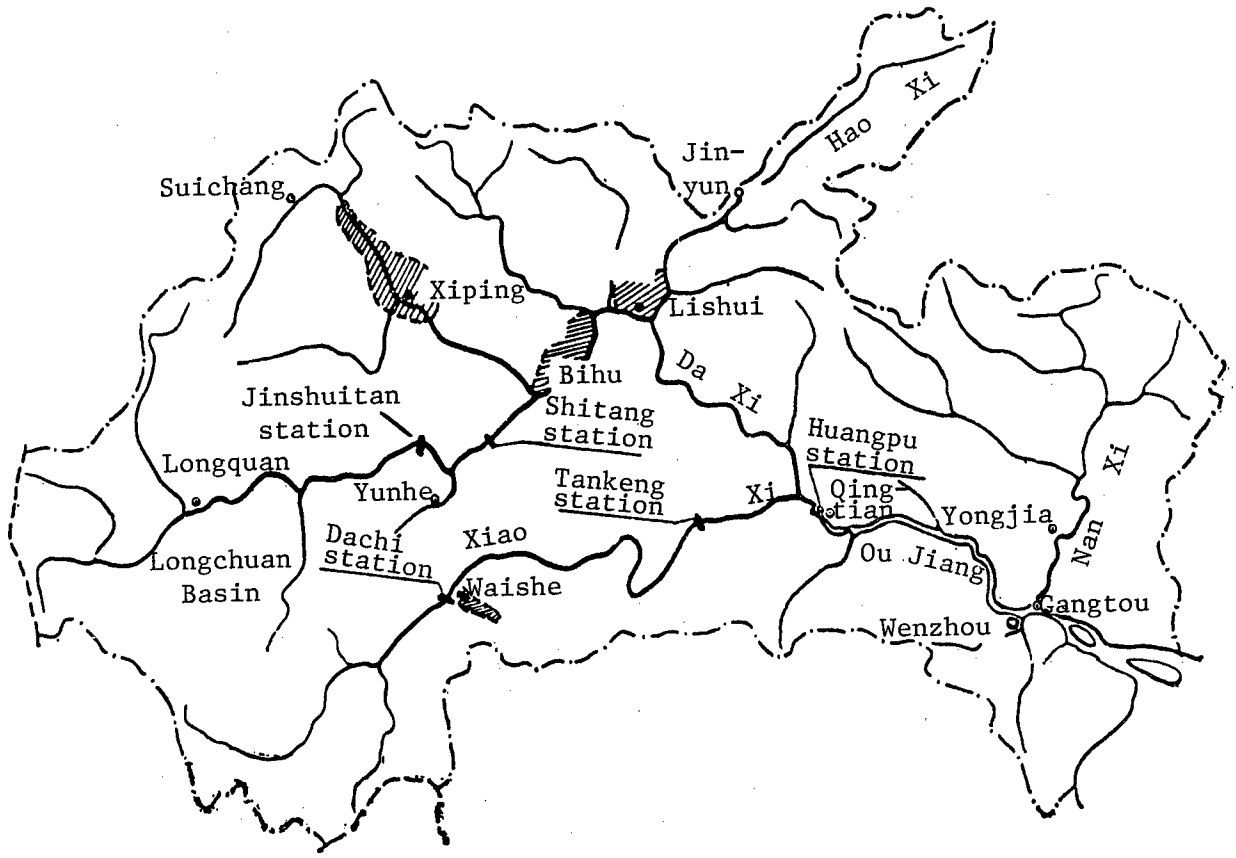
2) Jinshuitan, Tankeng, and Dachi will have excellent regulatory reservoirs capable of handling peak power regulation, frequency modulation, and accidents within the East China grid system;

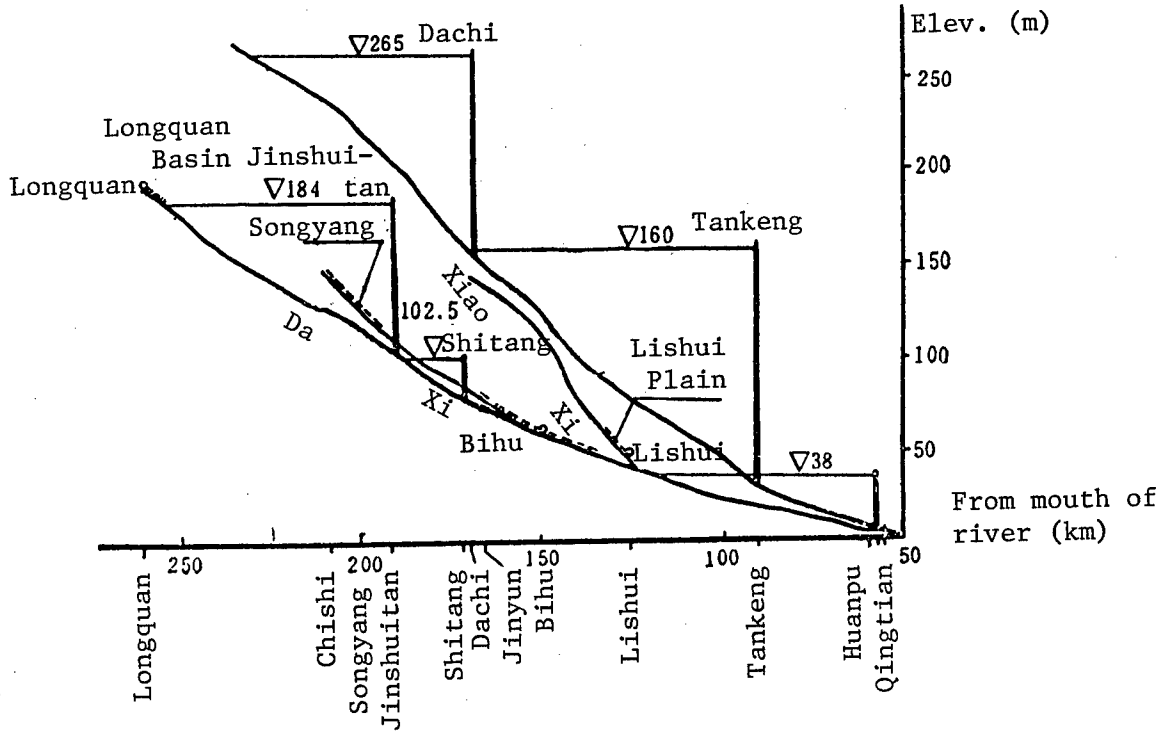
3) The natural conditions are advantageous, the geological conditions for the dam sites are good, and engineering relatively simple;

4) Geographically, the load centers are close by, the center of the river basin being only 400 kilometers from Shanghai, 200 kilometers from Hangzhou, and 100 kilometers from Wenzhou.

Data on Cascade Stations of the Ou Jiang River Basin

Item	Da Xi		Xiao Xi		Main stream
	Jinshuitan	Shitang	Dachi	Tankeng	Huangpu
Area of basin (km^2)	2,761	3,234	1,983	3,330	13,445
Normal reservoir level (m)	184	102.5	265	160	38
Normal reservoir cpty. (100 million m^3)	10.4	0.74	7.92	35.2	7
Installed capacity (10,000 kW)	30	7.8	13.5	60	25
Annual power output (100 million kW/hr)	4.90	1.89	4.95	10.35	8.46
Area of inundation (mu)	16,862	2,905	3,500	30,720	17,300
Total investment (10,000 yuan)	55,365	14,000	33,500	111,900	69,360
Unit cost per kilowatt-hour (yuan)	1.3	0.74	0.676	1.08	0.82


Suichang
Jin-
yun
Hao Xi
Xiping
Lishui
Bihu
Da Xi
Jinshuitan
station
Shitang
station
Huangpu
station
Longquan
Yunhe
Tankeng
station
Xi
Qing-
tian
Yongjia
Nan Xi
Dachi
station
Xiao
Longchuan
Basin
Waishe
Ou Jiang
Gangtou
Wenzhou


Elev. (m)
250
200
150
100
50
▽265 Dachi
Longquan
Basin
Longquan
Jinshui-
▽184 tan
Songyang
▽160 Tankeng
Xiao
102.5
Da
▽Shitang
Lishui
Plain
Xi
Xi
Bihu
Lishui
▽38
From mouth of
river (km)
250
200
150
100
50
Longquan
Chishi
Songyang
Jinshuitan
Shitang
Dachi
Jinyun
Bihu
Lishui
Tankeng
Huanpu
Qingtian

Fujian To Exploit Min Jiang Resources

40100009c Beijing XINHUA in English 1527 GMT 16 Oct 88

[Text] Fuzhou, October 16 (XINHUA)--East China's Fujian Province will try to exploit the hydropower resources of the local Min Jiang in a bid to help reduce power shortage in the locality.

This is part of a plan for the river's all-round development worked out by more than 1,000 local specialists and scholars in 6 years.

Min Jiang, with its main course extending 559 km, has an exploitable hydropower reserve of 4.63 million kW.

"Exploitation of these resources is the only way out for the province which lacks oil and coal," one of the experts said.

According to the plan, the 61,000-sq km river valley which takes up half of the province's total area will be built into a forestry, grain, tourism, and fish-breeding center by the turn of the century. It will also be improved for navigation.

Now the valley has power, paper-making, chemical, cement, and iron and steel industries with their combined output value accounting for half of the province's total.

Scientists from all over the country considered the plan as "workable" at a recent meeting called by a Fujian technical consultancy committee.

Fujian's Small Hydropower Woes Reflect National Problem

40130021 Fuzhou FUJIAN RIBAO in Chinese 26 Aug 88 p 2

[Article by correspondent Wu Pengfei [0702 7720 7378]: "The Present State of Development, and Future Prospects for the Province's Small-Scale Hydropower"]

[Text] Rivers and streams crisscross Fujian Province whose hydropower reserves are the highest in east China. The small hydropower stations that dot the landscape enjoyed a reputation even during the 1950's as "luminous pearls" of the southland. As a result of more than 30 years of building, the province's small-scale hydropower has developed from the stage of pilot projects for lighting and industrial processing to the stage of pilot projects for rural electrification. Current installed capacity and amount of electricity generated stand at respectively approximately 10 and 12 percent of the total for the country, and 10 counties have been designated national pilot project counties for rural electrification. This includes Yongan City, which ranks first in the country in terms of installed capacity and amount of electricity generated. In 1987, the province's small hydropower generated 3.24 billion kWh of electricity, or approximately one-third of all electric power generated in the province. Small hydroelectric power stations (those having an installed capacity of less than 25,000 kW) which are found everywhere in the province, have become a major integral part of the province's energy supply, and make an outstanding contribution to the economic development of the province.

Who would have thought, however, that the province's development of small-scale hydropower would have encountered very great difficulties during the past several years? A decline has occurred since 1980 in both the number of small hydropower stations built and newly installed capacity. Though 62,600 kilowatts came on stream at 155 hydropower sites in 1987, this was only three-fifths the capacity that came on stream in 1980. Furthermore, during the past 10 years, 1,053 small hydropower stations throughout the province have been scrapped. More disquieting is the large debt burden of 2,700 small hydropower stations that have been newly built and gone on stream, most of which are unable to pay interest or return capital.

Such a conflict between contribution and debt burden!

In the face of serious difficulties, some people have begun to doubt whether small hydropower is a winner in today's world in which enterprises have to produce economic returns in order to survive.

Some say there is already so much electricity that there is no need to build more small hydropower stations.

Others say that small hydropower is pollution-free, construction costs are low, social benefits are large, and the development of small hydropower shows great promise.

Some foreign traders would like the exclusive right to invest in electric power in mountain regions, or even buy up all the existing power stations, with large power grids being required to carry directly to coastal enterprises all the electricity they produced.

Some people in charge in power-short coastal areas would like to invest or engage in joint ventures to develop hydropower in mountain regions; however, they would like to be able to get on large power grids at any time in the same way as one boards a public bus, and permit the price of electricity to fluctuate.

The correspondent interviewed several experts who maintain that the old system has to be dismantled and a new road taken of operating in accordance with economic laws. Only by abandoning the traditional system of exclusive operation and supply of electric power, stimulating individual entities, collectives, and state enterprises, and attracting foreign traders to act as sole investors or to enter into joint venture to produce electricity, implementing a system whereby those who generate the electricity control the electricity will small hydropower be able to extricate itself from its predicament, survive, and develop rapidly.

This new road stems from reflection on problems existing in small hydropower during the past several years. Small hydropower problems reflect the ups and downs and the difficulties of reform, and they reflect the complex relationships and behavior among electricity producers, suppliers, consumers, managers, and policy makers. Electric power production is a point of convergence for numerous conflicts in reform today. First is the conflict between the electricity rates of the 1950's with the construction costs of the 1980's. "The sale price of 1 kWh of electricity is not enough to buy a single medium quality cigarette," said a person in charge of a small hydropower unit. Electricity for the support of agriculture is sold at 0.04 to 0.05 yuan per kWh, and to large power grids for 0.05 yuan. The electricity rates are from the 1950's, but the wage bill, and steel, lumber, and cement prices for building electric power stations have risen tremendously, and are running high right now. Before 1980, it cost between 800 and 1,000 yuan per kilowatt to build a power station, but now it costs more than 2,000 yuan. At the current price for electricity, the investment in construction of plants already on stream can be recovered in about 10 years, but for plants that go into operation now, it may not be recovered in 20 years. Since the current rates that have been in effect for 30 years seriously violate the laws of

value, the value created by power stations is artificially transferred forcibly into other sectors where returns show up. Second, loan time limits are short, and interest rates are high. One power station paid more than 1 million yuan annual interest on a more than 10 million yuan bank loan. Once the power station went on stream, social benefits were remarkable, but earnings were insufficient to repay interest. In a report to its parent unit, the power station lamented that at current electricity rates, the power station will never be able to pay interest and return capital. Such an abnormal situation can be found everywhere in the small hydropower industry. Third, power stations only generate electricity; they do not supply it. Those who generate the power go into debt while those who use the power get rich. Where there is no industry close by, some small power stations have no choice but to sell power to electric power supply units and large power grids for about 0.05 yuan per kilowatt, but large power grids have certain quotas on what they will buy during periods when plentiful water is available. Those in charge in some small electric power stations said that they have had to resort to all sorts of entreaties to get power supply units to buy electricity in order to get a larger electricity sales quota for themselves. Some small power stations that were unable to get a plan quota had no choice but to give away electricity to large power grids. Conversely, some electricity supply units have to hold down power consumption because of the shortage of electricity, with the result that some enterprises are unable to work full time. During May and June 1988, for example, electricity could be supplied only 5 days each week to Fuzhou. Industrial plants treated electric supply units with great deference in order to get an electricity supply quota.

As a result of the protracted overcontrol of small hydropower rates, and frictions between the new and the old system, as well as conflicts of interest among the various units and industries, difficulties in coordinating existing public financial relationships, and the incompleteness of some support policies, there is a serious imbalance between small hydropower rates and construction costs that has endured without resolution for a long time. The prevailing systems for small hydropower rates and for the operation and supply of electricity have put small hydropower in a predicament, thereby making it impossible for local power units to expand reproduction. Conversely, this has worsened the electric power shortage in a vicious cycle. One way to solve this problem is to readjust electricity rates. First, there has to be a coordination of the interests of the generators, suppliers, and users of electricity that enables electric power rates to fluctuate within a range that benefits producers, suppliers, and consumers. Concessions have to be made to the producers of electricity to enhance their ability for survival and self-development. At the same time, power stations will have to actively engage in diversification, doing more to produce and help themselves. Second, the limitations of the existing system have to be removed and social forces brought to bear in the generation of electricity, so that the generators of electricity will have not only the duty to make a contribution but the prospect of making a profit. Third, the electric power control system should be reformed, with authority being delegated to bring about an enlivening of the system. The rights of those who invest in the production of electricity to receive priority in the use of electricity and

in administration and management of it should be fully respected. Everyone should get a fair share of benefits and preferential conditions should be used to attract investment in the generation of electricity.

Fujian is an energy-short province in which most of the coal and oil that is used has to be shipped in with difficulty and at high prices. With the development of industrial and agricultural production, and a rise in the people's standard of living, the conflict between electricity supply and demand will become more acute. Experts predict that by the year 2000, the province will need close to 40 billion kilowatts, 15 billion kilowatts of it for rural use. Rural electrification cannot be realized through reliance on thermal power plants alone; hydropower is entirely able to act as an "assistant."

Clearly, as a result of some perplexing problems, small hydropower stations in the province are in difficult straits. However, [if] these problems are solved, there will be no limit to available power. A hydropower unit survey shows 3.31 million kilowatts of hydroelectric power as being available in the province for exploitation by small hydropower stations, only 1.04 million kilowatts, or 31 percent, of which has been developed. There is also a very great potential to be tapped by both existing power stations and power stations now under construction. With diligent reform, the provision of support, technical transformation, and the linking together of grids, or the building in upper reaches of turnkey regulating reservoirs, as well as through improved management, the generation of electricity can be increased and quality markedly improved. Therefore, by suiting measures to local conditions, and developing hydropower via intension and extension, prospects are extraordinarily broad.

State Planning Commission Issues Notice on Coal Conservation

40130019b Shanghai JIEFANG RIBAO in Chinese 31 Aug 88 p 4

[Article: "Coal Consumption Exceeds Production, Stockpiles Being Drawn Down"]

[Text] Recently the State Planning Commission issued a notice to the provinces, municipalities, and autonomous regions entitled "Notice on Appropriate Regulation of Coal Consumption, Increasing of Coal Stockpiles, and Guaranteeing of Production and Domestic Coal for the Winter and Next Spring." The notice stated that in the first half of this year, industrial output increased by the extremely high rate of 17.2 percent, and that while coal production increased by 4.5 percent and railway coal haulage capacity rose by more than 10 million tons, this was not enough to meet the increased needs of industrial and agricultural production. When coal consumption exceeds output, the only recourse is to draw down stockpiles. By the end of May, coal stockpiles nationwide had decreased by more than 24 million tons from the same time last year, a decline of 18.5 percent. Production enterprises' coal stocks were down 23 percent and municipal coal stocks were down 29 percent, and coal crises were occurring. If such situations continue to occur, industrial and agricultural production and the people's livelihood will be endangered. In order to control coal consumption, increase coal stockpiles and assure the availability of coal for industrial and municipal use in the winter and next spring, the following measures are instituted.

1. Cognizant departments at all levels must immediately take steps for appropriate control of fuel consumption. The output of energy-intensive products that are not urgently needed must be limited.

2. Electric power departments must increase the output of hydroelectric power and decrease fossil-fired power generation during high-water periods and must do everything possible to increase the coal stockpiles of power plants in order to assure sufficient stocks for winter.

3. The State Council document "Measures for Further Strengthening Conservation of Electric Power" must be rigorously implemented; electric power consumption quotas for electricity-intensive products must not be exceeded, and energy supply and energy consumption must be strictly in accordance with plan.

4. The transport departments must use available capabilities more efficiently in order to increase transport. Localities that can do so must organize increased coal transport so as to make a contribution to increasing the coal stockpiles of key enterprises and assuring the availability of coal for municipal use.

Coal Shortage Continues, No Short-Term Solution Seen

40130013a Beijing RENMIN RIBAO in Chinese 9 Sep 88 p 2

[Report by Zhao Mingliang [6392 2494 0081] and Wu Shishen [0702 1102 3434]]

[Text] Beijing, 8 Sep (XINHUA)--This year, a flood of telegrams reporting coal shortages have reached the State Council. Experts in the coal industry point out that the coal shortage in China is likely to be a long-term problem, and steps must be taken immediately to increase funding and to encourage development in the coal industry.

In 1985, there was a period when China's coal supply turned upward, the long-term gap between supply and demand appeared to narrow, and calls to the State Council subsided. But by early this year, the situation took a turn for the worse. Coal shortages were reported in Jiangsu Province, Shanghai city, and Fujian, Guangdong, Guangxi, Hunan, and Hubei provinces. Some of the key industries faced the threat of total or partial production stoppage; in Jiangsu Province, nearly 1,000 MW of power generators were forced to shut down. The governors, deputy governors and vice chairmen of Jiangxi, Zhejiang, and Guangxi provinces appealed personally to Beijing for a higher quota of coal supplies. By the end of June, China's coal reserves in storage were 17.2 percent below last year's level.

A study of the coal supply problem shows that the main problem is not due to slow production, but rather it is caused by the rapid industrial growth and inadequate rail transportation; in other words, the increase in coal supply cannot keep up with the increase in consumption. According to the National Bureau of Statistics, the total production of raw coal from January to August was 610 million tons, which was a 4.7 percent increase over the same period a year ago; however, during this period, industrial production grew by 17.1 percent, and coal consumption rose approximately 8 percent. The gap between supply and demand can only be filled by dipping into the coal storage reserve. Furthermore, China's coal production areas are generally located far from the industrial regions; hence transportation is also a major factor in coal supply. Early this year, due to limitations in rail transportation, coal shipment from China's western regions had been stalled; therefore, this country's coal production is often limited by its transportation capability.

Coal analysts believe that the problem of coal shortage due to constraints in production and transportation will not be solved in the near future; in fact, the extent of the coal shortage is likely to expand, and the situation is likely to continue.

It is estimated that by 1990, the demand for coal along the 12 coastal provinces and cities will exceed 200 million tons, which is a 20 percent increase over 1987. But during the Seventh 5-Year Plan period, many railroad construction projects near coal production centers were delayed due to lack of funds. For example, the Houma-Yueshan railroad in Shanxi Province originally scheduled for construction in 1986 has not yet been started; the western section of the Da-Qin railroad and the rebuilding of the Datong-Baotou line are not likely to be completed on time. Furthermore, the continuing funding cuts in the coal industry may cause disruption in future operation of unified distribution coal mines.

Coal, China's main energy resource, is a commodity which controls China's economic development. Faced with the urgent coal shortage, the Unified Distribution Coal Mine Co. invited 50 directors of coal mines and government agencies to Beijing to discuss strategies. They urged every coal mine to accelerate production in order to meet the urgent needs of the coastal regions. It was also pointed out by coal experts that we should not blindly push for rapid industrial growth without considering other factors. From now on, the government should seriously address the problem of future coal production by appropriating a higher percentage of funds to the coal industry relative to the total expenditure. At the same time, continuing support should be given to the local mines in the areas of operating funds and transportation. The regional governments should join forces to establish coal development funds, to raise the price of coal, and to help every coal mine to become self-reliant.

More Rolling Stock Assigned To Bring Coal to Power Plants

40100009b Beijing XINHUA in English 1531 GMT 14 Oct 88

[Excerpts] Beijing, October 14 (XINHUA)--Starting this month, the Zhengzhou, Harbin, and Beijing railway bureaus will operate 51 more special trains to join the 45 coal-moving trains already in operation between Datong Coal Base and Qinhuangdao Port, the Ministry of Railways announced here today.

This is only part of China's effort to speed up coal transportation and ease the coal shortage which is forcing some major enterprises in east and south China to consider shutting down, an official from the ministry told XINHUA in an exclusive interview.

On Thursday, Minister of Railways Li Senmao called on all railways to operate "as many special coal-moving trains as possible."

Special efforts are being made to transport more coal to supply power plants and production in Beijing, Tianjin, and Shanghai, said Wang Jiayu, ministry official in charge of coal transportation.

Since September, he said, the Railways Ministry has stepped up moving coal to Qinhuangdao, Lianyungang, Pukou, Shijiu, and Hanyang Ports and to eastern and southern China. During the month, Chinese railways operated more than 1,000 special trains, an average of 33.5 trains a day.

Currently Chinese railways transport an average of 26,537 cars of coal each day to different destinations, he added.

Statistics show that Chinese railways moved a total of 421.78 million tons of coal in the first 9 months of this year, 16 million tons more than the same period last year.

Yet coal supply is still far behind consumption despite the increase, Wang Jiayu said. "The muscles of the railways are almost stretched out," he added.

Shaanxi Acts To Ease Power Plant Coal Shortage

40130032a Xi'an Shaanxi Provincial Service in Mandarin 0030 GMT 2 Nov 88

[Text] The provincial economics commission has taken effective steps to achieve a coordinated solution of the coal shortage at the province's thermal power plants. Coal stocks have recently fallen dramatically at thermal power plants in Shaanxi, and they now have only 130,000 tons in stock, 200,000 tons less than at this time last year. Hence, the Qinling, Lueyang, and Baoji thermal power plants have sent out a distress signal for coal.

The provincial economics commission recently summoned leaders of the northwest power administration, the provincial coal department, and Xi'an Railway Subbureau to study arrangements for shipping coal to the thermal power plants in the last 2 months of the year. Shaanxi is about to enter the peak period for coal consumption, yet there is a shortfall in coal output. Hence, the commission demanded that the provincial coal department get a good grasp of production, step up shipments, and achieve balanced distribution. The department must ensure the supply of the 2 million tons of coal required by the power plants in the fourth quarter. The northwest power administration must achieve meticulous organization and distribution and strive for safe and full-load power generation. In the future, power plant coal supplies in excess of the planned amounts will be charged an extra 50 percent in accordance with the state regulations. The northwest power administration should promptly reckon up the total each month. The Xi'an Railway Subbureau must do a good job in transporting power plant coal in line with the above arrangements, and strive to transport more coal to the plants.

Shandong Power Grid Faces Coal Shortage

40130032b Jinan Shandong Provincial Service in Mandarin 2300 GMT 4 Nov 88

[Text] The Shandong power grid stopped operation on 29 September for lack of coal, resulting in a shortage of 200,000 kW of power. At present, it again lacks coal supply and faces the danger of a continued stopping of power generation.

Over the last few days, the coal reserve of the Shandong power grid has been declining daily. Since 2 November, its coal reserve declined to 310,000 tons, which was 210,000 tons short of demand. The main reason for the decline of coal reserve was that there was an inadequate coal transport. It is now getting more difficult to buy coal through the power grid's own efforts. From January to October, Shanxi transported a shortage of more than 927,600 tons of coal, and Shandong transported a shortage of 540,000 tons of coal, thus seriously affecting the fulfillment of the grid's power generation plan. So far, Shiliquan power plant has 28,000 tons of coal, which will be just enough for 4 days of operation. Zouxian power plant has 6,600 tons of coal, which will be just enough for 1 day. The coal reserves of the Huangdao, Jining, and (Nanding) power plants were basically running out and they are now relying on buying coal every day or picking up leftover coal scraps for power generation.

Adoption of New Technologies for Coal Utilization Analyzed

40130018a Beijing ZHONGGUO KEJI LUNTAN [FORUM OF SCIENCE AND TECHNOLOGY IN CHINA] in Chinese No 4, 1988 pp 21-23

[Article by Ma Chi [7456 7459]: "Thoughts on China's Development of New Coal Utilization Technologies"]

[Text] I. The Essence of New Coal Utilization Technologies

In applications terms, we apply the term "new coal utilization technologies" primarily to advanced coal-based systems for use in electric power generation, pollution control, the production of industrial substitute fuels (for petroleum and natural gas) and other areas. The advanced character of new technologies, in, say, the case of electric power generation, includes not only improvements in economic benefits, environmental characteristics and thermal efficiency, but also modularized and prefabricated construction techniques, the possibility of modernization of existing equipment, and suitability for many coal varieties. In terms of its range of applicability this type of technology can be classified as either modernized or new technology. The former type can also be classified in terms of whether the cleaning technique is applied before, during or after combustion; and the latter includes fluidized bed combustion, gasification-based systems (gasification units, gas cleaning systems and the like) and advanced technical schemes (fuel cells, magnetohydrodynamic power generation, direct-combustion gas turbines) and the like. To summarize, "new coal utilization technology" is a general term for coal utilization technologies that decrease pollution and increase efficiency. In the United States and some other advanced countries they are called "clean coal technology."

II. Motive Forces for Development of New Coal Utilization Technologies

According to statistics for 1985, China's coal consumption constitutes about 75.9 percent of total consumption of nonrenewable resources (the world average is 30.7 percent); 72.5 of the energy used by China's industry must be supplied by coal (the industrial departments account for about 62.9 percent of national end-use energy consumption); coal accounts for 56.9 percent of energy sources used to generate electric power and for as much as 47.7 percent of the energy used in transportation (some advanced countries have stopped using steam locomotives entirely); and coal accounts for 91.8 percent

of energy use for domestic purposes in the countryside. These figures indicate clearly the predominant role of coal in China's energy consumption.

The principal reason that China uses large amounts of coal is that it is economical, since coal is, after all, an easily obtained, cheap energy source in China. In addition, the fact that China has long failed to realize fully the importance of developing hydropower, has progressed slowly in developing nuclear power, and has imported large amounts of petroleum has promoted the large-scale use of coal; and the use of coal has in fact already become a major technical policy. Thus, the irrationality of China's current energy consumption structure is not something that developed quickly, and it therefore cannot be quickly rectified. Although readjustment and reform of the energy structure (e.g., development of hydropower and nuclear power, decreasing petroleum exports and the like) is extremely important, at present the adoption of new coal utilization technologies and the promoting of rational utilization of coal in the various areas of the national economy is logical.

China's coal resources are relatively abundant, and making every effort to utilize in-country resources is our policy; that China's current energy consumption centers on coal is an indication that a market demand environment already exists in China. The current policy environment and market environment together constitute an important internal motive force for the development of new coal utilization technologies.

III. External Conditions Affecting the Development of New Coal Utilization Technologies

It should be noted that the policy of reform and opening up of China's scientific-technological and economic system has created excellent external conditions for the development of new coal utilization technologies. Because system reform is stimulating the formation of enterprise development mechanisms, research and development departments in the energy field will be able to find many enterprises to act as partners in developing new coal utilization technologies. With plan guidance from the government departments and with financial support from the enterprises, these research and development departments will be able to implement enterprise technology transfer. There are many examples of such technology transfer abroad. For example, the U.S. Government has been dissatisfied with exclusive reliance on free competition as a mechanism for promoting industrial development of new technologies, and it has therefore begun to devote attention to linking government allocations to enterprise investment in order to bring about a united effort. This technique is very beneficial to the transfer of new technology to industry, and thus has greatly shortened the path of industrialization. The Clean Coal Technology Project (CCTP-1) and the Modernized Clean Coal Technology Project (CCTP-2) that are currently being implemented in the United States are excellent experiments.

Since China opened up to other countries, various policies have greatly benefited technology importation and foreign cooperation in research and development, providing the opportunity, paving the way, and creating

excellent conditions for the use of foreign capital to develop new coal utilization technologies. Even if these effects and results are still not apparent, their influences will be profound and far-reaching.

IV. Influences of Broad Management and Basic Facilities

Before making a specific evaluation of new coal utilization technologies, we will first consider major factors influencing the development of these technologies with reference to broad economic management and basic facilities.

China is a large country with extensive markets and numerous coal varieties, but with extremely uneven economic development; all of these factors are likely to have a major effect on the development of new coal utilization technologies. Because these technologies currently are at various levels of development or are in the industrial implementation stage, and because they differ somewhat in their range of applicability and suitability to various types of coal, it will be possible to gain results from most of these technologies in China, and they have excellent development prospects. For example, the fluidized-bed combustion technology can be used with low-quality coal, while other combustion technologies (especially combined gasification cycle technology) require rather good-quality coal in order to operate well. As a result, fluidized-bed technology is well worth popularizing in China.

We know that electric power construction is closely connected with economic development. Currently, China has an extreme shortage of electric power, and this has already become a serious constraint on economic development. But because China's economic development is extremely uneven geographically, and because the scale and degree of coverage of the electric power grid also vary greatly, it is very difficult to produce uniform guidelines for choosing the scale of use of new technologies. To produce rational guidelines, we may well refer to the situation in the United States and Great Britain in connection with the choice of the scale of application of new coal utilization technologies in various parts of China. In general terms, the rate of growth of electric power in the United States is not rapid, and U.S. power companies are rather small and decentralized; in this respect, they are entirely different from those in Great Britain and France. For this reason, some U.S. power companies always face difficulty in increasing their investments. They are rather inclined to modular and prefabricated construction methods, using them (e.g., adding several 100,000 to 300,000-kW power units) to increase national power generation capacity gradually. The advantages of this method are that it decreases the scale of investment, that the construction cycle is short, that power generation capacity can be increased rapidly, and that it is easy to satisfy the elastic power requirements of economic expansion. The process of adoption of new coal combustion technologies takes about 10 years, which is essentially suited to economic development requirements. But in Great Britain, certain rather large power companies, such as the Central Electricity Generating Board (CEGB) can rather easily raise large sums; as a result, they generally accord the highest priority to economies of scale. The CEGB plans to use 900,000-kWe gas turbines in its

next generation of coal-fired power plants as replacements for the existing 600,000-kW gas turbines, and to couple them with powdered-coal boilers. In this way, in Great Britain high-pressure fluidized-bed coal-fired power plants and combined coal gasification cycle power plants face competition from large 900,000-kWe units with sulfur removal facilities. As a result, these new technologies are not likely to produce an effect in Great Britain before the end of the century.

Furthermore, in terms of macro-scale development, in electric power construction we must consider the various solid and liquid wastes produced in the prevention of air pollution and in rational production disposal. In dealing with this problem, we must make decisions in terms of local suitability and in terms of development. Wastes must of course be recovered and utilized, but as a rule, there are great excesses of production waste, which give rise to new disposal problems, so that recovery and utilization cannot be achieved immediately; this problem naturally is not now of major significance.

In terms of feasibility, the country has little ability to develop all new coal utilization technologies at once. All it can do is to proceed selectively in terms of its current industrial base and technological capabilities, carrying out some most-needed technological development and importing the most-needed technologies.

V. Drafting of Environmental Protection and Pollutant Emission Standards

The development of new coal utilization technologies is closely related to environmental protection. When specifying pollutant emission standards and implementation methods, consideration must be given to numerous external factors, which not only are closely related to new science and technology, but also are subject to public opinion; thus, each country will draft quite different standards. For example, some countries' permitted discharges of sulfur dioxide from the burning of coal (or other fuels) are extremely strict, while other countries have regulations regarding the height of smokestacks, and still others limit the total amount of pollutant emissions or have a management system involving use of the "most easily available control technology" or the drafting of the "most practicable methods." Some countries apply pollution control management to newly constructed facilities, while other countries also require modernization of existing pollution sources. Furthermore, most countries apply different control standards to plants of different size, with stricter requirements applying to large plants and milder requirements to small plants. This too results in differences regarding pollution control technologies.

Pollution control levels are governed not only by standards, but also by the extent to which they are applied. West Germany has rather high standards that are rigorously applied, so that large-scale clean coal technology research and development and demonstration programs have made marked progress. Currently, most electric power plants there have flue gas desulfuring (FGD) facilities, and 40 units (still in the design, demonstration program or experimental stage) are equipped with various devices for removal of nitrogen

oxides. In the United States, the federal government issued the Clean Air Act in 1970, and in the 1970's the electric companies invested a total of $42 billion on stack scrubbers and other desulfuring devices. In 1977 the United States also issued the Revised Clean Air Act, which further strengthened environmental control. In the 10 years from 1973 to 1983, sulfur dioxide emissions decreased by 28 percent, of which 19 percent resulted from purification by coal-fired power plants. During the same period the amount of coal burned by power stations increased by 60 percent. The U.S. Clean Coal Technology Project and Revised Clean Coal Technology Project make reaching or exceeding the Clean Air Act standards as their objective. But the latter project takes improving pollution of the air in neighboring countries as a demonstration objective for the modernization of existing power plants, and in addition it proposes economic objectives for decreasing pollutant emissions.

Thus it will be seen that specifying environmental-protection pollution control standards is a major motive force in the development of new pollution control technologies. Only when a standard exists and the control level is clearly specified is it possible to decide on the scale of research and development. But China has not yet attached sufficient importance to this problem. Although China has already drafted an environmental protection law and has national air-environment standards, and in addition has drafted technical principles and procedures regarding local air-pollutant emissions standards, it still has not drafted a national emission standard for solid fuel combustion by power plants. It has particulate control standards only for boilers; similar standards for kilns and furnaces are now being drafted, and preparations are being made to draft state standards for sulfur dioxide emissions by power plants burning solid fuel; there has not yet been any consideration of nitrogen oxide emission standards. This state of affairs makes it clear that there is a great deal of indeterminacy in the implementation of new coal utilization technologies in China, and this is a matter that should be given serious consideration by the relevant departments.

VI. Government Functions in the Development of New Coal Utilization Technologies

--Drafting and issuing pollution control standards and organizing their implementation;

--Developing and drafting research and development and demonstration plans regarding pollution control and combustion technologies;

--Overall coordination, planning and evaluation of research developments and demonstration programs and of progress in their technological development;

--Coordinating research and demonstration programs with state energy policy and other relevant policies;

--Funds allocation for research and demonstration projects and organization of various other funds sources (including investments in the enterprise sphere);

--Strict oversight of demonstration projects and maintenance of close coordination between them.

In general, the government departments in China that will implement the above functions include the State Environmental Office, the State Science and Technology Commission, the State Planning Commission, and the soon-to-be-created Ministry of Energy. Because the development of new coal utilization technologies involves many departments, such as the coal and electric power industries, industrial boiler users, and the machine-building, building materials and chemical engineering departments, effective coordination of all departments throughout the country and organization of their work is extremely important. In 1987-1988 the State Science and Technology Commission carried out a soft-science research project on "Development Strategies and Policies for New Coal Utilization Technologies in China." Its objective was to investigate the questions involved at the broad national policymaking level. This research will have far-reaching effects on smooth development of new coal utilization technologies in China, and it is of important reference value for government departments as they implement large-scale management functions.

Problems Facing Petroleum Industry Analyzed

40130027 Beijing JINGJI GUANLI in Chinese No 7, 1988 pp 17-20

[Article by Yang Wanli [2799 8001 6849]: "Speeding Up the Development of the Petroleum Industry"; edited by Liu Qichang [0491 0366 2490]]

[Text] The development of China's petroleum industry has entered a crucial historical period. A careful analysis of the situation and major problems confronting the petroleum industry and efforts to study feasible countermeasures, grasp the opportune moment, and speed up the pace of reform will be of immense significance to our endeavor to sustain the steady growth of our petroleum production and meet the requirements of the targets and strategies of national economic development.

I. The Petroleum Industry Is in a Stage of Development

China's petroleum industry has made tremendous achievements in the 38 years since the founding of the People's Republic. Crude oil production has increased by 350,000 tons annually--from 120,000 tons to 134 million tons. For 26 years the rate of growth has stayed above 20 percent. The total revenue generated amounts to about 200 billion yuan, four times the amount invested by the state in the industry. The petroleum industry has become a major pillar of the national economy. If we take a look at the history of the world's petroleum industry, we will find that both the United States and the Soviet Union started developing this industry nearly a hundred years ago, while China has only been developing petroleum production on a large scale for less than 30 years. In 1957, petroleum and natural gas only amounted to 2.2 percent of China's total primary energy production. The figure rose to 26.8 percent in 1980. Such a fast rate of development is quite rare in the history of the world's petroleum industry.

In recent years, there has been a steady trend of growth in the development of the petroleum industry. A look at primary energy growth during the Sixth 5-Year Plan period shows that petroleum growth was beginning to lag behind that of coal and hydropower, being registered at 17.9 percent. How should we view this phenomenon? In my opinion, the trend of more stable growth in the petroleum industry is a normal but temporary phenomenon. There are many reasons for this. The general trend of the development of the petroleum industry is a good, or relatively good one. In fact, China's

petroleum industry now finds itself in a stage of development that is characterized by moving up from the bottom to the peak. Since 1981, petroleum output has been growing by 4 million tons each year. The present problem is that we must quicken the pace of our reform and opening up, mobilize all our strength, both internal and external, and push the development of the petroleum industry on to a new stage.

Whether there will be a new leap in China's petroleum industry depends on a combination of objective needs, material basis, and subjective factors.

To begin with, let us examine the urgency for the development of the petroleum industry from the needs of the national economy. Needs are the prerequisite and external driving force for the development of the petroleum industry. The 1990's will be an important period of all-round economic prosperity. It will be a crucial period for the realization of the target for the second phase of development. All-round economic prosperity will place even more pressing demands on the development of energy, which is a basic industry. As high-quality energy, the rate of growth of petroleum and natural gas production directly affects the development of the entire national economy. The development of agriculture, communications and transportation, and the chemical raw materials industry are particularly dependent on the petroleum industry for the provision of the necessary material conditions. Thus, we must attach importance to the petroleum industry in our development strategy.

Next, let us examine the possibility of the development of the petroleum industry from the perspective of China's oil and gas resources. China's long-range petroleum reserves are estimated at 78.7 billion tons, 17.8 percent of which are known and exploitable reserves, and most of these are found in the Northwest, North China, and the Central Plain. Rich reserves and extensive oil and gas prospecting areas provide great prospects for the development of the petroleum industry.

Further, let us examine the practicality of speeding up the development of the petroleum industry from the perspective of the characteristics and history of this industry. Besides great risks, huge investments, and long investment cycles, the petroleum industry also has the characteristics of developing by stages and by leaps and bounds. For example, the discovery of the Daqing oil fields in the early 1960's, the Shengli, Dagang, and Liaohe oil fields in the late 1960's, and the North China and Central Plain oil fields in the late 1970's were more or less 10 years apart. There was rapid development after each intermission. The exploitation of these oil fields provided ample practical possibilities for further development. Thus, only when we view the characteristics of the development of the petroleum industry by comparing its history and its realities, can we correctly appraise the changes that have emerged in the course of the development of this industry.

Finally, viewed from the general situation, China's economic policies are advantageous to the development of the petroleum industry. The policies adopted by China in recent years to reform and invigorate the economy and

open the country to the outside world have injected fresh vitality to and created excellent opportunities for the development of the petroleum industry. For example, the state's policy offering the petroleum industry a contracted output quota of 100 million tons is in line with the nature of the oil industry as a whole and has motivated the enthusiasm of the staff and workers of the industry. The open policy for drawing in foreign funds and developing off-shore oil fields through joint ventures, the policy of increasing the price of crude oil by a slight margin, and the method of the compensated use of oil and gas reserves proposed recently have been most helpful in alleviating the problem of the shortage of funds that is confronting the petroleum industry. Of course, with the development of the situation, necessary readjustments have to be made in existing policies, and new and more perfect policies should be formulated.

In short, in the 38 years since the establishment of the People's Republic, China's petroleum industry has risen from nothing. With the progress of the socialist modernizations, the petroleum industry will gradually proceed to its climax.

II. Major Problems Confronting the Petroleum Industry

The major problems confronting the petroleum industry are the increasing demands from socialist modernizations on the petroleum industry and the fact that the rate of development of the industry cannot cope with the growing demand. At present, China's per capita output of petroleum and gas is 140 kg oil equivalent, which is 16 percent of the world's per capita level. China's value of gross national product has to be quadrupled over the period from 1980 to the end of the century, but the annual output of petroleum can only be doubled over the same period. Therefore, the contradiction between demand and supply will remain acute.

Judging from the current situation, three major factors are holding back the development of the petroleum industry:

1) A serious shortage of funds, which is mainly seen in two aspects:

First, there is a big gap between the input of funds and the funds actually required. Petroleum prospecting involves great risks and a good deal of one-time investments. During the Sixth 5-Year Plan period, an average of 530 million yuan in investment was required to explore 100 million tons of oil. Sometimes as much as 900 million yuan was required. (It is estimated that the magnitude of growth in investment during the Seventh 5-Year Plan period will be even greater.) If we want to achieve an annual output of 200 million tons by the end of this century, we must be able to locate new reserves that have a capacity of between 10 and 18 billion tons. This will mean an investment of some 100 billion yuan. Since the output capability of oil fields is characterized by a natural diminishing tendency, the means of expanded reproduction should be used in oil production to maintain simple reproduction. For instance, over the last 4 years, an average growth of some 15 million tons was maintained in oil production capacity. However, since two-thirds of the production capacity was offset by the diminishing

output of old fields, the actual average annual output growth was only 4.8 million tons. Thus, in order to realize the target of achieving an annual output of 200 million tons of oil by the end of this century, investments amounting to between 300 to 400 billion yuan will have to be put in. Of these, 80 percent will be used in oil production. Investments are expected to be even more substantial in the large-scale development of fields in the Northwest and off the China coast because of natural and technological requirements. At present, most of the funds used in developing the petroleum industry each year are used in maintaining the existing crude oil production, and only 20 percent of the funds are used in expanding reproduction. The shortage of funds for expanded reproduction has affected the stamina of the development of the petroleum industry.

Second, the price of oil and gas is not rational. At present, the cost of crude oil only covers the cost incurred in extracting oil and does not cover the cost incurred in the prospecting and development of oil fields. Since the price of crude oil is worked out on this basis, a big gap between the value and the price of oil is inevitable, and the money invested in the prospecting and development of oil fields cannot be redeemed. When the international price of crude oil falls, the differential income from the overfulfillment of the production quota by petroleum departments under the present contracted output quota policy decreases substantially. Thus, the contradiction has become apparent and has intensified the pressure on the reinvestment of funds. The disparity between the value and the cost of crude oil is shown specifically in the following cases: A comparison between crude oil and end product prices shows that on international markets the price ratio between crude oil and its end products is 1 to 1.35, while on domestic markets the price ratio is 1 to 6. A comparison between international and domestic prices shows that even after the plunge in the price of crude oil in international markets, the price of oil is still registered at about $15 per barrel, or about 450 yuan RMB per ton, as against the 110 yuan per ton for home-produced oil, which is only a quarter of the international price. Over the last few years, the prices of the raw materials and equipment required in oil production have been going up, and the cost of oil production is becoming increasingly higher. The volume of oil output in 1981 was 102 million tons, and the amount of capital input was 5.4 billion yuan. In 1987, oil output was registered at 134 million tons, and the amount of capital input increased to some 19 billion yuan. In other words, while output has gone up by 31 percent, capital input has increased by 250 percent. Currently, China's petroleum industry is facing a serious situation in which losses are incurred across the board, and this has to a certain extent held back the development of crude oil production.

2) The level of the scientific and technological capability of the petroleum industry cannot meet the needs of production development. From the perspective of oil prospecting, modern technologies like seismic prospecting, oil well logging and testing, and information processing have not been put into general application. From the perspective of oil exploration, some of the oil fields are still below standard in terms of technology as well as instruments and equipment for exploiting low viscosity oil deposits and are unable to supply the necessary accessories for advanced

technologies for the comprehensive reform of the oil-bearing structure. Moreover, there is still a lack of sufficient means to increase the oil extraction ratio and the volume of exploitable oil reserves. All these have constrained the increase in labor productivity. When the United States and the Soviet Union surpassed the 100-million-ton mark in oil output, each worker in the industry produced 576.2 tons and 1,132.4 tons of oil respectively on the average. When China attained the 100-million-ton level, each worker in the industry could only produce 105.8 tons of oil on the average. Among the oil fields in China, the highest average was 290.5 tons, while the lowest was only 18.1 tons.

3) The proven reserve is insignificant. The rate of development of the petroleum industry is still constrained by the volume of reserves. Although from a long-term perspective China's oil resources are very rich, only a very small part of these are proven oil reserves. The ratio of reserves and extraction is 18 to 1, which is only 50 percent of the world standard. This shows that the relation between oil production and oil reserves is very tight. We should place the task of oil prospecting in an extremely important strategic position, so that we can provide a reliable material foundation for maintaining a sustained and steady growth of oil production. However, since the petroleum industry is a capital-intensive and technology-intensive industry, the solution to this problem depends on the availability of funds and the increase in the scientific and technological level. Thus, the problem of the availability of funds and the level of technology are two important factors holding back the development of China's petroleum industry.

III. Promoting the Development of the Petroleum Industry Through Reform

The problems that confronted the petroleum industry in the period when it was moving from the bottom to the peak are also important tasks that should be tackled in the development of the productive forces of the petroleum industry. Thus, reform should be grasped in order to promote the development of the petroleum industry and speed up the transformation of the oil industry from a product economy into a commodity economy. At present, we should seize the opportunity and handle well the following reform tasks with set priorities in a systematic and planned way.

1. External conditions should be improved, and price relations should be set right. Only when the price structure of oil and gas is rationally determined in accordance with the requirements of the law of value can the oil enterprises enhance their capability to accumulate funds themselves, transform themselves, and develop themselves. This requires that the state regulate the petroleum industry on the macroeconomic level and improve the industrial policy in such a way as to give more encouragement to the development of the petroleum industry. The crux of the problem lies in whether the price of crude oil and gas works on the single-track system or the double-track system. If the single-track system is adopted, the fees incurred in the prospecting, exploitation, and extraction of the resources should be included in the cost of the products. This will certainly increase the price of crude oil and natural gas substantially. Although

this will mean greater fluctuations and risks, the price problem will be thoroughly solved. If a dual-track system is adopted, the contracted base output quota should be reasonably set, so that the amount of differential revenue derived from the overfulfillment of production quota can offset the influences of any drop in international oil price or increase in the domestic price index. In this way, the essential funds needed by petroleum departments in exploring and developing petroleum resources and in achieving expanded reproduction can be guaranteed. In the absence of major moves in the price reform, the latter method is a feasible measure.

2. The investment structure of the petroleum industry should be reformed, and the practice of solely relying on state investment should be changed into a practice of diversified investments. What this means essentially is that diversified investment methods such as state investment, investment by local bodies, investment by enterprises with their own funds, the use of foreign capital, and so on, are adopted. At the same time, shares and bonds may be issued for subscription by the general public for the purpose of raising funds. Then, on the basis of the principle that the investor reaps the benefits, funds can be drawn in from diverse areas. In this way: 1) We will be able to alleviate the problem of state investment capability being insufficient. 2) At the same time as we draw in foreign investment, we will be able to draw in advanced technology to solve the problems of prospecting and exploitation in areas where conditions are complicated. 3) Under the current financial system of divided responsibility, the participation of local governments in investment can alleviate the problem whereby the local governments where oil fields are located demand a share of the profits. This can help reduce the burden of the oil fields, lower the cost of production, and maintain normal production at the oil fields.

3. The scientific and technological system of the petroleum industry should be reformed, and comprehensive coordinated technologies should be developed and perfected. Advanced prospecting technology and technology for renovating old oil fields should be developed, and technology for renovating low viscosity oil deposits and for triple extraction should also be developed, so that the targets of finding new reserves and increasing the recoverable reserves and the final recovery ratio can be realized. In order to organize key scientific and research tasks and the tasks of importing, digesting, and assimilating advanced technologies, the following measures should be adopted: First, scientific and technological investment should be appropriately increased, the system of project management and diversified investment methods should be adopted, and channels for drawing in funds should also be increased. Second, technology markets should be developed to turn technological achievements into commodities, so that the enthusiasm of scientific and technological personnel can be mobilized. Third, lateral technological cooperation should be developed to absorb the scientific and technological strength of the scientific and research units, colleges and universities, which are outside the oil profession, to fully utilize the advanced technologies and new achievements of other industries and to update petroleum technology. Fourth, with respect to the scientific and technological strength of the oil industry, efforts should be made to handle the

division of energy level and the joint tackling of important tasks to improve effectiveness and efficiency in overcoming scientific and technological problems.

4. The industrial structure and product mix should be readjusted, and the internal potential of oil field enterprises should be fully exploited. The situation where oil field enterprises only produce a single product and have low overall economic returns should be changed; a new structure centering on oil production and encompassing diversified management, comprehensive utilization, and the all-round development of a commodity economy should be established; and substitute industries should be developed. The oil field industry in general has a large scale of operation and has advantages and potential in respect of manpower, equipment, goods and materials, technology, personnel, resources of oil and natural gas, land resources, and mineral resources, which are symbiotic with or which coexist with oil and gas resources (such as sulphur, salt, soda, terrestrial heat, and so on). Only when appropriate policies are adopted to arouse the enthusiasm of the petroleum industry and its staff and workers can new industries be developed and an economy of scale with quality brand-name products forming the "dragon heads," factories forming the backbone, and a well-coordinated network of large, medium and small-sized enterprises be gradually formed. For instance, we could make use of the advantages enjoyed by these enterprises in terms of oil and gas resources to reduce waste; economize on crude oil consumption by the petroleum industry itself; recover associated gas; carry out intensified processing of the byproducts of oil and gas; and develop small-chemical fertilizer plants, agricultural chemical, and plastic industries. Their advantages in terms of machinery equipment could be made use of to increase the utilization rate of equipment and develop equipment manufacturing, repairing, and processing industries that are geared to the needs of the whole society. Their advantages in terms of land resources could be made use of to develop crop cultivation, fish breeding and poultry raising, and food processing. And their advantages as labor-, technology- and capital-intensive entities could be made use of to develop lateral economic ties within and outside the oil fields, promote the optimal combination of production factors, and vigorously develop diversified industries and diversified products. Through diversified management and the development of substitute industries, an oil field could become an enterprise group that is mainly engaged in oil and gas production and that also produces a range of products and achieve better overall economic returns. Thus, it could create more wealth for society and make a greater contribution to society, accumulate funds for oil prospecting and exploitation, improve the standard of living of the staff and workers, and solve the problems of providing employment for the children of staff and workers and finding replacements and outlets for fieldwork contingents.

5. The management structure of oil field enterprises should be reformed and diversified forms of the contracted management responsibility system adopted. The scope of the roles of planning and the market mechanism covers all of society. With the deepening of the reform and the policy of opening up to the outside world, complementary reforms should be carried out throughout the petroleum industry. First, the "Enterprise Law" should be earnestly

enforced. In accordance with the principles of the separation of government and enterprise functions, the separation of ownership and the power of operation, and management by different levels, enterprises should be given the responsibilities, power, and interests that are due to them, and efforts must be made to properly handle the relations between the interests of the state, the trade, the enterprise, and the staff and workers. In view of the characteristics of the petroleum industry, special efforts must be made to handle well the differences in benefits brought about by the differences in terms of resources and create the necessary environment for fair competition so that high-output oil fields, steady-output oil fields, diminishing-output oil fields, and oil fields with increasing reserves will all receive encouragement. Second, the internal management system of oil fields should be reformed. In accordance with the different professional natures and different scales of oil fields at the secondary level, diversified forms of the contracted responsibility system such as the system of project management, the responsibility system of contracted output targets, the contracted assets management responsibility system, the contract responsibility systems of leasing, and others should be adopted. In addition, competition should be introduced and the law of commodity production used to organize the internal production and management activities of oil fields. Efforts must be made to eradicate the old structure in which an entire oil field "eats from the same big pot" of crude oil production, and to establish a new system under which secondary companies and factories of oil fields can become relatively independent commodity producers and managers. Third, while the contracted responsibility system is being implemented, reforms in respect of planning, finance, labor resources, goods and materials, science and technology, education and so on should be carried out in a coordinated way so that oil field enterprises can establish a management mechanism that matches their own characteristics, meets the requirements of the development of a commodity economy, and enables them to develop and restrain themselves.

6. The petroleum industry should take part in the great international economic cycle, and the vitality of inland oil fields should be enhanced. At present, China's petroleum industry has entered the international arena in three respects: First, large quantities of oil products have entered the international market. Second, the prospecting of off-shore oil is now open to the outside world. While persisting in doing a good job in Chinese-funded oil prospecting, Chinese-foreign joint ventures are being established. Third, foreign funds have been drawn in by some inland oil fields. These measures have already produced obvious results. In my opinion, more open and flexible measures should be adopted to enlarge the scope opened to outside world. In the off-shore continental oil zones, fixed areas may be marked out for prospecting by foreign consortia. In the oil fields, a certain number of diversified management projects can be designated for Chinese-foreign joint development of new industries that have "the two ends outside." Apart from these, oil fields can be encouraged to form lateral economic ties with neighboring open areas and to make full use of the favorable policies offered by open areas to develop the tertiary industry.

Prospects for Petrochemical Industry in the 1990's Reviewed

40130104c Beijing LIAOWANG [OUTLOOK WEEKLY] in Chinese No 28, 11 Jul 88 p 21

[Article by Shi Xin [4258 0207]: "Key Project Construction by the Petrochemical Corporation To Invigorate the Petrochemical Industry of the 1990's"]

[Text] Following the development of new technologies and materials in today's world, petrochemical industry technologies are receiving growing attention. Comparatively speaking, China's petrochemical industry is rather backward, particularly in terms of per capita amounts of ethylene, plastics, synthetic fibers, and other petrochemical industry products, which are far below advanced levels in the developed nations. According to the state economic development strategy which focuses on developing the energy and raw materials industries, progress in key project construction by the China Petrochemical Corporation has been especially rapid over the past 5 years.

Ethylene is often called the mother of the petrochemical industry. For several years, the ethylene production capacity of mainland China hovered around 600,000 to 700,000 tons, much less than in other large nations. After 1981, the state imported four complete 300,000-ton ethylene facilities, but they were set aside temporarily due to readjustments in the national economy. In 1983 the petrochemical corporation was established as an economic entity and this brought life to resumed construction of these facilities. With major efforts and assistance from all areas and through the continuous efforts of several 100,000 construction employees over several years, the first part of the Daqing 300,000-ton ethylene project victoriously went into operation in August 1986; success was achieved on the first try in completion and startup of the first stage of the Jilu 300,000-ton ethylene project in May 1987, and construction of the first stage of the Shanghai 300,000-ton ethylene project formally began at the same time; and the first stage of the Yangzi 300,000-ton ethylene project successfully went into operation in July 1986. Within the brief period of 3 to 4 years, 1.2 million tons of ethylene capacity was constructed simultaneously and 900,000 tons of ethylene capacity was completed and put into operation, writing a new page in the history of petrochemical industry construction in China. Just as Comrade Zhao Ziyang pointed out, 900,000 tons in ethylene production capacity was added in a little over 1 year, more than doubling ethylene. This is a very big achievement and makes everyone happy. Startup of the three ethylene facilities substantially

increased production capacity in China's petrochemical industry, including an increase from 490,000 to 710,000 tons in plastics capacity, from 360,000 to 600,000 tons in synthetic fiber monomer capacity, from 310,000 to 510,000 tons in synthetic fiber polymer capacity, from 240,000 to 360,000 tons in synthetic fiber capacity, and from 380,000 to 710,000 tons in organic chemical industry raw material capacity. Economic results have improved, and they have alleviated urgent demand for petrochemical products in the national economy and markets.

Also being built simultaneously with the ethylene projects are the three 300,000-ton synthetic ammonia and 520,000-ton urea projects at Zhenhai, Urumqi, and Ningxia which use residual oil as a raw material. The large chemical fertilizer project at Zhenhai was completed in 1985 and received state acceptance in 1986. The large chemical fertilizer project at Urumqi was completed in 1987. The Ningxia large chemical fertilizer project was completed and went into operation in 1988 on the 30th anniversary of the founding of the Ningxia Autonomous Region. Completion and startup of these three large chemical fertilizer projects increased China's urea production capacity from 3.39 million tons to 5.03 million tons, and it will provide more high quality chemical fertilizer for continued development of agriculture.

Jinshan in Shanghai Municipality is a chemical fiber city which sprang up on the banks of the Huangpu River during the 1980's. In 5 years, on the basis of completing the first stage of the Shanghai Central Petrochemical Plant, the employees victoriously completed the second stage of the project, which includes 200,000 tons of synthetic fiber monomers and 100,000 tons of reeled silk, and they have achieved rather good economic results very quickly by assimilating imported technologies and innovations. When they started the second stage of the project, the people of Jinshan also set their sights on the third stage of the project, meaning the fourth ethylene facility mentioned above. The third stage of the project now is progressing smoothly and completion is expected in 1989.

The petrochemical corporation also has built projects for intensive processing and comprehensive utilization which have improved product quality and economic results. The 30-plus projects involving catalytic cracking facilities at Fushun, Jinxi, and Dalian, dacron long fiber at Tianjin, alkylate at Tianjing and Zhenhai, polyacrylic at Jinzhou and Zhenhai, and others have brought new increases in China's crude oil primary processing, secondary processing, and intensive processing capacity.

Over the past 5 years, the petrochemical corporation has completed 24.8 billion yuan in investments in fixed assets, with 20.2 billion yuan for capital construction and 4.6 billion yuan for technical transformation. Now, a new group of petrochemical industry projects are being planned and some will get under way during the Eighth 5-Year Plan. Construction of these projects will include joint investments and cooperation between the corporation and various localities and departments, multi-channel capital accommodations, issuing stocks to banks, and other new arrangements.

China Petrochemical Corporation Head on Issues Facing Industry

40130104a Beijing LIAOWANG [OUTLOOK WEEKLY] in Chinese No 28, 11 Jul 88 pp 18-19

[Article by Lin Zhen [2651 2525] and Ling Wancheng [0109 1346 2052]: "Five Years Down the Road--A Visit With China Petrochemical Corporation General Manager Chen Jinhua [7115 6930 5478]"]

[Text] In October 1984, LIAOWANG visited China Petrochemical Corporation general manager Chen Jinhua to discuss issues of reform and opening up. At the time, the corporation had just been founded, so he explained to reporters the relevant background and guiding principles behind the CPC Central Committee and State Council decision to organize the petrochemical corporation and discussed his views regarding development of China's petrochemical industry. Publication of that article aroused the interest of many readers. Students at Beijing Trade University wrote Chen Jinhua inviting him to discuss how such an enormous enterprise would be managed. More than 4 years have passed now, and how is the corporation doing? These questions also concern many readers in China and abroad. For this reason, reporters again visited Comrade Chen Jinhua.

"After 5 years of exploration and practice, it should be said that the framework for a new system in the petrochemical corporation has been established. China's largest multi-industry multi-region economic entity is growing year by year and making ever greater contributions to the nation," Chen Jinhua said candidly.

I. Major Undertakings Require Centralized Forces

Speaking to foreign guests, Comrade Deng Xiaoping said that an important advantage of the socialist system is its ability to centralize forces for major undertakings. Chen Jinhua has realized from their work over the years that this is extremely correct. Because of the implementation of the policies of reform and invigoration, the petrochemical corporation is an economic entity. It can raise enormous amounts of capital on its own, including foreign loans and issuing bonds within China; it can obtain its own materials; it can organize horizontal integration at various levels, including personnel training and S&T development; and it can take on economic responsibilities and complete state tasks. Over the past 5 years,

the corporation has used all of the company's forces and "attacked" with both hands. On the one hand, it has focused on technical transformation of old enterprises and promoted technical progress; on the other hand, it has focused on key project construction and developed new forces of production. From 1983 to 1987, the petrochemical corporation completed 24.8 billion yuan of investments in fixed assets, equal to 1.1 times the total investment in the petrochemical industry over the first 33 years after the nation was founded. Projects completed over this 5-year period include the three 300,000-ton ethylene first stage projects at Daqing, Jilu, and Yangzi; the 300,000-ton ethylene project in Shanghai and the Fushun ethylene project now under construction; the two large 520,000 tons/year urea output chemical fertilizer projects at Zhenhai and Urumqi; the 200,000-ton synthetic fiber monomer and 100,000-ton spinning projects in Shanghai; and the 10 oil refining and intensive processing projects with a total capacity of more than 20 million tons at Fushun, Jinzhou, Tianjin, and other locations, as well as several comprehensive utilization facilities. Construction and smooth startup of these key petrochemical projects increased China's crude oil processing capacity to 106 million tons, sixth worldwide. Our oil refining intensive processing capacity has increased 50 percent. Our ethylene production capacity has risen to 1.636 million tons, more than 1 million tons above and more than double the 1983 figure.

II. Taking the Lead in Implementing New Forms of Full System Contractual Responsibility

The development goals of the petrochemical corporation are to use capital rationally, develop forces of production, and improve economic results. Chen Jinhua explained to reporters that Comrades Zhao Ziyang and Yao Yilin [1202 0181 2651] visited the corporation not long after it was established and guided the company in implementing input-output contracting.

In October 1984, the petrochemical corporation implemented input-output contractual responsibility for the entire system for the 6-year period from 1985 to 1990. Based on the reform program approved by the State Council, the state stipulated total inputs in the petrochemical corporation, meaning the scale of total investments, and provided the necessary guaranteeing conditions. The petrochemical corporation was entirely clear about its responsibility to the state for total output, meaning the achievement of total profits and taxes and the corresponding contractual responsibility guidelines, and they divided up contractual responsibility guidelines among enterprises. Contractual responsibility for 6 years was unified with the terms of office for the plant manager and director. Each of the enterprises implemented various types of internal contractual responsibility and assigned contractual tasks down to the base level. The results of 4 years of contractual responsibility are obvious. Since the petrochemical corporation was established, it has grown at an annual rate of 8.3 percent. Actual profits and taxes over 5 years totaled 68.5 billion yuan, and they grew at an average yearly rate of 9.8 percent. They turned over 56.4 billion yuan to central financial authorities at higher levels, equal to one and one-half of the total fixed assets in enterprises under the petrochemical corporation at the end of 1982. Practice has proven that, given the close integration of

factors of production in the petrochemical industry, adoption of a "centralized leadership, unified planning, and unified management" input-output contractual responsibility arrangement is an effective way to make the petrochemical corporation use economic methods to manage enterprises, gradually weaken administrative management, and reinforce the vitality of base level enterprises.

Chen Jinhua said that the vitality of base level enterprises is the key to being able to manage the petrochemical corporation as an economic entity. Based on the relevant State Council decisions, we implemented 40 articles in conjunction with a reform program in 1984 to expand enterprise authority and then, as policies and situations changed, we supplemented the decisions several times. We can see now, although not enough has been done in many areas, that the vitality of base level enterprises obviously is stronger, as indicated mainly in four areas. One, enterprises have authority over personnel and make their own cadre appointments, with the exception of enterprise leaders. Two, they have the right to control products in excess of plan quotas and products from activities they run themselves. Three, according to state authority decisions, they have autonomous decisionmaking rights and project examination and approval rights within a certain range. Four, enterprises retain more profits and the living conditions and welfare of employees have improved every year.

Over the past few years, the petrochemical corporation also has undertaken a wide range of various types of economic integration within and outside China, including joint investments with local areas to build petrochemical projects, issuing stock to banks, and other high-level integration. They have developed equipment and materials with machinery, construction materials, shipping, and other departments, and they are building or planning to build more than 20 large petrochemical industry projects at a total scale in excess of 30 billion yuan through joint investments with 18 provinces, autonomous regions, and directly administered municipalities including Heilongjiang, Shanghai, Liaoning, Jiangsu, Shandong, Anhui, Xinjiang, Guangdong, and others to enter into more cooperative relationships with local areas and promote the development of the petrochemical industry.

III. New Challenges Face the Petrochemical Industry

China's entire petrochemical industry now faces new challenges and a rather serious situation. This is the overall view of General Manager Chen Jinhua.

Four main factors restrict development of the petrochemical industry. They are resources, capital, technology, and base level vitality. These can be considered the four main pillars of the petrochemical industry.

Regarding resources, Chen Jinhua said that there are crude oil shortages which cannot meet the needs of petrochemical production and growth of the national economy. Moreover, we need to invigorate petrochemical products, especially those used in agriculture, and supply cannot meet demand in either urban or rural markets. To increase crude oil production, petroleum

departments are making a maximum effort and very big contributions to the nation.

In the future, solving the oil shortage will be a major issue facing us and we must actively open up various resources from China and foreign countries.

General Manager Chen also introduced countermeasures like developing integration, raising capital from a wide range of sources, faster achievement of domestic production of technologies and equipment, removing restrictions to invigorate enterprises, and so on.

When the visit ended, the general manager again asked LIAOWANG to convey his gratitude and that of the petrochemical corporation to his friends throughout China and in foreign countries.

Domestic Production Meets Aviation Sector Needs

40130104b Beijing LIAOWANG [OUTLOOK WEEKLY] in Chinese No 28, 11 Jul 88 p 19

[Article by He Zuocheng [0149 0146 2052]: "News From the China Petrochemical Corporation: All of China's Aviation Oil Is Based on Domestic Sources"]

[Text] The China Petrochemical Corporation system now has the capacity to produce more than 3 million tons of aviation oil of 69 types. Besides satisfying domestic demand, it also exports some. This achievement was made possible by a large number of scientific experiments over several years.

Aviation oil includes aviation fuel, aviation lubricating oil, aviation lubricating resin, aviation hydraulic oil, and other oil products. Beginning in the early 1960's, S&T personnel in petroleum departments did research on domestic production of jet fuel, enabling Chinese aircraft to fly using domestically produced fuel. In the 1970's, they also successfully developed anti-icing, anti-static electricity, anti-abrasive, and other jet fuel additives which improved product quality and ended fires ignited by static electricity during aircraft refueling. This also solved problems with winter fuel icing in the high and cold regions of northeast, north, and northwest China and the poor lubricating qualities of lubricating oil. In the 1980's, aviation oil experiment and production units developed over 10 production technologies for low pressure hydrogenation, hydrocracking mixtures, alkali-belozem purification, and others. They worked on developing high flash point and high specific gravity military and civilian No 3 jet fuel and made new quality and quantity breakthroughs in China's jet fuels. They also made considerable progress in developing aviation lubricating oil (resin) and hydraulic oil (resin). The aviation hydraulic oil and aviation precision instrument lubricating resin which China developed itself basically have satisfied demand for development of the aviation industry. This is particularly true of special lubricating oils and resins tolerant to high and low temperatures and which have long useful lives, and they met urgent demands in the development of domestic aircraft, nuclear industry, and aeronautics industry.

After the 1960's, China imported large "Viscount," "Trident," and "Boeing" passenger aircraft and "Skylark," "Super Frelon," and other types of helicopters. To meet the needs of these imported aircraft and new types of domestically produced aircraft, S&T research personnel also undertook

research on developing, evaluating, and utilizing several 10 types of aviation lubricating oil, hydraulic oil, and gear oil, and raised quality indices of these products to those of similar products in foreign countries, meeting applications needs. Now, domestic supplies provide all of the primary oil products used in these imported aircraft.

Given the requirement to obtain the approval of aircraft manufacturing plants and businesses when using aviation oil, with the exception of jet fuel, most of the aviation oil used at present by aircraft owned by foreign aviation companies when they are in China is still imported.

Crude Oil Exports Create Domestic Shortage

40100017b Beijing CEI Database in English 15 Nov 88

[Text] Beijing (CEI)--Excessive exports of crude oil products are causing a short supply of crude oil products on the Chinese market, official sources of State Council department say.

China has been lacking crude oil for many years, but it exports large amounts every year.

In 1987, 27 million tons of crude oil were exported.

Officials noted that, due to the excessive exports of naphtha and calcium carbide, the production of polyvinyl and polyacrylic resin that uses naphtha as their raw materials has long remained low. Plastic films for agricultural use are in serious short supply, too.

Prices of these products have been soaring. For instance, the state has set the price of plastic film at 3,500 yuan per ton but black market price has shot up to more than 10,000 yuan per ton. The purchasing price of polyethylene chloride resin that uses calcium carbide as its raw materials was set at 2,700 yuan per ton in 1987 but the price rose to 5,000 yuan per ton in domestic markets.

BRIEFS

Large Field Discovered in Shandong--Jinan (CEI)--A large oil field has been discovered in Hengtai County of Zipo City in Shandong Province with an estimated oil reserve of about 25 million tons. The field, named "Jingjia oil field," occupies an area of 22 square kilometers and is easy to drill as it lies at a convenient stratum between 800-1,300 meters from the surface of the earth. The field is near the Shengli oil field. [Text] [40100017a Beijing CEI Database in English 31 Oct 88]

Gansu High-Yield Well--Beijing, October 19 (XINHUA)--A high-yield oil and gas well has been sunk for the first time in the western part of the Jiuquan Basin in Gansu Province, northwest China. The 4,400-meter-deep well produces 120 cubic meters of oil and 10,400 cubic meters of gas daily. Experts said the discovery of this high-yield well and another two wells, which were sunk earlier in the basin, indicates that the Jiuquan Basin is rich in undeveloped reserves of oil and gas. The experts said they will soon find the exact size of oil and gas reserves in the area. [Text] [40100009a Beijing XINHUA in English 1037 GMT 19 Oct 88]

- END -

10

Foreign Broadcast Information Service (FBIS) and Joint Publications Research Service (JPRS) publications contain political, economic, military, and sociological news, commentary, and other information, as well as scientific and technical data and reports. All information has been obtained from foreign radio and television broadcasts, news agency transmissions, newspapers, books, and periodicals. Items generally are processed from the first or best available source; it should not be inferred that they have been disseminated only in the medium, in the language, or to the area indicated. Items from foreign language sources are translated; those from English-language sources are transcribed, with personal and place names rendered in accordance with FBIS transliteration style.

Headlines, editorial reports, and material enclosed in brackets [ ] are supplied by FBIS/JPRS. Processing indicators such as [Text] or [Excerpts] in the firs: line of each item indicate how the information was processed from the original. Unfamiliar names rendered phonetically are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear from the original source but have been supplied as appropriate to the context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by the source. Passages in boldface or italics are as published.

SUBSCRIPTION/PROCUREMENT INFORMATION

The FBIS DAILY REPORT contains current news and information and is published Monday through Friday in eight volumes: China, East Europe, Soviet Union, East Asia, Near East & South Asia, Sub-Saharan Africa, Latin America, and West Europe. Supplements to the DAILY REPORTs may also be available periodically and will be distributed to regular DAILY REPORT subscribers. JPRS publications, which include approximately 50 regional, worldwide, and topical reports, generally contain less time-sensitive information and are published periodically.

Current DAILY REPORTs and JPRS publications are listed in *Government Reports Announcements* issued semimonthly by the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22161 and the *Monthly Catalog of U.S. Government Publications* issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

The public may subscribe to either hardcover or microfiche versions of the DAILY REPORTs and JPRS publications through NTIS at the above address or by calling (703) 487-4630. Subscription rates will be provided by NTIS upon request. Subscriptions are available outside the United States from NTIS or appointed foreign dealers. New subscribers should expect a 30-day delay in receipt of the first issue.

U.S. Government offices may obtain subscriptions to the DAILY REPORTs or JPRS publications (hardcover or microfiche) at no charge through their sponsoring organizations. For additional information or assistance, call FBIS, (202) 338-6735,or write to P.O. Box 2604, Washington, D.C. 20013. Department of Defense consumers are required to submit requests through appropriate command validation channels to DIA, RTS-2C, Washington, D.C. 20301. (Telephone: (202) 373-3771, Autovon: 243-3771.)

Back issues or single copies of the DAILY REPORTs and JPRS publications are not available. Both the DAILY REPORTs and the JPRS publications are on file for public reference at the Library of Congress and at many Federal Depository Libraries. Reference copies may also be seen at many public and university libraries throughout the United States.