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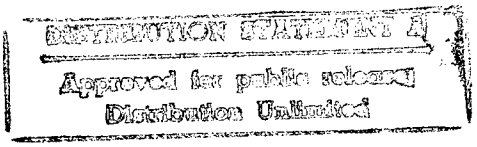
CHINA: Energy



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China: Energy

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Erratum: In JPRS-CEN-92-013, 24 December 1992, pg 32, the name in the headline of the first item (the name also appears in the first and second paragraphs) should read "Daba".

NATIONAL DEVELOPMENTS

POWER NETWORK

HYDROPOWER

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COAL

OIL, GAS

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CONSERVATION

Energy Shortage Hinders Economy

40100053A Beijing BEIJING REVIEW in English Vol 36 No 1, 4-10 Jan 93 pp 5-6

[Text] Despite a major breakthrough in the energy industry in 1992, China's national economy continues to be hindered by an energy shortage.

Up to December 14, power production for 1992 reached 705 billion kilowatt-hours. Production for the entire year is expected to top 740 billion kilowatt-hours, 35 billion more than planned and 63 billion more than in 1991. To further develop power industry, the State Planning Commission has approved 30 large power projects. When they are completed, electricity installation capacity will be increased by 17.4 million kilowatts.

Latest statistics from the Ministry of Energy Resources (MER) show energy production in 1992 amounted to 1,056 million tons of standard coal, 13 million tons more than 1991. Among this number, coal accounts for 74.4 percent of production, crude oil 10 percent, natural gas 1.98 percent, hydropower 4.6 percent and nuclear power less than 0.05 percent. It is estimated that coal production hit 1.1 billion tons, compared with 1.08 billion in the previous year.

However, the growth of energy production failed to keep pace with the rapid economic advances. The energy headache has become more prominent recently.

Power has been in short supply for many years, especially in rural areas. In many places, home electric appliances, such as refrigerators and washing machines, cannot be put to normal use due to insufficient power supply. Occasional power cuts are not unusual, even in big cities, and candles are still being used for home lighting.

Statistics also show that in 1992, per capita power consumption was 600 kilowatt-hours, placing China 78th in the world. In some developed countries, the figure is 5,000 to 10,000 kilowatt-hours. According to MER, the electricity generating capacity increased by 10.8 percent in 1992 while the gross national product (GNP) grew by 12 percent, and industry increased by 18 percent. That indicates how far the supply of electricity missed the demand.

China boasts rich resources of coal and achieved a record high of coal production in 1992. However, its coal reserves are heavily concentrated in the northern part of the country. Shanxi Province, for example, is the biggest coal base, also an economically undeveloped region. Meanwhile, coal shortages in developed northeast, east and south China have affected industrial production and living standards in those areas. Therefore it is vital to improve the railway system so as to ship coal in Shanxi out to other provinces.

In order to solve the problem, the state has invested a total of 6.6 billion yuan, including 18.4 billion Japanese yen (US$147 million) in loans from the Japanese government, to build the Datong-Qinhuangdao railroad in north China. The railroad links the cities of Datong, a major coal producer in Shanxi, and Qinhuangdao, the world's largest coal terminal.

Recently the railway line has opened to traffic, marking the start of China's first heavy-duty, double-track electrified railroad designed for coal transportation. As a strategic move to help ship out the rich coal resources of Shanxi, the 653-kilometer railway has the capacity to move some 55 million tons of coal annually. Its long-term handling capacity will top 100 million tons a year, earning it the title "China's energy lifeline."

Big Jump Registered in Coal, Crude Oil, Electric Power in '92

936B0042A Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 6 Jan 93 p 1

[Article by reporter Xu Xingtang [1776 5281 1016]: "Development of China's Energy Industry Enters Its Best Period; Coal, Crude Oil, and Electric Power Output Up Substantially Over 1991"]

[Text] In 1992, China's output of coal, crude oil, and electric power all increased substantially over 1991.

Minister Huang Yicheng [7806 3015 6134] of the Ministry of Energy Resources reported at the National Energy Resource Work Conference which opened on 5 January 1993 that China's raw coal output in 1992 surpassed 1.11 billion tons, a net increase of more than 200 million tons since the establishment of the Ministry of Energy Resources in 1987. China now has coal stocks on hand of more than 200 million tons and coal supplies for large and medium-sized thermal power plants are now basically guaranteed. Electric power output in China in 1992 reached 742 billion kWh, an increase of more than 10 percent over 1991. During the past 5 years, China has added 60,000MW in new installed generating capacity, which is equivalent to the total installed generating capacity during the 30 years prior to 1980. Crude oil output reached 142 million tons in 1992 and natural gas output was 15.7 billion cubic meters. This included offshore crude oil output of 3.8 million tons, more than double that 5 years ago.

Huang Yicheng said that China's nuclear industry has now walked onto the road of development. The first 300MW nuclear power generator at Qinshan Nuclear Power Plant was connected to the grid and placed into operation during 1992. Construction is proceeding smoothly on the two 900MW generators at Daya Bay Nuclear Power Plant and the first generator is expected to be completed and placed into operation at the end of 1993. He pointed out that during the past few years China's energy resource industry has grown faster than other industries. Now, although a few places have electric power and coal shortages, they have been greatly alleviated. This is one of the best periods for energy resource production, construction, supplies, and management since New China was founded.

Sino-Japanese Cooperation in Desulfurization Technology Signed

93FE0054F Beijing ZHONGGUO HUANJING BAO [CHINA ENVIRONMENTAL NEWS] in Chinese 19 Sep 92 p 1

[Article by Rao Beiya [7437 0555 0068]: "Sino-Japanese Industrial Experimental Cooperative Project on Power Plant Desulfurization Technology Officially Begun"]

[Text] On 16 September 1992, the Sino-Japanese Industrial Experimental Cooperative Project on Power Plant Desulfurization Technology was signed in Beijing. Lu Youmei, China's vice minister of the Ministry of Energy Resources, and Sugiyama Kazuo of Japan's Electric Power Development Co., Ltd., represented the respective countries. This signals the beginning of the cooperative project with the Japanese special investment of 7.33 billion yen.

This cooperative project is one of Japan's "Green Aid Program" projects assisting Third World countries in environmental protection. The amount of 7.33 billion yen is from the "Specific Expenses for Locally-Determined Projects" of the Finance Ministry's "Special Account for Promoting Measures." This fund will be used to build two sets of desulfurization installations using different technologies to treat the smoke from coal-burning power plants. The capacity is to treat 20,000-30,000 standard cubic meters per hour. The Japan side is responsible for the major portion of the expenses for the design, manufacture, installation, adjustment, and operation of the equipment. China will pay for water, electricity, steam, the desulfurization ground, as well as the treatment of ashes and cinders.

The Japanese government has designated the Electric Power Development Co., Ltd. to cooperate with China's Energy Resources Ministry to carry out this experimental research. After numerous discussions and negotiations between both sides and on-site investigations of candidate plants by concerned experts, the Huangdao Power Plant in Shandong Province was selected for the first stage desulfurization experiment. Using the rotary spray drying desulfurizing technology, the initial design, equipment manufacturing, installation and adjustment of the installations are planned to be completed between 1992 and 1995. Operation will be started in 1995. The experiment will be continued until 2000. The location and the technology of the second stage desulfurization experiment is pending further negotiation.

The Southwest: Nation's Greatest Potential Energy Base?

936B0024A Beijing LIAOWANG [OUTLOOK] in Chinese 2 Nov 92 pp 7-8

[Article by Luo Ping [5012 5393]]

[Text] The undulating mountains and plentiful rainfall infuse a great store of energy into the maze of rivers and streams of the great southwest, and causes a complex subterranean fomentation of many kinds of energy sources. Comparative studies done by the CAS have found that the richest stores of energy resources in China are in the southwest, and it can produce 190 million kW of hydroelectric power, or 50 percent that of the entire country. It holds over 7.7 billion tons of coal, more than half of the nation's natural gas, and a large potential for nuclear energy. These natural resources are evidence that the southwest harbors superior conditions and excellent foundations for building a great energy base for China. Not only is it self-sufficient in electricity and coal, but electricity can be sent to the east, and Guizhou coal can be shipped out, and that will be a decisive driving force for China in the 21st Century.

Investment System Reforms, Energy Construction Advances

Investment for development of energy is great and long term, but the southwest is one of the poorest regions in China. National investments have been small for many years, the rate of development has been slow, and long recognized resource advantages have not been turned into economic advantages.

The reform has opened up a path of hope for development of energy resources in the southwest. As the system reforms have progressed, various new avenues of investment have opened up. The completion of the large-scale Lubuge power station in Yunnan in June of last year opened the way for development of the hydropower system. The first use of World Bank funds, international competitive bidding, importation of funds, knowledge, electro-mechanics and engineering facilities, and even the modernized management and administrative experience were a great impetus to the development of the southwest power industry. Foreign funds were used in four electric power development projects, the largest of which was the Ertan hydropower station with an installed capacity of 3.3 million kW, for which over 10 billion yuan was invested including a 740 million U.S. dollar World Bank loan.

In 1985, Yunnan Province again took the lead in applying the national and local joint venture approach to building large-scale hydropower projects. The Manwan hydropower station with 1.5 million kW installed capacity was built on the Lancang Jiang as a ministerial and provincial joint venture. Ministry and province joint ventures have lead to multi-party joint ventures all across the province. Several eastern provinces, strapped for electric power, have taken a deep interest in the development of electric power in the southwest, and Guangdong and Hunan have made their investments. As many as 14 cascade stations could be built on the 1,240-kilometer segment of the Lancang Jiang flowing through Yunnan, and on the strength of the superior conditions of the lower reaches of the river, Yunnan plans to build the first eight hydropower stations there for a total installed capacity of 13.7 million kW. In May last year, the Ministry of Energy Resources, State Energy Investment Corporation, Yunnan, and Guangdong defined the principles for a 15-to-20-year cooperative

joint venture. The State Energy Investment Corporation will put up 60 percent of the investment for the 1.25 million kW installed capacity Dachaoshan hydropower station, and Yunnan Province would provide 40 percent of the investment. Construction will begin in 1993, and will be largely finished and in operation during the Ninth 5-Year Plan. For the 4.2 million kW installed capacity Xiaowan hydropower station, and the 14.5 billion cubic meter regulating reservoir, Guangdong's investment share will be 60 percent, the State Energy Investment Corporation will provide 30 percent, and Yunnan, 10 percent. Efforts will be made to get the projects underway by about 1995.

Last year, the Guizhou Wu Jiang Hydropower Development Corporation—the first watershed hydropower development corporation to be jointly managed centrally and locally—set a new model for electric power investment. The Wujiangdu power plant with a total installed capacity of 630,000 kW and the 510,000 kW installed capacity Dongfeng hydropower station was placed under management of this corporation, and returns on the investment will be reinvested again and again, compounding gains, to snowball the planned development of nine hydropower stations along the entire watershed. This will lace up joint enterprises and open new avenues for raising funds at the same time. The plan is, by this method, to build within 25 years, a Wu Jiang hydroelectricity base with a total installed capacity of 6.39 million kW. The distinctive feature of this approach is that it makes enterprize management into an investment body that develops itself. This method will be used for development of the Lancang Jiang cascades in Yunnan, and the Yalong Jiang in Sichuan.

The establishment of new multi-source investment structures has propelled the development of energy resources in the southwest. The 1990s sets a pattern of continued growth. The era of large-scale cascade development has arrived; On the three major water systems in Yunnan, Guizhou, and Guangxi, the Lancang Jiang, Wu Jiang, and Hongshui He which have the potential to generate power up to a total of 350 million kW, six large-scale hydropower stations are already under construction, including those at Manwan, Yantan, and Dongfeng. Sichuan is also preparing an electric power structure on the Jinsha Jiang and the Dadu He.

The East-to-West Electric Power Corridor

The South China Electric Power Corporation Ltd., jointly financed and operated by executives of the Ministry of Energy Resources, Yunnan, Guizhou, Guangxi, and Guangdong, have undertaken the construction of the electric power corridor in conjunction with the development of the southwest energy base. An investment of over 7 billion yuan will be made between 1990 and 1997 to build the Tianshengqiao No 1 and No 2 cascade hydropower station on the Nanpan Jiang at the border of Guangxi and Guizhou. Extra-high voltage transmission lines from Tianshengqiao to Guangdong, to Guiyang, and to Lubuge, will also be built. This corridor which will link up the southwest energy base with Guangdong and the Hong Kong-Macao area, and extend into the heart of the western energy base will open the way to send western electric power eastward, and it will ultimately connect Yunnan, Guizhou, Guangxi, and Guangdong into a huge southern power network; and by the year 2000, this huge network of nearly 100 large-scale hydropower stations and thermal power plants will have a total scale of installed capacity up to 300 million kW. The first 500,000 volt extra-high voltage transmission line on the Tian Guang line will begin at the 1.3 million kW installed power Tianshengqiao No 2 cascade power station at the Guizhou-Guangxi border, then traverse Guangxi through Pingguo, Laibin, Wuzhou, to Foshan and Jiangmen, a total length of 1,000 kilometers. It will be designated the "special express" of the "west to east power supply". The construction is entering the final stages and is expected to be transmitting power within a year. Another 500,000 volt extra-high voltage transmission line from the 1.2 million kW installed capacity No 1 cascade power station at Tianshengqiao will be under full-scale construction shortly and is expected to be finished in 1997.

Interactive Hydropower and Thermal Power Strides Forward

Guizhou and Yunnan are also the richest coal areas in the southwest. The two provinces, stalwarts in coal production, are now actively developing local and small rural coal mines simultaneously, and they are expanding and building a number of new large mines which will guarantee long-term leadership in the coal industry. Guizhou, the so-called coal capital of the south, having special advantages for mutually supportive thermal and hydropower, has the edge in developing this sort of cooperation. The famous Panxi-Liupanshui mining and coal rich area has entered an active stage of planning consolidated development and utilization. Guangxi, Guizhou, and the State Energy Investment Corporation are in a joint venture to build the Panxian thermal power plant, and the 30 percent of the investment supplied by Guangxi will be used to develop coal. In 1994 three 200,000 kW generators may come on line, as an investment of 170 million yuan has already been set for the construction of the main machinery room of the power plant, and the coal washing plant.

Turning Up the Heat on the Energy Industry

40100058 Beijing CHINA DAILY (BUSINESS WEEKLY) in English 8 Feb 93 p 8

[Article by Ying Pu]

[Text] The Chinese Government has announced massive investment plans this year to expand the country's energy industry in a bid to cope with a worsening power shortage as a result of high economic growth.

The central government alone has promised to channel 71 billion yuan ($12.5 billion) worth of investment into

the energy industry in 1993, which represents a hefty 44.4-percent rise over last year.

Plus provincial investment, total input on energy projects this year is sure to surpass 100 billion yuan ($17.5 billion).

Of the total investment, 16 billion yuan ($2.8 billion) will be poured into coal mines to increase national coal production by 30 million tons a year.

A big chunk of the investment, 52.2 billion yuan ($9.2 billion), will be channeled into electricity production and transmission. This is 50 percent more than in 1992. Hydropower projects will absorb 31.1 billion yuan ($5.5 billion), thermo-power projects will get 11.5 billion yuan ($2 billion) and the rest will go to electrical transformation projects.

New generators to be put into operation this year will have a total generating capacity of 20.7 million kilowatts, including 11.5 million kilowatts from 28 thermal power projects and 9.2 kilowatts from hydropower projects.

Planning on another 23 projects with a total generating capacity of 22.2 million kilowatts will begin this year.

The remaining 40.9 billion yuan ($7.2 billion) will be invested in petroleum and natural gas projects.

Of that, offshore oil projects will absorb 1.4 billion yuan ($245 million), while onshore oil projects will get 39.5 billion yuan ($6.9 billion).

Altogether, new projects could add an annual output of 16.5 million tons of oil and 500 million cubic meters of natural gas to the industry.

According to the government's plans, China will produce 1.1 billion tons of coal this year, 40 million more than last year. It will turn out 140.8 to 141.3 million tons and 16 billion cubic meters of natural gas. The 1993 production plan of electricity will top 800 billion kilowatt-hours, up 8.1 percent.

Analysts said the power supply shortage this year is expected to ease, but coal firms still face heavy losses from operations.

New mines opened in the last 5 years turned out 200 million tons of coal.

Oil production emerged from a slack period and began to report steady increases. Also, nuclear power stations began construction.

These achievements have helped rescue a number of power-hungry industries.

But in the meantime, because of low selling prices for power, backward production technology, and the high costs of input into energy production, coal enterprises alone suffered a total loss of 12 billion yuan ($2.1 billion) last year while oil enterprises also recorded an overall loss of 10 billion yuan ($1.75 billion). To help these companies survive, the central government had to subsidize them to the tune of 10.8 billion yuan ($1.9 billion).

To solve the problem, these companies are looking for cooperative projects including mining and prospecting in neighboring countries such as Southeast Asia and the former Soviet republics.

New Multi-Purpose Incinerator To Be Popularized

93FE0054E Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 5 Sep 92 p 4

[Article by Fu Qian [0102 6692]: "China's 1992 Environmental Protection Plan Promotes New Product Re-Combustion Multi-Purpose Incinerator"]

[Text] Recently, Type SZ-120 re-combustion multi-purpose incinerator, designed and manufactured by the Handi Mechanical and Electrical New-Tech Company in Beijing's Haidian District, is listed as a promotion product in China's 1992 plan for environmental protection.

This type of incinerator has an adjustable dual-flue construction. The combustion chamber has an automatic ignition unit performing the function of automatic temperature control, pressure adjustment etc. It is equipped with an air pre-heater, and a consolidated system to utilize the heated air. An air screen is installed at the incinerator door. The screen prevents the incinerator gas and heat out-flow and at the same time supplies additional heated air for better combustion. The incinerator lining, which is cast with refractory material in one piece, has high strength, long life, good airtightness, and it is easy to maintain. The outstanding feature is its two combustion chambers. After being burned once, the burned wastes pass to the second chamber and undergo intensified burning for a second time. Thus, all the germs, bacteria, and virus are thoroughly destroyed. The entire process is smokeless and odorless, hence the environment is not polluted. This incinerator is suited for processing all kinds of medical wastes and other discharged wastes from chemical plants, pharmaceutical plants, animal farms, and plants for biological products.

Ningxia To Transmit Power to Sichuan

936B0032C Chengdu SICHUAN RIBAO in Chinese 19 Nov 92 p 1

[Article by reporter Cao Yuzhen [2580 7193 4776]]

[Text] After 4 days of amicable talks, the Deputy Secretary of the Ningxia Hui Autonomous Region Party Committee, Liu Guofan, Deputy Secretary of the Sichuan Provincial Committee, Vice Governor, Li Boyong, exchanged signatures on the text of an agreement of intent to cooperate in transmitting electric power from the Ningxia Hui Autonomous Region to Sichuan.

The Ningxia Hui Autonomous Region which is rich in coal, proposed the idea of converting from the shipping of coal to the transmitting of electricity. Sichuan is rich in hydropower resources, but must maintain a certain proportion of thermal power capacity to use during periods of drought to keep up the supply of electricity and to adjust peak loads in high water periods. The Ningxia Economic Cooperation Delegation, headed up by Li Boyong, and the authorities of relevant offices and bureaus of Sichuan joined earnestly in deliberations on the problems involved in transmitting electricity from Ningxia to Sichuan, and they reached a common understanding. Both sides are in agreement to study further a feasible plan for sending electricity from Ningxia to Sichuan.

Jiangsu Planning 13,750MW in New Construction

936B0038A Shanghai JIEFANG RIBAO in Chinese 2 Dec 92 p 3

[Article by reporter Cai Mingde [5591 2494 1795]]

[Text] Nanjing, 1 Dec—Before the end of the century Jiangsu will raise large amounts of capital for new installed electric power capacity of 13,750MW, build a line of high-capacity, high-parameter, highly automated and high efficiency modernized power plants, and associated trunkline networks of 220 kv and up, that will charge the economic development of Jiangsu, and boost the East China network. This was announced by Jiangsu Governor, Chen Huanyou, at the close of the Jiangsu Electric Power Working Conference on 30 November.

Since the Seventh 5-Year Plan, the policy of raising funds for electric power has been implemented and electric power construction has taken off. At present, the installed capacity of units of 500 kW and up has reached 8200MW, more than 75 percent of which are high-temperature high-voltage units, and the entire province has been covered by a large power grid. But it still lags well behind the economic development of the province and the rising standard of living of the people. Last year per capita average consumption of electricity was only 663 kWh, far behind the other coastal provinces and cities. Therefore the Jiangsu Government has made an early decision to step up the pace of electric power construction.

Roof of World Rich in Energy

40100054A Beijing CHINA DAILY (BUSINESS WEEKLY) in English 1 Feb 93 p 7

[Text] Lhasa (Xinhua)—Tibet has made significant achievements in developing hydroelectric and geothermal energy resources, officials say.

It has constructed 435 hydropower stations and two geothermal power stations throughout the region.

With a total generating capacity of 160,000 kilowatts, the region's 441 power stations, including four thermal power stations, produced 370 million kilowatt-hours of electricity last year, which supplied 60 percent of Tibet's counties.

Tibet has a lot of hydroelectric and geothermal energy resources as about 56.6 million kilowatts of hydroelectric power can be developed, while more than 600 sites can be exploited for terrestrial heat with a total potential capacity of 800,000 kilowatts.

The two geothermal power stations have a total generating capacity of 27,000 kilowatts.

Developing Medium-Sized Hydropower Projects in Jiangxi Province

936B0029A Beijing SHUILI FADIAN [WATER POWER] in Chinese No 10, 12 Oct 92 pp 18-19

[Article by Ni Qixiang [0242 0796 7449] and Zhu Tiezheng [2612 6993 6927]]

[Text]

(1) Summary

The total volume of installed capacity of hydropower resources on a scale of 500 kW or more that can be developed in Jiangxi adds up to 5.1026 million kW, and an annual output of 19.054 billion kWh. The special features of hydropower resources in Jiangxi are: 1) high precipitation and abundant run-off; 2) the mainstreams of the Gan, Xin, Xiu, Fu and Rao river systems have gentle channel gradients, the drop heights are not concentrated, and the drop heights are relatively greater on their tributaries; 3) the geologic structure of the area is stable, the seismic intensity is not high, the geological conditions for reservoir engineering are not complex, the building of dams for reservoirs requires structures of moderate height, and the geological conditions are favorable; and 4) some of the engineering requirements for construction on the mainstreams and several of the larger tributaries will cause considerable inundation, and that can be a restricting factor for hydropower construction.

Jiangxi is short on energy resources, there being only 1.49 billion tons of coal reserves, only .1 percent that of the entire country, and development of thermal electric power is limited by coal resources and transportation conditions. For these reasons hydropower remains the better energy resource. There is a need to develop comprehensive use of Jiangxi hydropower resources for flood prevention, irrigation, and navigation, and an energetic development of hydroelectricity will have an important role in the energy resource picture for Jiangxi.

(2) Recommended Near-Term Development Goals

Jiangxi has only three large-scale hydropower stations, and they are all on the mainstream of the Gan Jiang. The Wan'an station is now under construction, but the Xianshan and Xiajiang projects will be problematical in the near term because they will cause much inundation. The solution to the energy crunch Jiangxi now faces is to make the most of medium-sized hydropower development. After investigation the projects recommended for scheduling as near-term development goals to be built in stages and groups are five: medium-sized stations at Tongmuqian, Xiankou, Gaoyi, Sishun, and Baozishi, a medium-sized multiple purpose station at Liaofang, and a medium-to-large station at Taihe. The special indicators for recommending early development are shown on the chart:

Table 1. Index of Special Indicators Recommending Early Development

	average annual run-off (m^3/s)	normal catchment (m)	maximum dam height (m)	length of intake (m)	reservoir capacity (100 million m^3)			installed capacity (10,000 kW)	assured output (10,000 kW)	annual output (kW x h)	land flooded (10,000 mu)	population displaced (10,000)
					total capacity	regulating reservoir capacity	flood prevention pool capacity					
Tongmuqian	15.9	382	63	1100	1.06	0.81		3.0	0.73	0.73	0.20	0.20
Xiankou	17.0	300	58.2	1370	0.23	0.14		2.55	0.78	0.67	0.02	0.01
Gaoyi	29.3	180	34	6650	0.40	0.28		3.6	0.83	1.06	0.19	0.29
Sishun	3.7	640	86	1076	0.15	0.15		2.52	0.54	0.87		
Baozishi	145	95	31					2.5	0.65	0.95	0.24	0.42

Table 1. Index of Special Indicators Recommending Early Development (Continued)

	average annual run-off (m^3/s)	normal catchment (m)	maximum dam height (m)	length of intake (m)	reservoir capacity (100 million m^3)			installed capacity (10,000 kW)	assured output (10,000 kW)	annual output (kW x h)	land flooded (10,000 mu)	population displaced (10,000)
					total capacity	regulating reservoir capacity	flood prevention pool capacity					
Gaohu	8.9	190	67	1102	1.78	1.10	0.27	2.52	0.33	0.66	0.45	0.24
Daao	16.9	217	95	847	2.66	1.52	0.26	4.0	0.73	0.85	0.51	0.61
Liaofang	223	66	34.6		5.53	1.77	4.17	5.0	0.71	1.7	2.79	2.10
Taihe	1050	88	21		9.78	0.12		18.0	4.2	6.23	3.0 approx.	1.30 approx.
total					21.59	5.89	4.7	43.69	9.5	13.72	7.40	5.17

1. The Five Hydropower Stations

The chief advantages of the Tongmuqiao, Xiankou, Gaoyi, Sishun, and Baozishi hydropower stations are: 1) they have specified regulating reservoir capacities, and when finished they will provide the regulatory peaking service for the power grids; 2) there will be little inundation and the resettlement issue will be easily solved; 3) they are of moderate scale (averaging about 30,000 kW), save on investment, amenable to many levels and avenues for raising funds for construction, and they are suitable to present material and financial strengths; and 4) the engineering will be easy, quick, and will meet near-term power consumption needs.

Tongmuqiao, Xiankou, and Gaoyi will be cascade stations on the north branch of Suichuan Jiang, a tributary of the Gan Jiang. The north branch of the Suichuan Jiang is a stream with abundant water, high drop height, little inundation, and the stream plan is finished and ready for review. After assessment the opportunity must be seized, work apportioned, early-stage processing expedited, and construction scheduled in order to assure successive cascade development. The total installed power of the three medium-sized stations will be 90,000 kW with a guaranteed output of 23,000 kW, an annual output of 250 million kWh; 4,100 mu of land will be flooded, and 5,000 persons resettled.

The Sishun hydropower station will be located at Sishunshui on the Shangyou Jiang, a tributary of the Zhang Jiang in southern Jiangxi. Using the trans-basin method a drop height of over 300 meters can be claimed almost without inundation or resettlement. The initial plan is for an installed capacity of about 25,000 kW, which will be a good power resource to start with. The early stage work is incomplete, and there still needs to be additional planning and study for a rational multiple purpose layout for the trans-basin engineering to reach the requisite rational utilization of its hydropower resources. After completion of plans and assessment the follow-on work should be actively pursued.

The Baozishi hydropower station, located on the upper reaches of the Xiuhe, will be a low-head station. It will use to good advantage the run off from the regulating reservoir of the Daduan hydropower station already built on a tributary of the Xiu He, which has a total reservoir capacity of 113 million cubic meters, or the Dongjin hydropower station on which construction has just begun upstream, and which has a total reservoir capacity of 795 million cubic meters. The preliminary design work for this station has already begun.

2. The Three Multiple Purpose Stations

Jiangxi can build three stations at Gaohu, Daao, and Liaofang, each with an installed capacity of medium-sized stations, the construction conditions are quite good for multiple use of water conservation stations.

The Gaohu multiple purpose station will be located on the south branch of the northern tributary of the Liao He, a tributary of the Xiu He, where the watershed is not only high, but there is a tailwater catchment basin (average annual in-flow volume of 5.02 m^3/s) of the Luowan hydropower station of an already finished trans-drainage-basin project. There will be little inundation, and besides having an installed generating capacity of 25,000 kW, it will also be able to irrigate 310,000 mu of agricultural land. The initial design of the Gaohu multiple purpose hydropower station is already finished. It will take care of the Liaohe basin water shortage problem during droughts, and will fulfil the growing requirements for electric power, and efforts should be made to schedule the project as soon as possible to get construction underway.

The Daao multiple purpose hydropower station, located on the middle reaches of the Shixi Shui, a tributary of the Xin Jiang, can irrigate an area of 190,000 mu of new land and improve the irrigation of another 140,000 mu of land, as well as provide 40,000 kW of installed electric power capacity. The feasibility study for this multiple

purpose station is now underway, and with the prerequisite quality guarantees, the early stage work should be expedited, and the project should be scheduled as soon as possible.

The Liaofang multipurpose hydropower station, located on the middle reaches of the Fu He, as a spigot reservoir will be effective for flood prevention, irrigation, and navigation. Once built, it will have a flood prevention reservoir of 374 million cubic meter capacity that will raise the downstream flood prevention standards from a 10 to 20-year cycle to a 20 to 50-year cycle, and basically solve the downstream flood prevention problem. It will provide water for irrigation of 508,000 mu of agricultural land; will have an installed capacity of 50,000 kw, and can also raise the navigation capacity of the middle and lower reaches of the Fu He up to the 100-ton class, and its only drawback is that the loss to inundation will be quite severe. The feasibility study has just been started, and it is recommended that further study be done on the possibility of reducing the losses due to flooding.

3. The Taihe Hydropower Station

The Taihe hydropower station will be located on the mainstream of the Gan Jiang within the boundary of Taihe County, but the reservoir area will be largely within Wan'an County. Investigations conducted jointly from September to December 1990 by the Huadong Survey and Design Academy, the province, prefecture, and county found that 48,370 mu of tillable land will be inundated and 22,390 people will be displaced. Preventive measures are being studied, and if they prove feasible the inundation can be reduced to 30,000 mu and resettlement (including those otherwise affected) can be held to 13,000.

The Taihe hydropower station reservoir will be the reregulating reservoir for the Wan'an hydropower station, and if it is not built soon the area will not get full benefit of Wan'an's power output, flood prevention, or navigation. When the Taihe hydropower station is built, in addition to the benefit of its 180,000 kw of installed power, it will free up 25,000 kW of Wan'an station's base load, allowing the fifth unit installed at Wan'an to provide the peak load capability for its power grid. It will also correct the inability of the Wan'an water turbines to meet minimum load requirements, and will also create deep water for navigation on the 42-kilometer water course from Wan'an to Taihe.

The feasibility study for this hydropower station is finished, and it is now proceeding on the resettlement plan and inundation prevention plan. The hydropower station can be selected as the follow-up to the Wan'an hydropower project, and because it is a medium-to-large project, it should be treated as a large-scale project.

(3) Conclusion

The Jiangxi Province hydropower industry has grown vigorously in the recent decade, and the growth rate of installed capacity and average power output for the whole province has been 8.5 percent and 7.5 percent respectively, but because the original electric power base was rather weak, shortage of electricity is still a serious problem. The average per capita consumption of electricity is now only 321 kWh, less than two-thirds the national average. Development of Jiangxi's electric power industry in the next decade will be essential to meeting the requirements for industrial and agricultural production and the people's livelihood, and whether proceeding from the water conservation or energy resource position, there must be a rapid development and utilization of Jiangxi's water resources to meet requirements for the electric power which grows daily, as well as for flood prevention, and for irrigation, and for the economic development of Jiangxi.

Technical Problems Overcome at Wuqiangxi Hydropower Station

936B0020A Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 3 Nov 92 p 2

[Article by Zhang Chunbao [1728 2504 6202] and Wen Boqi [3306 0130 0366]]

[Text] Through hard work of more than 7,000 workers of the Chinese Eighth Engineering Bureau for Hydroelectric Power, a number of technical "bottlenecks" at Wuqiangxi Hydropower Station in Hunan, a national key project, have been overcome. This project has accumulated valuable experience for constructing large hydropower stations in China. Problems like the secondary sieving vibration of the quartz aggregate and cement mixing tower are directly relevant to the Three Gorges project that is about to begin.

Construction of the Wuqiangxi hydropower station began in 1986. It is located in Yuanling County in Hunan Province, on the lower reaches of the Yuanjiang. Total investment will be more than 5 billion yuan, total generator capacity will be 1.2 million kilowatts, and the annual output will be 5.3 billion kWh. It is jointly sponsored by the central government and Hunan Province. It is also the only large hydropower station with a capacity exceeding 1 million kW. The plan calls for power output from the first generator in 1994 and completion of the entire project in 1996.

The Wuqiangxi project is a large-scale construction with a high degree of difficulty. The construction uses the most advanced equipment in China and the most capable technical organizations. Since some of the technical equipment and raw materials are used for the first time in a major Chinese construction engineering project, some unprecedented technical difficulties were encountered. These hurdles once affected the progress of the project. With the hard work of technical personnel in the Chinese Hydroelectric Power Eighth Engineering Bureau, the "bottlenecks" were overcome one by one and construction progressed rapidly.

Aggregate is the "staple" for hydropower construction. The aggregate used at Wuqiangxi is the high hardness quartz aggregate, used for the first time in China's hydropower construction. The quartz content is as high as 70 to 90 percent and the hardness is greater than that of steel. As a result, the machinery of the aggregate handling system was severely worn and their lifetime greatly reduced. Mechanical failures often adversely affected the progress of construction. After repeated investigation and improvement by the engineers of Wuqiangxi hydropower station, the capacity was doubled, the conveyer belt was widened, and the sieve screen was changed from a steel screen to a pliable and elastic rubber screen. With these technical improvements, the monthly output of manually-produced aggregate has increased from 30,000-40,000 cubic meters to the current level of 150,000 cubic meters. The new output has basically satisfied the engineering needs.

The cement mixer tower at Wuqiangxi was designed as an experimental tower for the Three Gorges project. It was the first tower in China that uses a sieve at the top of the tower. The advantages are the compactness in layout, the convenience in accessing ingredients, and the high speed. However, secondary sieving on the 45-meter tower, equivalent to the height of an 11-story building, causes excessive vibration. Vibration has interfered with the normal operation of the weighing system and instruments in the building, and also affected the integrated facility and pipes of the entire building. Malfunctions were frequent and the vibrations caused screws to come loose. Experts and technical staff at Wuqiangxi finally installed vibration dampers and located the control room outside the building. These measures have basically solved the vibration problem.

The solutions to technical problems at Wuqiangxi have provided valuable experience for other future major hydropower constructions in China.

Shanxi Planning Heavy Investment in Power Plant Construction

936B0034A Beijing JINGJI RIBAO [ECONOMIC DAILY] in Chinese 9 Nov 92 p 1

[Article by reporter Tie Jingkui [1586 4842 7608]]

[Text] The celebration of the ribbon cutting to begin construction of two 100,000 kW units at the Shanxi Huaneng Yushe power plant on 31 October opened the curtain on the second age of large-scale energy construction in Shanxi.

In keeping with the spirit of the 14th National Party Congress, with fresh new ideas and intrepidity, Shanxi will leap onto a new economic stage; over and above the existing installed capacity of 7.4 million kW of large plants, large units, and large grids, Shanxi will again invest 50 to 60 billion yuan to build 18 million kW in installed capacity at large-scale pit-mouth power plants, and locally bring coal into a second age of energy resources; and increase the transmission of electricity to Guangdong, Jiangsu, Shanghai, Beijing, Tianjin, and Hebei from the present 7.8 billion kWh to 45 billion kWh a year, raise the annual provincial consumption of coal for power from the present 12 million tons to 70 million tons, and effectively relieve the pressure on railroad transportation.

Shanxi, in entering upon this second age of energy construction to move from raw coal dominated output build toward the production of coal and electricity on an equal footing, on a scale of engineering second only to the Three 3 Gorges project, unprecedented in the annals of China's power industry, and has gained not only the support of the central leadership and departments, but the support and cooperation of the coastal and surrounding provinces and cities as well.

Not long ago, Shanxi and Jiangxu signed a document of intent to join in a venture to build the Shanxi Yangcheng power plant of over 4 million kW. By mutual accord the power plant will be a joint venture between the national government and Shanxi, and the power grid will be jointly funded and built by the national government and Jiangsu. Both sides are furnishing manpower and equipment, and through various means have received foreign funding and funds from outside the provinces.

The sending of electricity from Shanxi to Guangdong and Jiangsu is not only necessary for the national energy effort, but within the range of long distance capability and cost. From the standpoint of the cost of electricity forecasted in the feasibility report on transmitting power outside of Shanxi done by the Ministry of Energy Resources' Electric Power Science Academy, the cost of sending power from Shanxi to Jiangsu and Guangdong will not exceed the cost in power of both provinces separately building coal-fired power plants. This is the modus operandi employed the world over in solving energy equations, and its application to this economy can be beneficial.

Construction in Full Swing on Phase 1 of Dalad Power Plant

936B0022B Hohhot NEIMENGGU RIBAO in Chinese 10 Sep 92 p 1

[Article by reporter Li Shuxiu [2621 3219 4423]]

[Excerpts] The first-phase of construction of the Dalad power plant, a key national engineering projects of the Eighth 5-Year Plan, was formally inaugurated on 8 September. Vice Minister of the State Planning Commission, Yao Zhenyan, Vice Chairman of the Inner Mongolia Autonomous Region, Liu Zuohui, President of the State Energy Investment Corporation, Wu Jingru, and Deputy Director of the Capital Construction Department of the Ministry of Energy Resources, Lu Yuanrong, cut the ribbon to start construction.

The Dalad power plant is the western energy base of the Autonomous Region, and will be the second key project for redoubling electric power in the Eighth 5-Year Plan. Two 330,000 kW units scheduled to be installed in the first phase of construction will occupy 42 hectares of space (with an investment of 1.69 billion yuan). The first unit will come on line in late 1994, and the other by the end of 1995. When phase 1 goes operational it will generate 4.2 billion kWh per year. As it satisfies the ever-increasing power demands for Baotou, electric power from the Fengzhen power plant will be freed up for the Jing-Jin-Tang grid and that will ease the power shortage in North China.

The Dalad power plant is located 3 kilometers southwest of Shulinzhao in Dalat Banner of Ih Ju League; to the east is the Bao-Xi (Baotou-to-Xian) highway and to the west the Bao-Shen rail line. About 18 kilometers north is the water source on the Huang He, about the same distance from there as the Region's industrial City of Baotou, and to the south, the Wanlichuan coal mines average about 50 kilometers distant. This favorable geographic environment with convenient transportation conditions and natural resource advantages are the prerequisites for development of the Dalad power plant. [passage omitted] After phase-1 construction is completed, two more 330,000 kW units will be added, and in the Ninth 5-Year Plan, a 600,000 kW unit will be built. By the end of the century the installed capacity will be up to 2.5 million kW, and ultimately, the goal is to build a 5 million kW installed capacity extra-large-scale enterprise, a first-class Asian power plant that will be the pride of the Orient.

Shentou No. 2 Update

936B0042B Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 24 Dec 92 p 1

[Article by reporters Lei Jiande [7191 1696 1795] and Yang Shuxiang [2799 5486 0686]: "Shanxi Builds Another 1,000MW Power Plant"]

[Text] The 500MW No 2 generator at Shentou No 2 Power Plant, a key state construction project during the Eighth 5-Year Plan, smoothly completed 72 hours of trial operation according to state standards on 22 December 1992 and was formally completed and placed into operation. This is an indication that the first-phase project at Shanxi Province's Shentou No 2 Power Plant has been fully completed and that China has added another large 1,000MW power plant. Finishing construction of the first-phase project at Shentou No 2 Power Plant makes Shanxi Province the only province in China with four large 1,000MW power plants.

Shanxi Strategy Is To Become Major Electric Power Exporter

936B0036A Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 14 Dec 92 p 2

[Article by Jin Yining [2516 0001 1380], Yang Shuxiang [2799 5486 0686], and Lei Jiande [7191 1696 1795]]

[Text] As reforms take hold and the economy grows the imbalance between supply and demand for electric power increases daily. Shanxi, armed with its "Sea of Coal," is meeting this new situation with a proposal to give equal emphasis to coal and electricity, change coal exports to export of electric power, and make the electric power industry responsive to the needs of a developing socialist market economy. Looking into the question of exporting electric power from Shanxi, the President of the Shanxi Electric Power Corporation, Bian Xuehai, summed up the past decade of the electric power industry: from 1980 to 1990, there has been profound growth in the total installed capacity of the whole province, its annual output volume, and volume of electric power exported. The electric power industry's gross output value has increased by 146 percent, and that has greatly relieved the heavy burden placed on transportation by shipping coal out of the province. Because of the attention given to making use of S&T advances in the Seventh 5-Year Plan, the province's electric power industry has moved into the age of large plants, large units, large grids, high voltage, high parameters, and a high degree of automation, and has prepared a technical and management force for the next decade. The electric power industry, however thus developed, is not keeping up with the needs of the developing economy.

"Shanxi is rich in coal and it is geographically well situated for concentrating large mine-side power plants for on-site conversion of coal into the next form of energy, and transmitting it to the coastal development zones and the surrounding large and middle-sized cities." This is how President Bian introduced the objective significance of Shanxi's electric power industrial development, and then he said, "Energy is one of the main critical factors in coastal economic growth. Shanxi has long been a major energy province and its chief energy export has been Shanxi coal, but because of insufficient transportation capacity, every year there still is a large backup of coal throughout the province, and this leads to great waste. Converting coal to electric power for large volume export can not only relieve railway transportation pressures, it can effectively make full use of the energy base, and effectively raise production efficiency and drive the economic development of Shanxi."

Is it feasible to export electricity from Shanxi? By the end of 1990 there were 32 DC transmission projects in various countries around the world. In China the Gezhouba-Shanghai 500 kV extra-high voltage transmission line, a total length of 1,080 kilometers, has already been built. Are the distances from Shanxi to the various locations all within the range of economic possibility? In President Bian's analysis, "The price structure of electricity transmitted from Shanxi to the coast and to medium and large cities will not be greater than the price of electricity from local power plants built in the same time frame."

The Corporation plans to build the Yangcheng No 1 and No 2 power plants, each with an installed capacity of 2400 to 3600MW, and from each a 500 kV DC transmission line to the Shaoguang power plant in Guangdong and to northern Jiangsu, and in Hequ County, a 1200MW installed capacity power plant, and will expand the Shentou power plant with two 600MW units, and increase the power sent to the North China network. The Yangquan No 2 power plant, and Niangzi Guan power plant, after new construction and expansion, will transmit power to southern Hebei.

Bian Xuehai said that by the end of century, the total installed capacity of the province could reach 18,000-21,000MW, of which 8,000MW will be exported out of the province, and the amount sent out annually will reach 40 billion kWh, equivalent to increasing the amount of coal shipped out by 24 million tons. Not only can inferior coal (which is difficult to sell outside the province), washed medium coal, anthracite, and gangue then be consumed locally, but earnings for Shanxi can be increased 5 billion yuan. After repayment of capital with interest, each year's exported power can also raise profit taxes by around 2 billion yuan. As the socialist market economy develops, Shanxi's second staple product, the electric power industry, will contribute to building the province and enriching the people.

The plan to export power from Shanxi has received the full support and active cooperation of relevant central departments, the coastal and surrounding provinces and cities. The Shanxi electric power system is in the hands of the Ministry of Energy Resources and provincial offices; the document of intent to export power to Guangdong has been signed, and the Yangcheng feasibility study is finished. President Bian is confident about prospects for the future, and says, " Changing the exportation of Shanxi coal to the exportation of electricity accords with the needs of the developing socialist market economy and the national energy struggle, and leaves the future wide open".

Update on Huolinhe No 1 Strip Mine

936B0022C Hohhot NEIMENGGU RIBAO in Chinese 5 Sep 92 p 1

[Article by reporter Li Yuzuo [2621 3768 3820]]

[Excerpt] After 16 years of effort, one of China's large-scale open pit coal mines, the Huolinhe Mining District, welcomed in a new stage of development. On 3 September, the Huolinhe No 1 strip mine, equivalent in volume to nearly one-third of the total volume of new mines opened this year, passed inspection for its phase-2, 7-million ton expansion project, and it has been formally gone into production. The Huolinhe coal mine has joined the ranks of the extra-large coal enterprises of over 10-million-tons of annual output.

Phase-2 construction of the No 1 strip mine began on 1 September 1989. In 3 years of construction, 14,57 million cubic meters of earth and rock were stripped away to make a surface production system of two production lines, 10-million-ton coal plant and a mining district oil storage, and the knotty problems of handling sewage under severe cold conditions, and central heating for the housing area were successfully solved, and a production capability of 7-million tons was achieved.

The Huolinhe mining district is a key national construction project. Preliminary proven reserves in the coal fields is 13.1 billion tons, all good quality lignite. Construction of the mining district began in 1976, and after 5 years of preparations and 3 years of construction, phase 1 of the No 1 Huolinhe strip mine with an annual capacity of 3 million tons went into operations in September 1984. It is now in a dual production and construction phase. Since beginning production the mining district has produced 20.15 million tons of coal, meeting the needs of the Tongliao and Changshan power plants, and has made a great contribution to development of the local economy. [passage omitted]

Update on Railroad, Port Construction

936B0021A Shijiazhuang HEBEI RIBAO in Chinese 18 Oct 92 p 1

[Article by reporters Yin Qingshun [1438 3237 7311] and Sun Baohua [1327 5508 5478]]

[Text] The preliminary design for the Shuoxian to Huanghua Harbor rail line construction project undertaken by the Ministry of Railways' Third Survey and Design Academy is nearing completion, and by the end of the month it will be formally submitted. This means the day for start-up of construction of a corridor for shipping coal from the west to the east is soon to arrive.

The 57.90-square-kilometer Shenfu Dongsheng coal field, located in northern Yulin Prefecture in Shaanxi and southern Ih Ju League in Inner Mongolia, holds 233.16 billion tons of reserves, and is the largest recently opened high-quality coal base in China. The western segment of the rail line for shipping coal directly from the mining district to the harbor, the Shen Shuo line, is now under construction and is expected to be completed in 1994. Initially, Shenmu coal can pass through this segment and then be shipped out through the excess capacity of the Beitongpu and Dazhai line. By the year 2000 the volume to be shipped out will reach 45 million tons, and eventually the northern route will be unable to carry the load, which necessitates construction of the Suoxian-to-Huanghua harbor line to complete a corridor for shipping coal from the Shenfu Dongsheng mining district to Huanghua harbor.

The Shuo Gang rail line will run from the Shen Shuo line at Shenchi station, along the south side of the Ning Ke line southwestward passing west of Ningwu, through Longgong, south of Yuanping, again along the Hutuo He, eastward through Dongye, Dongshuishe, Xingtang, Dingzhou, Boye, Lixian, Suning, Hejian and Cangzhou, and on to Huanghua harbor. There are about 190 kilometers of track within Shanxi Province, and nearly 410 kilometers within Hebei. The Ministry of Railways' Third Survey and Design Academy started surveying the entire line on 17 February of this year. The surveying was very difficult because of the complex terrain with precipitous mountains, deep valleys and crisscrossing ravines. The surveying, drilling and geophysical prospecting was done by 580 experienced men who ate and slept in the mountains and valleys. By the end of April, the topographical features were calculated, and in early May the specialists had reached the early design stage, 5 months ahead of long-range estimates.

The Ministry of Railways Third Survey and Design Academy's chief technical criteria for the Shuo Gang line are that it be a first-class electrified rail line; that the 250 kilometers from Shenchi to Dongshuishe be double tracked at the earliest; and the 348 kilometers from Dongshuishe to Huanghua harbor also be double tracked; and that the three connecting lines would be single track.

— (Reporters Long Xingguo [7893 2450 0948] and Han Xianjun [7281 3807 6511]) According to the Hebei Province Route and Harbor Construction Mobilization Cooperative Directorate, preparations for the phase-1 construction of the Shuoxian to Huanghua harbor rail line have gone well.

In the first-phase, plans are to build three or four 35,000-ton deep-water coal berths at Huanghua harbor for an annual loading capacity of 30 million tons. Prior to state approval Hebei had invested over 10 million yuan for over 8 years of long-range preparations, and by the end of October the harbor project plan will be given to higher authorities for assessment. The preliminary plan for the Shuoxian to Huanghua coal shipping corridor connecting to the harbor can be presented to the state level at the end of October.

Up to the present, the integrated rail and harbor engineering package has progressed rapidly. The 10,000-ton-class loading pier proposal for the harbor has been reported to the State Planning Commission for inclusion in the Eighth 5-Year Plan. The 89.41-kilometer highway construction project to the harbor has progressed smoothly, and is certain to be open to vehicles by the end of 1993. The construction plans for water conduits from Yangcheng reservoir to the harbor are set, and it will be built this winter. Electricity, water, and telecommunications for the corridor and harbor project construction period have been worked out. The town plan for the harbor development zone is ready for assessment by experts. The feasibility study for supply of construction materials for the harbor construction and repair of the local Dingzhou-to-Quyang rail line segment are completed, and that will assure that construction will progress simultaneously with the work on the Shuo Gang rail line.

World Stage the Goal of CNOOC

40100055A Beijing CHINA DAILY (BUSINESS WEEKLY) in English 1 Feb 93 p 2

[Article by Lao Chang]

[Text] The China National Offshore Oil Corporation (CNOOC), which has co-operated with foreign firms for 11 years, is eager to become an internationally-competitive conglomerate.

Toward that end, CNOOC will take bold steps this year which the firm's senior officials describe as a "crucial" year for its international success.

Wang Yan, CNOOC's president, said key projects already in place are to be accelerated and new ones kicked off.

"This year is crucial for that," Wang noted at China's national congress on energy industry held early this month in Beijing.

BUSINESS WEEKLY has learned that CNOOC, which first started co-operation with firms from Western nations in China after 1949, will invest in developing overseas oilfields.

It also will join in higher-risk oil exploration in countries that are rich in oil reserves. Several nations in Asia are targeted.

In addition, CNOOC will set up petroleum-trading subsidiaries overseas.

CNOOC officials said they are confident of their firm's overseas business.

Co-operation with foreign firms for 11 years has helped CNOOC conform its operations to international conventions and foster a strong contingent of scientists and technicians.

Some 50 firms from 13 countries, including Shell, French Total, American Amoco, Arco, Texaco, Chevron and Mobil, Italian Agip and British BP Petroleum, have worked with CNOOC.

At least 72 agreements and contracts on oil exploration and development have been signed with foreign firms over the past 11 years.

The agreements and contracts were worth $3.36 billion in overseas investment, including $2.54 billion for risk exploration.

CNOOC has developed a five-point strategy for this year:

- Continue and expand co-operation with foreign oil firms;
- Continue and push forward self-reliant oil exploration and development;
- Build a large natural gas field in the western part of the South China Sea;
- Start large-scale co-operation with foreign firms in the East China Sea; and
- Launch refineries and petrochemical plants.

This year CNOOC will start construction of three oil and natural gas fields. That means all 10 fields CNOOC has discovered will have been started by the end of this year.

At present, six offshore oilfields are in production.

By 1997, CNOOC will produce 10 million tons of oil and 3.75 billion cubic meters of natural gas annually.

CNOOC produced 3.8 million tons of oil in 1992, 1.4 million more than that in 1991. Output was 1.24 million tons in 1990 and 986,000 tons in 1989.

In the latter half of this year, negotiations will begin between CNOOC and foreign oil firms on tapping petroleum resources in the East China Sea.

CNOOC announced the opening of two areas in the East China Sea totalling 72,800 square kilometers to international bidding by foreign oil developers and exploration firms in 1992.

So far, at least 67 firms from 16 countries have applied to tap reserves in the area.

The bidding, the fourth round held by CNOOC, is expected to conclude in 1993, with exploration due to start in 1994.

CNOOC expects to sign the first batch of agreements in this round of bidding with foreign firms this year.

CNOOC also expects to sign a contract this year with foreign firms on co-running a petrochemical plant in Guangdong Province.

CNOOC officials described 1992 as a year of encouraging achievements.

That year saw important discoveries of oil and natural gas in the Bohai Sea and the South China Sea.

Total offshore reserves of oil now amount to 1.1 billion tons and those of natural gas to 170 billion cubic meters.

Colossal Oil Find Sparks Scouring of Tarim Basin

40100055B Beijing CHINA DAILY (BUSINESS WEEKLY) in English 1 Feb 93 p 2

[Article by Chang Weimin]

[Text] Chinese oil explorers, inspired by discovery of a large oil field in the basin of Tarim in Xinjiang Uygur Autonomous Region, will scour the basin for more oil.

Officials from the China National Petroleum Corporation (CNPC) said elite professionals and the best equipment will be used in the basin.

Early in January, CNPC announced that a large oil field was discovered in the central part of the basin. Oil reserves there were verified at 100 million tons or more.

Encouraged by the discovery, which was called the largest find in years of exploration in the basin, CNPC is going to beef up exploration there.

Wang Tao, CNPC's president, and Zhou Yongkang, its vice-president, flew to Tarim for a conference after receiving reports on the discovery.

Hundreds of experts gathered there for the conference to discuss plans to bolster exploration.

Wang spoke highly of the discovery, saying it will greatly help exploration for resources in the whole basin.

Large-scale exploration is to unfurl in an area of 1,100 square kilometres around the central part of the basin.

The newly found oil-bearing structure has been confirmed to consist of three layers of oil deposits, which total 42 to 98 metres in depth.

The discovery was made through a well called Tazhong-4. About 290 cubic metres of oil and 53,000 cubic metres of natural gas gushed from the well per day.

In trial operation of another well, 589 cubic metres of oil and 65,000 cubic metres of natural gas were produced daily.

Well-head pressure was high and experts said that means oil deposits underground are highly recoverable.

A third well will be put into trial operation soon. Experts said they hope it will give further evidence of the high productiveness of the deposits.

Drilling of another pair of wells is underway now and will begin on three more before long.

China, which will need about 200 million tons of crude oil in the year 2000, expects to find more reserves in the northwest, especially in Xinjiang.

Exploration in the northwest is strategically important, as stable production at old oil fields in North and Northeast China, after decades of exploitation, is getting harder to sustain.

Five large oil fields have been discovered in the Tarim Basin, and 16 oil- and natural gas-bearing structures have been verified there.

That means confirmed reserves will guarantee that the basin can produce 5 million tons of oil in the year 1995.

In another basin of Turpan-Hami in Xinjiang, 11 oil fields have been discovered. With those, that basin is likely to produce 4 million tons of oil in 1995.

New discoveries have also been made in the basin of Junggar. Exploration is being extended now to the Junggar basin's central and corner areas.

In the meantime, CNPC is cranking up exploration in the northeastern province of Liaoning.

Reports say discoveries in Liaoning Province show that large oil production bases can be built there.

Experts said oil reserves are rich beneath 100,000 square kilometres in the Songliao basin along the banks of the Songhuajiang River.

Oil-bearing structures have also been discovered in two other areas in the province. One is near the western part of the Liaohe River, covering 150 square kilometres, and the other near the Bohai Sea, covering 14,000 square kilometres.

Onshore oil fields in China produced 138 million tons of oil in 1992, 880,000 tons more than in the previous year.

In 1992, 7,330 new wells were put into operation, up 6 per cent from the previous year. Production in the new oil fields was about 10 million tons.

Daqing Oilfield in Northeast China, the country's largest, produced 56 million tons of oil in 1992, 250,000 more than planned.

That means the field has kept annual oil production above 50 million tons for 17 successive years.

Photo caption: Black Gold: Workers fit tools to drill for crude oil 3,000 metres under ground at the Liaohe oil field, Liaoning Province. Equipped with custom-made technology, the field produces 5.95 million tons of oil a year, which is 70 percent of China's total. [Photo not reproduced]

Daqing Trying To Update Oil Industry

40100049 Beijing CHINA DAILY (BUSINESS WEEKLY-REGIONAL REPORTS) in English 21 Dec 92 p 6

[Article by Yuan Zhou]

[Excerpt] Northeast China's Daqing oilfield, which produces 40 percent of the country's crude oil, has pinned its future hopes on the development of high-tech industries in petrochemical products and in oil exploration.

A new high-tech petrochemical development zone, with an area of 12 square kilometers, has been established in Daqing for domestic and foreign investment.

Daqing officials said that as many as 4,000 domestic and overseas companies have flocked to the new development area to discuss investment projects. So far, more than 80 new companies have been registered, including 33 overseas-funded firms.

The oilfield has announced more than 100 projects for foreign cooperation in chemistry, medicine, new materials, electronics, machinery and other fields.

Daqing officials said they are also considering joint development of oil and gas fields with the Commonwealth of Independent States.

Additionally, a trading market for South Korea's products is also planned for Daqing, officials said.

Officials hope that the new high-tech developments applied to the aging oilfield will prolong its useful life and provide jobs for a local population of 1 million when the oil resources dry up.

The annual oil output of Daqing—known to be one of the 11 largest oilfields in the world—has been maintained at 50 million tons for 16 consecutive years. Prospectors estimate that the field should continue to yield at this rate until the year 2000.

By the end of 1992, Daqing is expected to have produced 1.2 billion tons of oil since going into operation in 1960.

However, as the oil becomes mfore and more difficult to pump, the local officials said they must develop new technologies to stabilize oil output for a longer period of time and keep up regional economic prosperity. [passage omitted]

A Plan To Develop Nine Offshore Oilfields

40100059 Beijing CHINA DAILY (BUSINESS WEEKLY) in English 8 Feb 93 p 5

[Article by Zheng Caixiong]

[Text] Guangzhou—China Offshore Oil Nan Hai East Corporation (Conhe) is planning to develop nine offshore oilfields in 5 years to achieve annual production of about 7 million tons by 1997.

To reach this goal, one or two new oifields are expected to come into production annually over the next few years.

According to an official from the corporation, about $2.5 billion will be spent to develop these oilfields.

"By the end of 1997, when nine offshore fields are to be in production, Nanhai (South China Sea) offshore oilfields will become the sixth largest oil production base in the country following Daqing in Heilongjiang Province, Shengli in Shandong Province, Liaohe in Liaoning Province, Zhongyuan in Henan Province, and oilfields in Xinjiang," the official said.

Last year, two offshore oilfields generated 2.58 million tons of oil and accounted for two-thirds of the country's total offshore oil output, which was an increase of 1.34 million tons over 1991.

About 40 percent of the crude oil is being sold abroad and the rest domestically.

A total of $1.4 billion, including $1.2 billion from overseas investors, was invested in exploring and developing the offshore oilfields in the east district of the South China Sea by the end of last year. Over 30 oil companies from 10 nations were committed to exploring and developing the oifields in the area.

The oilfields, Huizhou 21-1 and Huizhou 26-1 are the only two offshore oilfields that have started production in the east district of the South China Sea. The two fields are jointly developed by Conhe and its ACT operator group (ACT OG).

Conhe is a subsidiary of China National Offshore Oil Corporation and ACT OG consists of Agip (Overseas) Ltd of Italy, Chevron Overseas Petroleum and Texaco Petroleum Maatschappij (Nederland) B.V.

Huizhou 21-1 was China's first commercial offshore oilfield. Production there started in 1989. The Huizhou 26-1 field opened in November 1991.

A new field is expected to begin production this August. The field, Lufeng 13-1, is developed by Conhe and JHN oil group of Japan.

Minoru Kuraishi, president of the JHN group, said 75 percent of the total $200 million investment came from Japanese oil firms.

Japanese JHN group consists of Japan Petroleum Exploration Company, Huanan Oil Development Company and Nippon Mining Company.

And in 1994, another two new fields, Xijiang 24-3 and Xijiang 302, are scheduled to join the offshore oil output of the South China Sea.

The two fields will be developed by Conhe, Phillips Petroleum International Corporation Asia and Pecton Orient Company of the United States.

And ACT OG is considering developing another two fields, Huizhou 32-2 and Huizhou 32-3, in the years ahead.

Other offshore oilfields that will be developed by Conhe and foreign oil companies in the following years include Lufeng 22-1 and Liuhua 11-1.

Offshore Prospecting Verifies Oil Reserves of 90 Million Tons

936B0038b Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 25 Dec 92 p 1

[Article by correspondents Huang Kangsheng [7806 1660 3932] and Deng Boyuan [6772 2672 0337]]

[Text] Guangzhou, 23 Dec (Xinhua)—This year, splendid gains have been made in China's offshore petroleum prospecting; over 90 million tons of reserves have been verified, controlled and forecasted natural gas reserves exceed 300 billion cubic meters, and offshore crude oil production is up to 3.8 million tons.

In 1992, offshore petroleum corporations have set historical records in prospecting in the major gas region of

the western South China Sea. The Yinggehai Ya-13-1 oil and gas field, China's largest offshore oil and gas field, has entered the developmental stage. At the same time, major finds have again been made in natural gas prospecting in the South China Sea; and in western Bohai, three oil and gas bearing structures have been found, showing that western Bohai has a rich belt of oil and gas fields for commercial development, and opening up the East China Sea to the outside has brought new life to the development of the offshore petroleum industry.

There are six oil field appraisal wells that have brought good news, of which three newly drilled appraisal wells in the Bohai Suizhong 36-1 oil field show new increases in proven reserves of 70,000 tons, and the total reserves there are over 200 million tons.

In addition, development and construction of the other three oil fields are going smoothly.

Pinghu No 5 Strikes Oil, Gas in East China Sea

936B0032B Shanghai JIEFANG RIBAO in Chinese 19 Nov 92 p 1

[Article by reporter Yu Yuanming [1358 6678 2494]]

[Text] The project to develop natural gas in the East China Sea, which will help the population of Shanghai get rid of 800,000 coal stoves, is reaching the end of its early stage processing.

The Pinghu-5 well, which represents the final preparations for the formal opening of the East China Sea to oil and gas exploitation in the first half of next year, started up its second 10-hour gas and oil tests beginning at 0900 on 18 November with a fire plume up to 10 meters long that could be seen for over 10 kilometers around.

Pinghu-5, located 420 kilometers southeast of Shanghai, is an evaluation well for implementing exploitation of the Pinghu oil and gas field that was set up after the establishment of the Shanghai Petroleum and Natural Gas Corporation. The goal is to ascertain the extent of the oil and gas deposits in the Fangheting [Van Houten?] structure "single block placement" of the Pinghu oil and gas field to fill out the parameters required for accurate and sufficient data for the evaluation of the Pinghu deposits, and to lay out its overall development.

Pinghu-5 enters the earth's crust 93 meters down in the East China Sea. Drilling began on 4 July and was completed on 23 September. Estimating from the surface of the drilling platform, the well is 3788.18 meters deep, and there are 26 seams of oil and gas in a layer 196.75 meters thick.

On 9 November, in the second test seam, the daily output of natural gas was 151,800 cubic meters, and a valuable industrial gas flow of 29,3 cubic meters of condensate. A report on the third test seam arrived on 18 November claiming a daily output of up to 200,000 cubic meters of natural gas. This well test again proves that the Fangheting structure of the Pinghu oil and gas field holds rich oil and gas reserves that promise a reliable exploitation for industry.

This well was contracted to the Third Marine Geological Survey Unit of the Shanghai Marine Geology Survey Bureau by the Shanghai Petroleum and Natural Gas Corporation. It is this 12th well drilled by the "Prospector No 3" Shanghai well drilling platform. With next year's exploitation of the Pinghu oil and gas field coming on, and drilling interrupted by the onslaught of five typhoons since the typhoon season began more than 4 months ago, the drilling teams and the marine geology surveyors, struggled against time on the high seas, and repaid the concern and support of the people of Shanghai with gratifying returns.

Gansu Reports Abundant Oil and Gas Reserves

936B0022A Lanzhou GANSU RIBAO in Chinese 23 Oct 92 p 1

[Article by Zhang Kacong [1728 0595 5115] and Bai Xiaoxia [4101 7197 1115]]

[Text] At a recently held conference to examine and assess the oil and gas resources of Gansu it was announced that Gansu has a very bright future for development of its oil and gas reserves.

The various organizations and specialists from in and outside of the province attending a special study conference jointly held by the China Oil and Natural Gas Corporation and Provincial Government discussed the latest report on the results of oil and gas prospecting done within the province. According to contents of the report, Gansu has within its boundaries 24 sedimentary basins of various sizes covering a total area of 180,000 square kilometers, ten of which already produce or show evidence of oil and gas. From the assessment by the organizations involved it is estimated that the total volume of oil and gas reserves is about 1.7 billion tons, and development prospects are promising. The experts believe the Gansu petroleum industry has a solid base on which to flourish.

In order to speed the pace of oil and gas prospecting, and turn Gansu's resource advantages into production advantages as soon as possible, Vice Governor Li Ping, representing the Provincial Government at the conference, announced that Gansu will formulate preferential policies respecting land, labor, electricity, transportation, telecommunications, and livelihood, and will set a series of policies favoring the industrial and enterprise elements of the China Petroleum and Natural Gas Corporation; and will give the green light to development of oil and gas reserves. He declared that Gansu will follow the spirit of the 14th National Party Congress in strengthening cooperation and coordination, and will set new records in oil and gas prospecting in Gansu Province.

Waste of Coal Gas in Northern Shaanxi Said "Alarming"

936B0032A Xian SHAANXI RIBAO in Chinese 21 Oct 92 p 1

[Article by Hui Huangzhang [1920 3562 4545]]

[Text] In the 1980s, a 223.6-billion-ton coal field and a gas field with 100 billion cubic meters of natural gas were found in northern Shaanxi, and this historically barren piece of geography was turned into the "Kuwait" of China, almost overnight.

But now, "Kuwait" is in despair. It is in an alarming state of self- destruction. In the arid valleys of the upper reaches of the Kuye He on the Shaanxi-Mongolia border, strip mines stretch out like a black dragon, but very few men or vehicles move about on the desolation of the ravaged ruins. One local resident relates that when the Shenfu Dongsheng coal field was found it was as beholding a gold mine to the local people who have been impoverished for many generations, and a multitude gathered on the banks to sacrifice their lives in the diggings. Great ditches were dug into the coal strata many meters to tens of meters thick, mountains of coal reached skyward, and Kuye He became a hole in the ground. Because the area is remote, transportation is difficult, and besides the rail line to Datong, Shanxi, bought by the Huaneng Coal Refining Corporation, there is a shortcut road to Baotou on the Shaanxi-Mongolia border which no Shaanxi vehicles can pass.

Coal cannot be shipped out, and after a long period of time, what is not deteriorated by weathering has caught fire or has been washed away. The farmer's dreams of panning for gold have burst like soap bubbles, and the coal has been carted away to make animal pens, repair roads, or build terraced fields, on top of its other uses. And the experts say the mine surface damage is not the worst of it. Aside from this upheaval, layers of coal have been honeycombed, and no protective precautions have been taken whatsoever. Once water has seeped into the coal field it is like a rotten apple in a barrel, and can affect the quality of the entire surrounding area. This sort of excavation takes a few bites, leaves the rest, and no one has the stomach for it. For mining resources, such a state of affairs is disastrous.

If the damage and waste in the coal fields is enough to make one ill, the site of useless burning off of escaping natural gas can bring on heart seizure. At the site of the Shaan-3 well in Jingbian County flames are spurting out from a cluster of pipes bringing up natural gas from a completed well. The fire ball is tens of meters high and the sound would drown out a Boeing jet engine. It has killed the surrounding trees out beyond 50 meters, and there is not a blade of grass. One technician said this well has been burning for a month, impervious to rainstorms, and it will burn for 2 or 3 more months. He also said that every completed well is tested in this way, and burns up to 400,000 to 600,000 yuan worth of gas. If each well wastes 500,000 yuan, the 130 or more wells that have been completed there have burned away 70 million yuan. Some say that, in fact, the loss is much greater than that, up to 400 million yuan.

This sort of squandering of the top is not unavoidable. In many advanced western countries the process of testing gas is done at a workshop, or it is shipped out. But, because China is a poor country there is no means of sending it to cities where it is badly needed, and fund for operating a workshop are lacking, so the only course is to burn it away.

A technician was asked about cases where many wells are tapped into the same gas layer, wouldn't it be enough to test a few? He replied that the higher ups want full parameters from all wells, otherwise the results of prospecting can't be accepted. The mission will not have been completed. So, in effect, this wastage has become a code of law, and who cannot be just a little opposed to that?

There is evidence that China's total consumption of energy resources is second only to that of the U.S., but its volume of energy resources averaged to population is only one-fourth that of the world overall. China is short by 200 billion tons of coal, 110 billion tons of oil, and 500 billion kWh of electricity, so approximately 20 to 30 percent of its energy capability is not being fully utilized.

It is not great size that makes a country, it is abundance of resources; but it is not in finding abundance of resources, it is in their utilization. Energy resources are a one-time commodity; once gone they are irreplaceable. Some may think the waste of energy is not great; that given the vastness of the coal and gas fields, it is infinitesimal. It must not be forgotten that Shaanxi is a poor province, and energy resources are its greatest advantage in developing a market economy. How can Shaanxi bear the burden of this "infinitesimal" waste? If things continue to go on like this, Shaanxi will not be able to afford this loathsome burden.

Yinggehai, Minhe Basin Updates

936B0038C Shijiazhuang HEBEI RIBAO in Chinese 27 Nov 92 p 4

[Text] Haikou, 25 Nov (Xinhua)—The fully revised agreement for development and production of China's largest gas field, the Yinggehai Ya-13-1 gas field, was recently signed at Shenzhen, and the Sino-foreign cooperative Ya-13-1 gas field is now declared formally under full-scale development.

This gas field was discovered in 1983 through a cooperative effort of the China Offshore Petroleum Western South China Sea Corporation, the Sino-American Ake [7093 4430] Corporation, and the Sino-Kuwait Kepeike [4430 0160 0344] Corporation. The three participants signed two agreements for the development of this gas field. The fully revised agreement definitively stipulates concrete actions and items respecting the Ya-13-1 gas field from start up of construction to start of production,

and even to gas field management after production begins, as well as distribution of profits.

Once the Ya-13-1 gas field goes operational it will supply 524 million cubic meters of gas to Hainan Province each year.

Lanzhou, 26 Nov (Xinhua)—Large-scale petroleum geological prospecting in the Minhe Basin between Lanzhou and Xining has just begun.

The Minhe Basin, an area of 11,300 square kilometers lying along a mid-Cenozoic fault, is a basin of mountains and depressions that were piled up on the eastern end of the Qilian system following the Indosinian movement.

Over 70 oil seeps have been found on the surface of the Minhe Basin, and after applying a variety of calculations, experts place the basin's reserves at around 100 million tons. This large-scale petroleum geological prospecting effort is expected to be finished within 3 years.

Natural Gas Structure Found in Eastern Sichuan

936B0020B Beijing RENMIN RIBAO OVERSEAS EDITION in Chinese 9 Nov 92 p 1

[Article by He Lanyong [6320 3620 3057]]

[Text] According to the Sichuan Petroleum Management Bureau, Chuandong Exploration Company has discovered a gas-rich "great sky pool" structure in eastern Sichuan. The company placed 16 wells in this structure and 10 of them turned out to have industrial value. Six of the wells were high-yield wells, with a cumulative controlled natural gas reserve of several tens of billions of cubic meters.

The "great sky pool" structure is located in Kaixian, Kaijiang, Liangping, and Dianjiang counties in eastern Sichuan. This area has rugged mountains and complex geological structures. From 1988 to 1991, Chuandong Exploration Company discovered a total of four natural gas structures in eastern Sichuan, signaling promising prospects.

In 1992, the China Natural Gas General Company and the Sichuan Petroleum Management Bureau gave the region a high priority and strengthened the management and direction. Using new technology and method, the "great sky pool" structure was discovered.

Prospects Said Good for Shallow Zhejiang Gas Deposits

936B0042C Hangzhou ZHEJIANG RIBAO in Chinese 24 Nov 92 p 1

[Article by reporter Jiang Yuliang [5592 3768 2733]: "Excellent Prospects for Developing Natural Gas in Shallow Strata on Southern Bank of the Qiantang Jiang"]

[Text] The Zhejiang Petroleum Exploration Department did a substantial amount of exploration work along the southern bank of the Qiantang Jiang in Zhejiang during the second half of 1992 and made rather good exploration achievements. The information now in hand confirms that there are substantial natural gas reserves in shallow strata on the southern bank of the Qiantang Jiang and that the exploration prospects are excellent.

After completing the first village converted to natural gas in Zhejiang Province at Xiazao Village in Xiaoshan County, the Zhejiang Petroleum Exploration Department expanded the scope of its exploration, which indicates a continual expansion in the natural gas-bearing area in this region and lays an excellent foundation for further development and utilization. During mid-November 1992, the department also drilled nine wells searching for natural gas in the area of Hongjian Village north of Keqiao Light Industry and Textiles Village in Shaoxing Prefecture and found natural gas in all of them. Three of the wells erupted with rather substantial amounts of gas, confirming that this region has significant natural gas reserves and that the gas strata are shallow and the pressure is high. This provides an important foundation for further natural gas exploration and development in the Keqiao region of Shaoxing Prefecture.

Contract Signed for Construction of Qinshan NPP 300 MW Full-Range Simulator

93P60096 Beijing KEJI RIBAO [SCIENCE AND TECHNOLOGY DAILY] in Chinese 30 Nov 92 p 1

[Article by Wang Hui [3769 6540]: "Asia Simulation Ltd. To Manufacture Full-Range Simulator for Qinshan 300 Megawatt Nuclear Power Generating Units"]

[Summary] A contract for manufacture of a full-range simulator for the 300 MW Qinshan Nuclear Power Plant has been formally signed in Zhuhai. This full-range simulator, critical equipment for training personnel in safe operating principles, will incorporate nineties-level internationally advanced technology. According to the contract, the simulator will be manufactured by Asia Simulation Control Systems Engineering Ltd. and turned over to the Qinshan Nuclear Power Corporation within the next 36 months.

10-Year Development Plan of Southwest Physics Institute

936B006A Chengdu OUTLINE OF 10-YEAR DEVELOPMENT PLAN (1991-2000) in Chinese Mar 92 pp 1-5

[Text]

I. Introduction

The Southwest Physics Institute is an institute dedicated to the basic and applied research of nuclear fusion. The ultimate goal of nuclear fusion research is to construct pure fusion reactors for commercial use to fundamentally meet the energy demands of mankind. Since 1980, large Tokamak facilities have been put into operation in the United States, Russia, Western Europe and Japan to demonstrate the feasibility of nuclear fusion. Based on deuterium and tritium discharge derived from parameters obtained, the required fusion point has essentially been reached. In the 1990's, work will focus on the construction of a new generation of experimental reactors beyond those built to demonstrate feasibility. These reactors are expected to be completed early in the next century. Since the successful development of China's largest experimental fusion device in 1984, HL-1 has been in operation for more than five years. Over 400 scientific accomplishments have been obtained. A review committee headed by famous physicists Wang Ganchang [3769 3227 2490] and Xue Minglun [5641 2494 0243] firmly believe that the plasma physics parameters of HL-1 are essentially at world class level for similar Tokamak devices. Furthermore, the facility is in the position to compete or cooperate with other international fusion studies. This achievement marks a new era of controlled fusion research in China and offers a bright prospect in this area. It also provides a solid foundation for the construction for the larger, more modern HL-2.

Controlled fusion is a cutting edge science which covers a wide range of disciplines. It involves a long research cycle, complex technology and huge capital investment. Nevertheless, it is strategically important to the social development of mankind in the 21st century. It is included in long-range energy development plans in all developed nations in the world. Sufficient funds and resources are made available at an annual investment of approximately $2 billion. This is attractive because the energy problem can be fundamentally solved by the middle of the next century by means of controlled fusion. After more than 30 years of effort in China, although encouraging progress has been made in controlled fusion, the overall level is still 10-15 years behind developed nations. Hence, fusion development should be included in the national nuclear energy plan. A long-range development plan for nuclear fusion should be formulated. Existing resources must be treasured and sufficient attention and financial support should be provided to keep the development effort going forward; otherwise, we will be committing a costly error.

The development and use of fusion energy requires the long-term effort of several generations. However, it also spins off a great deal of intermediate technology which can be widely used to build our economy. The Institute is also totally committed to implementing the systemreform policy of the central government. To this end, as an objective of the 10-year plan, it will speed up the transfer of intermediate technology associated with fusion for private use in order to contribute to the new combined economic system.

Focusing on energy, educating talented people, raising the level of technology, constructing the reactor core, accelerating transfer for civilian use, and promoting fusion development is the guiding principle of the Institute and is also the philosophy behind the 10-year plan.

The goal of the 10-year plan for the magnetic confinement nuclear fusion research is to construct and operate a core simulator (HL-2) in Chengdu by 1998. It will lay a solid foundation for the construction of an experimental reactor capable of producing 100 kg of plutonium, or 1 kg of tritium, on an annual basis by the beginning of the next century. To this end, preliminary study to modify HL-1 to HL-2, i.e., HL-1M, will be completed in 1993. Preliminary study and experimental research on key technology associated with HL-2 will also begin to provide a scientific basis for the design and definition of HL-2 in 1993.

II. Magnetic Confinement Fusion Development

In order to achieve the ultimate goal of fusion for energy, a series of theoretical and engineering problems associated with the construction of a pure fusion reactor must be solved one by one. Strategic objectives must be set stage by stage to make it come true. Based on the current trend of controlled fusion research in the world, and by taking where we stand in China and at the Institute into consideration, our strategic objectives by stages are to complete the core simulator (HL-2) and to finish the preliminary design of an experimental engineering

hybrid reactor by 2000, to complete the development of the experimental engineering reactor core by 2010 and to construct an engineering reactor capable of producing 100-kg plutonium, or 1-kg tritium, per year and to proceed with system testing on related technology by 2015, and to complete construction of commercial demonstration reactors capable of producing tons of nuclear fuels by 2030-2040 in order to supply fuels to fission reactors and to promote the design and research of pure fusion reactors for commercial use. This eventually will make it possible to meet our energy demands with fusion by the middle of the 21st Century.

10-Year Plan Objectives

Based on the strategic targets, the objectives of our 10-year plan for 1991-2000 (see Table 1) are centered around the construction of the core simulator (HL-2). On the basis of the technical design of the reactor, studies of the physical mechanisms associated with the reactor and preliminary research on key technology will be initiated. In addition, research on the axial symmetric serial magnetic mirror will be done. Experimental studies on related designs and new concepts will be performed on smaller devices. Cutting edge theoretical research associated with controlled fusion and development and testing of technologies related to HL-2 such as wave heating, driving current, neutral injection, fueling and ash removal, low temperature superconductivity, and thermal nuclear vacuum will also be performed. The goal is to develop technology and train personnel in order to lay a solid material and technological base for the construction of an experimental engineering reactor by early next century.

5-Year Plan Objectives (Eighth 5-Year Plan)

In order to accomplish the goal set for the 10-year plan, the primary objective of the Eighth 5-Year Plan is to complete the modification of HL-1 to HL-1M as an experimental apparatus for the development of HL-2. This is a key milestone in the realization of the 10-year plan goal. It must be put into operation in 1993 in order to perform certain experiments necessary for the design of HL-2. It will provide the basis required to complete the scheme optimization and design of HL-2 in 1993. It also requires the completion of construction design and key technology research of HL-2 in 1994-1995. Furthermore, basic construction of HL-2 will also begin at the same time. By 1998, a core simulator (i.e., HL-2) comparable in scale to that built in the 1980's with key technology and quality parameters at 1990 levels will be completed (i.e., $R = 1.5$ m, $a \times b = 0.15 \times (1.6 \times 0.45)$ m^2, $K = 1.6$, $B_t = 4$-5 T, $I_p = 1$-2 MA, $t_D = 10$ sec, $\Delta\Phi = 10$-15 v s, $n = 1 \times 10^{14}$cm^{-3}, $T_i = 10$ keg, $T_e = 5$ KeG, $\tau_E = 80$-200 ms, 10-15 MW of auxiliary heating, and 5 MW of low noise driving current). This is the essence of the Eighth 5-Year Plan which is the prerequisite for the success of the 10-year plan.

In addition to devoting efforts to HL-1M and HL-2, we must also carry out all the HL-1 experiments scheduled for 1991 and 1992, the "863" high technology projects and other experimental and research programs that run through the 10-year period in order to create a favorable condition for the successful achievement of the 10-year plan in the Ninth 5-Year Plan.

Table 1 (In thousands of yuan)

Annual budget	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
HL-1 experimental physics (1,500)	(7,630)	(9,000)	(5,150)	(13,320)	(12,370)	(39,250)	(42,850)	(26,150)	(6,150)	(5,350)
	Experimental physics (2,500)									
HL-1M development and experimentation (22,950)	Construction design and machining (4,000)	Complete machining and installation (7,500)	Engineering testing and preliminary experimental physics (3,450)	In-depth physics and engineering experiments (2,000)	(2,000)	(2,000)	(2,000)			
HL-2 development (122,800)	Design and optimization (200)	(300)	Technical design and definition (350)	Construction design, key technology pre-development, begin construction (10,000)	(9,000)	Full-scale machining and construction (35,000)	(38,000)	Finish machining, installation (23,150)	Engineering tuning and testing (3,800)	(3,000)
Experimental reactor design and research (10,720)	Experimental reactor design scheme, key technology areas such as reactor magnets and jacket (500)	(520)	(650)	(700)	(800)	Experimental reactor technical design, pre-development for jacket tritium technology and tritium enhancing agent (1,300)	(1,400)	(1,550)	(1,600)	(1,700)
DCHJ design and development (4,000)	Scheme perfection (50)	Construction design (300)	Full-scale machining (300)	Installation (200)	Tuning (150)	Engineering adjustment and physical experimentation (500)	(1,000)	(1,000)	(300)	(200)
Small device physical experiment (3,000)	Physical and engineering experiments in leading edge fusion topics and to provide data for new devices such as magnetic mirror, reverse field and small Tokamak (300)	(300)	(300)	(300)	(300)	(300)	(300)	(300)	(300)	(300)
Theoretical fusion research (1,250	Theories associated with leading edge, apparatus, projectile melting and wave heating mechanism (80)	(80)	(100)	(120)	(120)	(150)	(150)	(150)	(150)	(150)
Fusion-related technology	Initiate development and physical experimentation of related technology such as LHCD, ICRH, ECRH, NBI, fueling and ash removal, diagnostics, low temperature superconductor, thermal nuclear vacuum and promote applied research on military-oriented technology such as plasma engine (underwater and airborne), electromagnetic trajectory gun and military materials. (Funding already included in items listed above; an additional 5,000,000 yuan will be located through other sources.)									

Domestically Developed HTGR Helium-Gas Purification System Certified

93P60111A Beijing RENMIN RIBAO [PEOPLE'S DAILY OVERSEAS EDITION] in Chinese 6 Jan 93 p 1

[Article by Cao Zhi [2580 2535]: "Nation Develops Helium-Gas Purification System"]

[Summary] Beijing, 5 Jan (XINHUA)—The high temperature gas-cooled reactor (HTGR) helium-gas purification techniques and purification system jointly developed by CNNC's Second Research and Design Institute and the CAS Guangzhou Institute of Energy Resources passed State appraisal a few days ago. This research project, begun in 1989, has produced the following results: elaboration of a purification system process flow and construction of a corresponding experimental apparatus; screening of a high-performance adsorbent and development of adsorption methods for effectively eliminating chemical impurities, toxic gases, and radionuclides generated in the helium carrier gas; and development of microdetection methods for the helium purification process, as well as construction of a corresponding computer processing system for automatic detection, display, and storage of process parameters and data.

Ultrasonic Emulsification Technology Used as Conservation Measure

936B0020C Beijing ZHONGGUO KEXUE BAO [CHINESE SCIENCE NEWS] in Chinese 9 Oct 92 p 2

[Article by Yan Shibiao [7346 0013 1753] of the Institute of Acoustics, Chinese Academy of Sciences]

[Text] China has only limited petroleum resources, far below the demand, and must import oil. Conservation measures are therefore very important.

With a small investment, oil conservation methods may make a big difference. Many of China's current oil-burning boilers and kilns have low efficiency, waste oil, and generate black smoke. By improving their burning system, these boilers and kilns can show dramatic improvement.

Ultrasonic emulsification of oil and water mixture is one of the important techniques in oil conservation. By adding 10-15 percent water into the fuel oil, ultrasonic emulsified burning can save 5 to 10 percent. The State Science and Technology Commission has designated this technology as one of the major oil conservation projects for promotion.

The Institute of Acoustics has been studying the mechanism for ultrasonic emulsification of fuel oil and developing the technical facility since the "Sixth 5-Year Plan." The ultrasonic emulsification system that we developed for oil and water mixture consists mainly of the ultrasonic emulsifier, oil-water mixer, and monitor for the operating characteristics. In order to conserve oil and improve burning, we have also developed chemical boosters and ultrasonic booster.

The ultrasonic emulsification combustion technique includes the mixing of heavy oil and water, and the mixing of kerosene and water. In China the emulsification technology has been applied and promoted in large and medium enterprises (such as Anshan Steel, Baotou Steel, and Yixing Precision Ceramics), diesel engines of river boats, automobiles and tractors. Incomplete statistics showed that the technology saved several thousand tons of oil for China each year, and saved more than 10 million yuan. These economic and social benefits are very important for the construction of the national economy.

Data showed that China consumes 40 million tons of fuel. Since the thermal efficiency of the industrial boilers and kilns in China is quite low, there is great potential for conservation. If one-half of the furnaces and kilns switch to burning ultrasonically emulsified oil and water mixture, at least 1 million tons of fuel may be saved. One million tons of oil costs about 100 million yuan. The economic benefits are substantial.

In summary, in today's environment of energy shortage, ultrasonic emulsification is a technique that requires low investment, shows quick results and is practical and effective to implement.