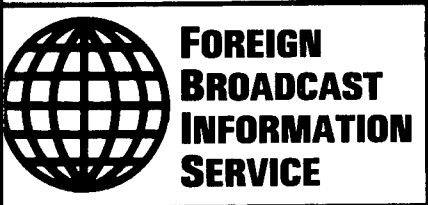


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# *JPRS Report*

# Science & Technology

*China: Energy*

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## SCIENCE & TECHNOLOGY

### CHINA: ENERGY

#### CONTENTS

##### NATIONAL POLICY

First Quarter 1987 Sees Steady Increase in Energy Output (RENMIN RIBAO, 16 Apr 87) .....	1
Nationwide Energy Development Needs Detailed (Du Yaojin; LIAOWANG, No 3, 19 Jan 87) .....	2
Cooperation Between CAS, MPI Producing 'Outstanding Results' (Shi Wenjie; BEIJING KEJI BAO, 14 Jan 87) .....	9
Status of, Prospects for Turbogenerator Manufacture in China (Shen Liangwei; DADIANJI JISHU, No 6, Nov 86) .....	11

##### NEW TECHNOLOGY

5MW Heat-Supply Reactor To Be Completed in 1988 (Feng Zai, Dong Zhixiang; KEJI RIBAO, 19 Mar 87) .....	28
Development of China's Gas Turbines Chronicled (Tang Ding; HANGKONG ZHISHI, No 2, Feb 87) .....	30

##### POWER NETWORK

Success of Eastern Grid in Generating Power Detailed (JIEFANG RIBAO, 23 Mar 87) .....	34
Strategy for West-to-East Power Transmission Outlined Stressed (Song Zemin; GUANGMING RIBAO, 20 Mar 87) .....	35

Xinjiang Conference Focuses on Power Shortages (Xinjiang Regional Service, 28 Mar 87) .....	37
Hunan Addresses Chronic Power Shortage Problems (HUNAN RIBAO, 18 Feb 87) .....	38
Guangdong Steps Up Pace of Energy Construction (Kuang Ji; NANFANG RIBAO, 3 Feb 87) .....	41
Using 20kV Voltage Would Greatly Accelerate Rural Electrification (Sun Xihua; DIANLI JISHU, No 12, 5 Dec 86) .....	44
Briefs	
Worsening Sichuan Power Shortage	48
Shanxi Output Grows	48
Xichang Substation Operational	48

#### HYDROPOWER

State Council Approves Another Big Huang He Project (Deng Xiushen, Zheng Xiuyun; HENAN RIBAO, 5 Mar 87) .....	49
Way Cleared To Begin Work on Main Part of Shuikou (Liu Yi, Liu Lunan; FUJIAN RIBAO, 5 Jan 87) .....	51
Shuikou Project Slated for Completion in Early 1995 (FUJIAN RIBAO, 10 Mar 87) .....	52
Big Pumped-Storage Station To Be Built in Guangdong (RENMIN RIBAO, 22 Apr 87) .....	53
Yunnan Accelerates Work on Two Major Stations (XINHUA, 1 Mar 87) .....	54
More Bank Loans for Small-Scale Operations (XINHUA, 17 Mar 87) .....	55
Briefs	
Tianshengqiao Passes Inspection	56

#### THERMAL POWER

Work Accelerated on Big Pingyu Pit-Mouth Plant (ANHUI HUABAO, No 1, 1987) .....	57
Shajiao-B Power Plant Lights Off Its No 1 Boiler (NANFANG RIBAO, 16 Mar 87) .....	58
Dawukou Power Plant To Boost Northwest Grid (NINGXIA RIBAO, 13 Jan 87) .....	59

Sichuan Pursues Ambitious Thermal Power Construction Program  
(SICHUAN RIBAO, 30 Mar 87) ..... 60

Briefs

Jilin 2400MW Plant ..... 61  
Jiangyou Expansion Project ..... 61

COAL

Coal Exports To Increase 62 Percent in 1987  
(XINHUA, 3 Mar 87) ..... 62

Nation's Verified Reserves Grow by 8.3 Billion Tons  
(RENMIN RIBAO, 13 Apr 87) ..... 63

Progress Being Made in Comprehensive Use of Coal  
(Liu Xiaojie; RENMIN RIBAO, 10 Mar 87) ..... 64

More Strip Mines Slated To Open in North  
(XINHUA, 26 Feb 87) ..... 66

Need To Change Shanxi Coal Production Policy Stressed  
(Zhao Keming; SHANXI RIBAO, 6 Jan 87) ..... 67

Pingdingshan Mines Chalk Up Record for Output, Sales  
(Guo Xianwen, Sun Yanxing; RENMIN RIBAO, 28 Mar 87) ..... 69

Ground Readied To Develop Enormous Shaanxi Field  
(Huang Changlu, Jiang Wenrui; LIAOWANG, No 7, 16 Feb 87) ..... 71

Briefs

Shandong 1986 Output ..... 75  
Shaanxi Prospecting ..... 75

OIL AND GAS

Industry Confident of Exceeding 133-Million-Ton Annual Quota  
(Ding Lisheng; CHINA DAILY, 27 Feb 87) ..... 76

Oil Exports Maintain 'Normal Trend'  
(Xie Songxin; CHINA DAILY, 18 Apr 87) ..... 78

Daqing's Verified Natural Gas Reserves Increase  
(XINHUA, 27 Feb 87) ..... 79

Daqing Could Maintain Present Output Levels to 1995  
(XINHUA, 11 Mar 87) ..... 80

AMOCO Said Encouraged by South China Sea Strike  
(XINHUA, 9 Mar 87) ..... 81

Oil-Gas Structure Found off Fujian Coast (ZHONGGUO XINWEN SHE, 17 Feb 87) .....	82
Japanese Consortium Makes Strike in Pearl River Basin (Xu Yanchao; CHINA DAILY, 5 Mar 87) .....	83
Zhujiang Basin Proving Rich in Oil Reserves (Jin Guolin, Xu Yuming; ZHONGGUO XINWEN SHE, 17 Apr 87)	84
Jilin Field Now Nation's Eighth Largest (JILIN RIBAO, 31 Mar 87) .....	86
Shengli Rapidly Developing Binhai Oil, Gas Field (RENMIN RIBAO, 29 Mar 87) .....	87
Bohai Oil Field Begins Commercial Production (XINHUA, 23 Mar 87) .....	88
Agreement Signed on Developing Qaidam Basin (Qinghai Provincial Service, 22 Feb 87) .....	89
Qinghai To Develop Gas Hure Oil Field (XINHUA, 5 Mar 87) .....	90
Efforts Under Way To Develop Nation's Highest Oil Field (XINHUA, 24 Mar 87) .....	91
Luoyang Oil Refinery Is Major 7th FYP Project (Ma Fenglu, Jiao Zucui; HENAN RIBAO, 10 Mar 87) .....	92
Daqing Develops Technology To Exploit Oil in Thin Strata (XINHUA, 14 Apr 87) .....	93
Galaxy Computer Processes Seismic Data for Oil Exploration (Wang Xiyuan, Huang Fengchu; XINHUA Domestic Service, 12 Feb 87) .....	94
Role of Oil Shale in China's Energy Picture Discussed (Lei Shitai; KEJI RIBAO, 9 Feb 87) .....	95
Briefs	
South China Sea Drilling	98
 NUCLEAR POWER	
Shanghai's Heavy Industry Producing Nuclear Power Equipment (ZHONGGUO XINWEN SHE, 2 Mar 87) .....	99
Southeast Coast Most Likely Nuclear Waste Dump Site (Chan Wai-fong; HONGKONG STANDARD, 30 Apr 87) .....	100

SUPPLEMENTAL SOURCES

Qinghai-Tibet Plateau Is Leader in Solar, Geothermal Resources (XINHUA, 3 May 87) .....	102
Dachen Island: Future Site of New Energy Resource Studies (Shao Tong; RENMIN RIBAO, 10 Feb 87) .....	103
Rural Areas Develop Alternative Energy Resources (XINHUA, 19 Mar 87) .....	105
Briefs	
Geothermal Plant Expansion	106

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NATIONAL POLICY

FIRST QUARTER 1987 SEES STEADY INCREASE IN ENERGY OUTPUT

Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 16 Apr 87 p 1

[Text] Figures recently released by the State Statistical Bureau show that in the first quarter of 1987, China's output of coal, electric power, and oil registered an increase over the same period of last year.

IN the first quarter of 1987, raw coal production came to 199 million tons, an increase of 33 percent over the same period of 1986; crude oil output was 32.6 million tons, a 5.5 percent increase over the 1986 period. Electric power output was 114.58 billion kilowatt-hours, an increase of 9.9 percent over the same period of 1986. Here, thermal power output accounted for 99.75 billion kilowatt-hours, an increase of 13.1 percent when compared to 1986.

Daqing, China's largest petroleum production base, produced 13.6 million tons in the first three months of 1987; Shengli, the nation's second largest petroleum production base, produced 7.7 million tons, for an increase of 18.7 percent over the same period of 1986.

Although economists feel that the nation's energy output is providing a good impetus for across-the-board growth and stable industrial production, they also point out the fact that it is inadequate to meet all demands of the national economy. In order to do so, energy construction must be beefed up.

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## NATIONAL POLICY

### NATIONWIDE ENERGY DEVELOPMENT NEEDS DETAILED

Beijing LIAOWANG [OUTLOOK] in Chinese No 3, 19 Jan 87 pp 18-21

[Article by Du Yaojin [2629 6460 6651]: "A Strategic Plan for Energy Development"]

[Text] China's four modernizations drive is often hindered by "fuel" shortages. According to statistics, each year China has a shortage of about 20 million tons of coal, 10 million tons of petroleum, and 50 billion kWh of electric power, and about a quarter of the country's industrial production capacity is idle due to power shortage, causing a loss of nearly 100 billion yuan in output value.

Experts think that to fundamentally solve the energy shortage, while it is imperative to adopt all kinds of effective energy conservation measures and vigorously strive to increase energy utilization rate, it is also necessary to build one or two large energy bases. They have suggested two tentative plans. One is to build an energy base with the three gorges as the center. The other is to build an energy base in the five provinces in the middle reaches of the Huanghe River, which is mainly a coal production base. For a variety of reasons, work on the three gorges plan cannot possibly get started for quite some time. Thus, people are pinning their hopes for solving the energy problem on coal. This mainly coal energy base includes all of Shanxi Province, three cities and five leagues in western Nei Monggol, the part of Henan Province west of the Beijing-Guangzhou Railway, the area north of the Qinling Mountains in Shaanxi Province, and all of the Ningxia Region, with a total area of 1.17 million square km.

#### A "Major Effort" That Has To Be Made

Considerable progress has been made in energy development in the 30 years and more since the founding of New China. In 1985, China's energy production totalled more than 855 million tons of standard coal, ranking third in the world after the United States and the Soviet Union. Between 1949 and 1985, coal output increased from 32 million tons to 872 million tons, crude oil from 120,000 tons to 124.9 million tons, and power generation from 4.3 billion kWh to 410.7 billion kWh.



However, when these figures are divided by China's population, the resulting per capita shares are pitifully small. China's per capita energy consumption is less than half the world average. With the development of production and construction and improvement of the people's living standards, energy has been in short supply in China for many years. To achieve the strategic goal of quadrupling the total industrial and agricultural output value and raising the people's living standard to a relatively comfortable level by the end of the century, an important precondition is that our energy production must be increased to more than 1.4 billion tons of standard coal by the year 2000. In other words, 15 years from now, our energy production must increase by more than 500 million tons of standard coal. It is obvious that for both immediate and long-range reasons, a major effort must be made to increase energy production.

### Three "Conventional Energy Sources" With Emphasis on Coal

What should be the main direction of China's effort to develop energy production?

China's three major "conventional energy sources" are coal, petroleum, and hydraulic power. China's petroleum reserves are quite abundant. However, owing to intensive extraction in the past decade or so and the fact that oil prospecting has failed to keep pace with exploitation, it is difficult for the current level of production to increase significantly in a short period of time. Even if oil production can be increased significantly, the state, in need of funds, will have to export a considerable part of it for foreign exchange and to use petroleum as raw material for the chemical industries. Therefore, for a rather long period to come, petroleum is not going to be the main energy source for domestic consumption.

China's hydroelectric resources rank first in the world. According to a general survey, China's theoretical water power reserves total 676 million kW, of which 378 million kW can be harnessed for hydroelectric power generation to produce 19,200 trillion kWh of electricity a year. However, China's rivers have a common characteristic: Their rate of flow changes drastically from year to year and season to season. Take the much-debated Three Gorges key water conservancy project for example. If a huge hydroelectric power station with a total installed capacity of 13 million kW is built there, only a part of the generating units with a total capacity of just 3 million kW will be operating during dry seasons. This means that a number of thermal power plants, each with a capacity of more than 1 million kW, will have to be built to supplement the hydroelectric power station. Also, China's water power resources are largely distributed in the mountainous southwest region, making exploitation and utilization very difficult. Moreover, though water power is cheap, it takes a long time and requires a huge one-time investment to build a hydroelectric power station, which makes it unsuitable because the country has an urgent present need for energy and is short of funds. Therefore, it will take some time to accumulate funds and make technological preparations before large-scale development can be started.

While petroleum has become the major energy source in the world, China is one of a few countries still relying mainly on coal for energy. For a long time, coal has accounted for more than 70 percent of China's total energy production and energy consumption. This unusual pattern is in the final analysis determined by China's unusual coal conditions. According to estimates of the 10th World Energy Conference, China's coal reserves total 5.07 trillion tons, the world's second largest after the Soviet Union, and its prospective reserves total 1.4 trillion tons, the world's third largest. At present, China's planning is based on reserves of some 700 billion tons, which, if extracted at an annual rate of 1.4 billion tons, can last 200 to 300 years. Moreover, most of these coal deposits are of high quality, suitable for exploitation, and require relatively small investments. This is why in the foreseeable future China will continue to rely mainly on coal for energy. The pattern of coal accounting for more than 70 percent of China's total energy production and consumption will remain unchanged for a long time to come.

#### Richly Endowed by Nature

Distribution of coal resources is uneven in China. If the Beijing-Guangzhou Railway is taken as a demarcation line between east and west, then the proven and prospective reserves are 15 percent in the east and 85 percent in the west. If the Qinling and Dabie mountains are used to divide the north and the south, then 94 percent of China's coal is in the north, and 6 percent is in the south. The five provinces west of the Beijing-Guangzhou Railway and north of the Qinling and Dabie mountains--Shanxi, Henan, Shaanxi, Nei Monggol, and Ningxia--have 43 percent of the coal reserves, and the nine provinces and municipalities south of the Changjiang River have only 0.6 percent. There is more in the north than the south, more in the west than the east, and more in the northwest than the southeast. This is the way China's coal resources are distributed.

When we look closer at the five provinces in the middle reaches of the Huang He, we will find:

--that here lie more than 500 billion tons, or 70 percent, of China's proven coal reserves, more than 200 billion tons in Shanxi, more than 150 billion tons in western Nei Monggol, 17 billion tons in western Henan, nearly 100 billion tons in northern Shaanxi, and more than 30 billion tons in Ningxia. There are two especially large coal fields, each with reserves in excess of 100 billion tons: the Qinshui coal field in Shanxi and the Ordos coal field astriding Nei Monggol, Shaanxi, and Ningxia.

--that in terms of conditions for development, the geological structure and hydrological condition of the coal deposits here are simple; most of the coal deposits are close to the surface of the earth; and some are suitable for strip mining. The coal seam is thick and slopes gently. Mines can be opened quickly, and per-ton investment will be small.

--that in terms of variety and quality, there are many kinds of coal here, including high-grade noncoking coal, high-grade anthracite, and high-grade rich coal, coking coal and lean coal which can be used to produce coke, and most of the coal here is of low ash and sulphur contents and high calorific value.

With all these advantages, this area has become a major contender for development into a large energy base.

#### The State Council's Policy Decision

For quite a long period, a basic policy on developing the coal industry has been to "put an end to moving coal from the north to the south," and a lot of manpower, financial and material resources have been invested in areas south of the Chang Jiang, where coal deposits are very limited. Despite heavy investment in the south, not much coal has been found. In Shanxi and other places with abundant coal resources, railway construction has slowed down owing to sharply reduced investment. As a result, the nationwide energy shortage has been aggravated by the lack of coal transport capacity.

In 1979, after an inspection tour of coal production in Shanxi, Bo Yibo, then vice premier of the State Council, suggested that Shanxi should be built into a mighty energy base as soon as possible. Subsequently a joint investigation team was formed by the State Planning Commission, the State Capital Construction Commission, the Ministry of Coal Industry, the Ministry of Electric Power, the Ministry of Railways, and the Ministry of Water Conservancy. The team conducted an investigation on coal resources in Shanxi and Nei Mongol. In its report, the team recommended that major efforts be made to exploit the coal resources in Shanxi and Nei Mongol and turn the area into a mighty energy base for the whole country, noting the great significance of such a plan to the four modernizations drive.

In May 1981, Yu Qiuli, then minister in charge of the State Energy Commission, toured Shanxi and Henan to study how to accelerate the development of the coal industry. In his report to Zhao Ziyang, Wan Li, and Yao Yilin, he made a number of policy recommendations on developing coal production in Shanxi. On Zhao Ziyang's instruction, Ma Hong [7456 3163], director of the State Council Technical and Economic Research Center, had an appraisal made by experts from various fields. The experts' recommendation: Shanxi's coal should be exploited under a comprehensive plan based on the overall national interests.

For a year and more in about the same period, more than 1,400 experts, scholars, and professional workers studied and evaluated the area. They made a lot of suggestions on different aspects of the area's development into an energy base.

In July 1982, Premier Zhao Ziyang personally went on an inspection tour to Shanxi. After hearing a wide range of opinions, he said that exploiting Shanxi's coal is indeed an important strategic plan to solve the country's energy problem. Development of coal fields in Shanxi should be expanded to include those in western Nei Monggol, western Henan, northern Shaanxi, and Ningxia. Geographically this area is only 500 to 600 km from Tianjin, Shijiusuo, and other seaports, much shorter than the 2,000 km distance over which coal is moved from the east to the west in the Soviet Union, and from the west to the east in the United States. If actively developed, Shanxi can become China's Ruhr and Saar. He also pointed out that Shanxi should not only be developed into an energy base, but should be built into a heavy chemical industry base step by step. It is necessary to develop coal-chemical industry, build power stations, and develop industries which consume a lot of energy but do not need much water.

Thus, the scope of the energy base and the direction of its development were basically determined. At the end of 1982, the State Council officially approved the establishment of an energy base planning office, which is specifically responsible for coordination and planning work on behalf of the State Council. Guo Hongtao [6753 3163 3447] vice minister in charge of the State Economic Commission and a communications and transportation expert, was put in charge of the office's work.

### Three Moves in Building the Base

To build an energy base of this size is no easy task. There are two major problems: 1. China has a rather weak economic base and does not have the financial resources to carry out large-scale development projects. 2. Since the base is a transprovincial and multitrade developing economic zone, its comprehensive and rational construction will inevitably pose a challenge to the existing economic management system and certain economic policies. In view of these problems, the central government has decided that construction should proceed while reforms are being made to find a new way which is suited to China's national conditions and regional characteristics.

After detailed investigation and study and careful appraisal and evaluation, an overall balance is achieved. And on this basis, the State Council Energy Base Planning Office suggests three moves to make steady and sure progress.

1. In rallying efforts, the state, local authorities, collectives, and individuals should all play a part, and it is necessary to develop horizontal associations and open up to other provinces and cities and to foreign countries. For example, it is necessary on a selective basis to build large-scale opencut mines, renovate and extend old mining districts, actively support township-operated mines, and develop various forms of cooperation with foreign countries including joint ventures, loan arrangements, and so forth.

2. The development strategy should be "10 years to the east, and another 10 years to the west, of the river." In other words, between 1980 and 2000, the first 10 years should be devoted to the development of Shanxi and Henan east of the Huang He, and the next 10 years, while continuing this area's development, work should be extended toward the vast region west of the Huang He to lay the foundation for large-scale development in the next century.

3. The huge base should be planned and built as a number of smaller zones within its boundaries. The Energy Base Planning Office has worked out an agreement with related departments and areas on coordinating the development of the coal, power, aluminum, water, and transport industries in the Jindongnan and Jiaozuo area. A decision has been made to treat the related aluminum, coal, and power projects in Jiaozuo as a "group" in the national investment plan to insure their coordinated and simultaneous development. Plans have also been worked out on the comprehensive development of the Shenmu coal field in Shaanxi and Dongsheng coal field in Nei Monggol, the overall arrangements and coordinated construction of coal mines, power stations, and roads in Jungar, Nei Monggol, and the linking up of railway, highway, and river transport for coal and the coordinated improvement of collecting, loading, hauling, and unloading facilities.

#### Looking Ahead

Though the overall economic development program for the energy base has not been officially published yet, some clues have been revealed by experts concerned about the future of the base by the year 2000:

--Energy development. A number of coal production bases and thermal power bases will be completed. The coal production bases are: four noncoking coal bases including Yantong, Jungar, Changzhi, and Shenfu-Dongsheng; six coking coal bases including Xishan, Liliu, Huoxi, Xiangning, Pingdingshan, and Helanshan; and four anthracite bases including Yangquan, Jincheng, Jiaozuo, and Ruqiguo-Gulaben. Among them the Datong, Shenmu Ruqigou, Xiangning, and Lishi mines will also become important export coal bases. It is estimated that by the year 2000, the coal output of the entire base will double that of 1985.

Large thermal power plants will be built in the following areas: Yanbei and Datong in Shanxi; Hequ, Baode, and Pianguan in northwestern Shanxi; Jinzhong in Shanxi; Pingdingshan and Yaoment in Henan; Jindongnan and Jiaozuo on the border between Shanxi and Henan; Jungar in Nei Monggol; Dawukou and Haibowan on the border between Ningxia and Nei Monggol; and Weibei in Shaanxi. By the end of the century, the base's total installed generating capacity will be 3 to 4 times the present capacity. After meeting the base's own requirements, some power will be transmitted to the north China and the central-south power grids.

--Transport development. Three groups of main coal transport railway lines will be built in the north, the central, and the south. The northern group includes the Baotou-Beijing, Datong-Qinhuangdao, Yuanping-Beijing, and Jining-Tongliao lines; the central group includes the Taiyuan-Shijiazhuang line and a line from Shenmu through Shuoxian, Shijiazhuang, and Hengshui to the coast; and the southern group includes the Xian-Houma-Xinxiang-Heze-Yanzhou-Shijiusuo line, the Shenmu-Yanan-Xian-Ankang-Sichuan line, and the Jiaozuo-Zhicheng line. In addition, all existing highways will be rebuilt into second- or third-grade highways, and the use of Huang He shipping and [slurry] pipelines to transport coal will also begin.

--Development of high-energy-consumption raw and semifinished materials industries. The Baotou, Taiyuan, and Wuyang iron and steel corporations and a number of better-equipped small and medium-sized local steelworks will be renovated and expanded to double their output. The abundant aluminum resources in the base area will be fully tapped. While renovating and expanding the existing aluminum plants, several large new aluminum plants will be built, including alumina plants of the 1-million-ton class and electrolytic aluminum plants of the 100,000-ton class. By that time, the base's alumina and electrolytic aluminum production capacity will be several times that in 1985. Using coal as raw material, a number of large chemical fertilizer plants and integrated chemical industrial enterprises producing calcium carbide, caustic soda, soda ash, and polyvinyl chloride will be established in the five provinces in the base. Production of methanol, which may well become a substitute for gas, and related products will also begin to develop.

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## NATIONAL POLICY

### COOPERATION BETWEEN CAS, MPI PRODUCING 'OUTSTANDING RESULTS'

Beijing BEIJING KEJI BAO in Chinese 14 Jan 87 p 1

[Article by staff reporter Shi Wenjie [0670 2429 1240]: "Cooperation Between Chinese Academy of Sciences and Ministry of Petroleum Industry Producing Outstanding Results"]

[Text] The full-scale, long-term cooperation between the Chinese Academy of Sciences and the Ministry of Petroleum Industry in science and technology has produced great results. At the recently held second scientific and technological cooperation conference between these two units, Comrade Zeng Xianlin [2582 2990 2651], vice minister in charge of the State Science and Technology Commission, pointed out: "This is an example of high-level cooperation, an example of the integration of applied research with industrial development."

The cooperation between the CAS and MPI has produced some 50 results, some of which have already brought significant economic benefits, and others are being used as the basis for long-range oil field development. The CAS Lanzhou Geology Institute and Guiyang Geochemical Institute, together with related MPI units, evaluated the geological oil and gas resources and conducted general research in the Zhungaer Basin in Xinjiang. They submitted 127 reports on various stages of the studies and finally turned out a treatise on "the formation and evolution of the Zhungaer Basin and the laws of the formation of oil and gas" and 11 special research reports. Their findings represent a major breakthrough in oil prospecting. The expert system of interpretation for loggings of the mudstone layer, jointly developed by the CAS Shenyang Automation Institute and the Shengli Oil Field Logging Co, has been used to interpret the logging data of 115 wells, and the average accuracy rate is more than 94 percent. This shows that we have made new progress in using artificial intelligence to interpret loggings and blazed new trails in expressing knowledge. The research on the "numerical method of seismic prospecting," conducted by the CAS Computer Center, has produced results that are up to advanced international level. Three of these results have been put in software for practical use by petroleum departments in oil field prospecting.

In cooperation with related MPI units, the CAS Metals Research Institute has conducted metals and anticorrosion studies and achieved a number of practical results. The four brands of alloy oil pump ball valves developed by the institute can increase the recovery ratio as has been proven by tests at the Shengli oil field. If the ball valves are used by all the oil fields in China, it will mean more than 200 million yuan in additional oil revenues each year. A K-grade oil pump stem developed by the institute can be used continuously for more than 12 months. In the past, stems had to be replaced every 15 days or so. The CAS Applied Mathematics Institute, together with comrades of the Daqing oil field, has opened up a new field, using economic mathematics and management science to achieve the optimum decisions on development and ground construction planning and designing, which will be of great technological and economical significance to oil field exploration and development in China.

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## NATIONAL POLICY

### STATUS OF, PROSPECTS FOR TURBOGENERATOR MANUFACTURE IN CHINA

Harbin DADIANJI JISHU [LARGE ELECTRIC MACHINES AND HYDRAULIC TURBINES]  
in Chinese No 6, Nov 86 pp 1-9

[Article by Shen Liangwei [3088 2733 0251], Harbin Heavy Machinery  
and Hydraulic Turbine Institute of the Ministry of Machine Building]

[Text] Text of English Abstract: This paper introduces the present situation in Chinese turbogenerator manufacture. On the basis of past experience and lessons, it further discusses development measures and then suggests forward proposals for future products.

#### 1. The Status of China's Turbogenerator Manufacture

##### 1.1 Output and Types

Old China's industry was backward and the turbogenerators used within China were almost all imported. China's turbogenerator manufacturing has come into existence since 1949 going from small to large, and developing very rapidly. Basically, this can be divided into three stages. The first stage, 1953-1958, was the stage of imitation. The main feature of this stage was the establishment of two large generator equipment manufacturing bases: the Harbin base, which imported Soviet technology, and the Shanghai base, which imported Czech technology. Beginning with imported technology and digesting from imitation, the ability for batch production of air-cooled 25MW and smaller generators gradually took shape. The second stage, 1958-1980, was the stage of self-development. In this period, from self-developed air-cooling, dual inner water cooling and hydrogen cooling technology, three large series were formed providing 100MW, 200MW and 300MW generator groups. We basically resolved the key technologies of dual inner water cooling, for example, stator and rotor coil water system and coil structure; the rotor's water intake and debouchure and the water tank sealing structure; the stainless steel diversion structure of the rotor's inner cooling; corrosion prevention of the stator and rotor water path; loss, heating and cooling of construction elements of the stator iron core and the two ends, ... etc. We mastered the key topics in hydrogen cooling technology, as well as measures to increase the cooling ability such as circulation type sealed tile, end-covered bearings and gap drawn gaseous hydrogen inner cooled rotors, etc. We made good progress in the

commonality of large capacity turbogenerators, such as analysis of stator winding electromotive power; calculation of rotor dynamic balance and critical rotation speed; stator B-class mica insulation; stationary silicon rectifier alternating current exciter system; stator dynamic characteristics and isolation structure; and rotor negative order bearing capability, etc. In 1978, while improving domestically manufactured large generator sets, due to the implementation of the policy of opening up to the outside, to satisfy the demand for electric power supply for the Chinese economy to quadruple the value of gross output by the end of this century, beginning in 1980 we went through another stage of importing. Table 1 is a listing by years of the new products developed.

By the end of 1985 China's overall rated capacity was approximately 85,000MW, in 1985 the annual volume of electricity generated was 408 billion kWh, the cumulative production of turbine generators was approximately 56,000MW, or about 80 percent of the domestic thermoelectric rated capacity. There are now in China four plants (Shanghai Electric Machine Plant, Harbin Electric Machine Plant, Dongfang Electric Machine Plant, and Beijing Heavy Electric Machine Plant) which can manufacture turbogenerators with single machine capacity of 200-300MW, and, together with other plants in the country, form a turbogenerator production system of large, medium, and small division of labor.

Table 2 is the primary product types of China's turbogenerators: these include the small scale waste heat turbogenerator series with capacity of 0.5-3MW; the air-cooled series with capacity of 3-25MW; the dual inner water-cooled series, with capacity of 50-300MW; the hydrogen inner-cooled series with capacity of 100-300MW; and 300MW and 600MW machines manufactured under license from the U.S. Westinghouse Company. While the products satisfy the domestic markets, some are also exported, such as the 60MW dual inner water-cooled turbogenerator supplied to Korea by the Harbin Electric Machine Plant, and the 210MW turbogenerator provided to Pakistan.

## 1.2 Plant Production Capability

China has eight mainstay enterprises which produce turbogenerators. The two large bases of the Harbin Electric Machine Plant and the Shanghai Electric Machine Plant were formed during the First Five-Year Plan and the Sichuan Dongfang Electric Machine Plant was built in the seventies. The productive capacity of the equipment of these three plants averages 1,200MW in annual output. During the Sixth Five-Year Plan, when thermoelectric technology was being imported, the state carried out large scale technological reform of the Shanghai and Harbin bases. During the Sixth Five-Year Plan, the state invested in the construction at the Shanghai Electric Machine Plant of a 17,784m<sup>2</sup> plant building, whose main plant turbogenerator bay is 36m wide and 312m long, and has a 400t crane and the necessary test equipment. During the Sixth Five-Year Plan the state also invested in the expansion of the production area at the Harbin Electric Machine Plant to 25,600m<sup>2</sup>. During the Seventh Five-Year Plan, if the domestic plants carry out the scheduled technological reform goals, the capacity for domestic production of turbogenerators will greatly increase.

Table 1. Chronological Table of China's New Turbogenerator Product Development

	Product Name	Year 1st Manuf.	Manufacturing Plant	Notes
Imitation Stage	Air-cooled 6MW, TQC-6-2	1954.9	Shanghai EMP	Czech imitation
	Air-cooled 25MW, TQC-25-2	1958.10	" "	" "
	Air-cooled 25MW, TQ-25-2	1958.10	Harbin EMP	" "
	Hydrogen outer cooled 50MW, TQQ-50-2	1959	" "	" "
Self-development Stage	Dual inner water cooled 12MW, TQSS-12-2 and dual inner water cooled TQSS series	1958.9 to 1962	Shanghai EMP	
	New air-cooled series QF3-25MW	1962 to 1965	Jinan Shengjian EMP Beijing HEMP Nanjing TGP	
	New dual inner water cooled QFS series			
	QFS-50-2	1966	Shanghai EMP	
	QFS-60-2	1975	Harbin EMP	
	QFS-100-2	1974	Beijing HEMP	
	QFS-125-2	1969	Shanghai EMP	
	QFSS-200-2	1972	Harbin EMP	
	QFS-300-2	1974	Shanghai EMP	
	New hydrogen outer cooled 50MW, QFQ-50-2	1966	Harbin EMP	
Hydrogen and water cooled 200MW, QFQS-200-2	1972	Harbin EMP		
Hydrogen and water cooled 300MW QFQS-300-2	1985	Dongfang EMP		
Completely hydrogen inner cooled 300MW QFN-300-2	1985	Shanghai EMP	Imported U.S. WH technology	
Hydrogen and water cooled 600MW, QFQS-600-2	1986	Harbin EMP	Imported U.S. WH technology (in plan)	

EMP = Electric Machine Plant  
HEMP = Heavy Electric Machine Plant  
TGP = Turbogenerator Plant

Table 2. Important Series of China's Current Turbogenerators

Series	Model Number	(1)		(2)		Cooling method			rpm	(10)	Eff. (%)	Weight (t)		Exciter (kW)
		MVA	MW	sta-tor	Rotor	Iron Core	Sta.	Ro.						
Residual heat series	QF-0.75-6	0.9375	0.75	air-cooled	air-cooled	air-cooled		3000	0.8	95.35	2.6	1.6	(11)	
	QF-1-2	1.25	1	air-cooled	air-cooled	air-cooled		3000	0.8	95.1	2.7	1.6	"	
	QF-1.5-2	1.875	1.5	air-cooled	air-cooled	air-cooled		3000	0.8	95	1.365	1.44	"	
Air-cooled series	QF-3-2	3.75	3	air-cooled	air-cooled	air-cooled		3000	0.8	95.48	4.8	2.4	"	
	QF-6-2	7.5	6	air-cooled	air-cooled	air-cooled		3000	0.8	96.52	9.08	3.5	"	
	QF-12-2	15	12	air-cooled	air-cooled	air-cooled		3000	0.8	96.4	11.6	5.3	"	
	QF-25-2	31.25	25	air-cooled	air-cooled	air-cooled		3000	0.8	97.64	18.5	7.8	"	
	QF-50-2	62.5	50	air-cooled	air-cooled	air-cooled		3000	0.8	97.4	40	16	"	
Dual water-cooled series	SQF-100-2	117.5	100	water-cooled	water-cooled	air-cooled		3000	0.85	98.1	52	18	(11)	
	QFS-125-2	147	125	water-cooled	water-cooled	air-cooled		3000	0.85	98.4	71.5	24.7	(12)	
	QFSS-200-2	235	200	water-cooled	water-cooled	air-cooled		3000	0.85	98.4	93	32	(11)	
	QFS-300-2	353	300	water-cooled	water-cooled	air-cooled		3000	0.85	98.32	163	46	(12)	
	QFQ-50-2	82	50	water-cooled	water-cooled	air-cooled		3000	0.85	98.6	157	57	"	
Hydrogen-cooled series	QFN-100-2	117.5	100	(4)	(3)	(6)		3000	0.8	99.4	90.8	25	(11)	
	QFQS-200-2	235	200	"	(4)	"		3000	0.85	98.7	110.7	29.3	(12)	
	QFQS-300-2	353	300	water	(4)	"		3000	0.85	98.6	180	43	"	
	QFQS-300-2	353	300	"	(5)	"		3000	0.85	98.65	180	49	"	
Generator series	QFN-300-2	353	300	(7)	(7)	(6)		3000	0.85	93.5	255	48	(13)	
	QFNS-600-2	666.6	600	(4)	(4)	"		3000	0.9	98.775	325	66.3	AC exciter	

Key:

1. Apparent power MVA
2. Active power MW
3. Outer hydrogen cooled
4. Inner hydrogen cooled
5. Air gap drawn ventilation
6. Hydrogen cooled X biaoya [5903 1090]
7. Axial hydrogen inner cooling
8. Inner water cooling
9. Power coefficient
10. Short circuit ratio
11. Axial dc exciter
12. Axial ac exciter
13. High initiation reaction brushless exciter

From this it is clear that the production potential of domestic manufacturing plants is very great. The key is in how to let them "eat their fill" so that the latent capacity is truly exploited.

### 1.3 Concerning Technological Imports

Technological imports are designed to accelerate the pace of development, improve our ability to be self-reliant, and are a strategic measure to diminish the gap. The advances brought by technological imports become clearer day by day. During the Sixth Five-Year Plan (1980-1985), the state paid a great deal of attention to technological imports for generating equipment manufacturing, signing 13 agreements abroad, including a contract signed on 5 February 1981 between the Chinese and U.S. Governments for the transfer of 300MW and 600MW generator set manufacturing technology for a 15-year period. For the past few years such technological import-related tasks as personnel training, conversion of blueprints, technological reform, and checking of generator set trial manufacture have been going according to plan. Absorbing and digesting this imported technology is an enormous task.

Summarizing now the turbogenerator, there are at least a few points worthy of consideration for future technological import work. First is the method used for technological imports. Generally speaking, there are three methods for technological imports: joint financing, purchasing licenses, and joint design and cooperative production. In the early fifties, China's turbogenerator manufacturing was non-existent. At this time it was appropriate to adopt the method of purchasing licenses for importing entire sets. By the early eighties, the situation had changed and we had nearly 30 years of experience, each plant had its own technical tradition, structural features and technological strengths, thus in adopting the method of joint design and cooperative production there is the possibility of incorporating our national situation and our valuable experience which may reduce the volume of work for domestication after importing. Second, in importing technology, we must definitely pay attention to economics, and will definitely suffer economic restrictions, and definitely cannot have unrestrained expenses for technological reform of plant and unrestrained product prices. Until the year 2000, thermoelectric 300MW and 600MW generator sets will be the primary generator sets of China's electric power network. In the early eighties, the defects in 300MW generator sets in operation basically were already rather clear. As concerns the 600MW generator sets, in 1972-1978 Harbin and Shanghai gained 7 years of experience, going from assignment letter, preliminary design, technological design, and sample manufacture to completed construction design. To improve the quality of the 300MW and 600MW domestically manufactured generator sets, it was believed that the manufacturing plant could decide on what was the suitable technology to import for the actual situation. China's electric power construction should spend less money, deliver more electricity, and this determined that China's manufacturing plants first of all should develop middle level technology. This so-called "mid-level technology" refers to a technology which is suitable, practical and durable, and this means that first of all we should resolve the matter

of sending timely help and then consider making it even better. Why are the 210MW generator sets we export to Pakistan competitive? It should be recognized that the thermal efficiency, peak adjustment performance, and level of automation are not up to the advanced countries, but the Chinese-manufactured 210MW generator sets can generate satisfactorily, stably and for long periods and the price is only one-half that of Japanese generator sets! The product should suit the purchasing power of the user market, for you can say it's advanced, but if people cannot afford it then that's no good either. Third, imported technology should be combined with our own traditions. First of all we should clarify, what are our traditions? Are these traditions advanced, do they have a future? If the answers are in the affirmative then they cannot be easily discarded. The stator winding water inner cooling, rotor winding gap drawn gaseous hydrogen inner cooling method, the stator multiple insulation system and the three generator stationary semiconductor exciting systems are traditions of the Harbin Electric Machine Plant and the Dongfang Electric Machine Plant. These traditions similarly are world-accepted advanced technology and similarly require further development. As concerns dual inner water cooling, this is a developmental direction for large generator sets, and in addition, we have already taken a few steps and should move further ahead through technological imports. The combination of imported technology and rational manufacturing plant tradition can improve the advantages and avoid the disadvantages, can reduce investment in technological reform and avoid increasing unnecessary equipment, can reduce varieties and increase output, can concentrate limited strength and improve and intensify it in certain technological areas. Some say, "Any cooling method will do, any configuration will get by, the technology is very complete and can suit the user's needs, it can supply anything he wants." Actually, what the user needs is a turbogenerator of high quality and low price which operates reliably, and making a great variety of products cannot match comparison of product and similarly cannot have any competitive ability.

#### 1.4 The Gap

There is still a definite gap between Chinese manufactured generator sets and those of the advanced countries in terms of single generator capacity, annual output, some performance indicators and in the use of computers. These specific issues are well known to those in the industry, so we will not go into details but will focus on how to get organized to exploit our superiority and reduce the existing gaps in the shortest time.

While admitting the gaps, we should also note that we have many favorable conditions for reducing the gaps and coming out ahead, and this is the reason why we are fully confident that we are ready to take off. The favorable conditions are:

- 1) Our turbogenerator design and manufacture is characterized by a complete range of product types and rather comprehensive technology. In terms of cooling methods: in stator winding, we have mastered the two methods of inner water cooling and inner hydrogen cooling; and in rotor winding, we have mastered the two methods of inner water cooling

and inner hydrogen cooling. Among the inner hydrogen cooled rotor winding there are three types: gap air drawn slope flow ventilation (GE Company type), high pressure fan axial ventilation (Westinghouse Company type), and secondary trough radial ventilation (A-A Company type). In terms of stator insulation, what we originally developed was a ring mica multiple jiao insulation system, and now we are developing a vacuum pressure infusion (VPI) system. For exciter systems there are the ac exciter diode flow regulator system, the brushless exciter system imported from Westinghouse, and the controllable silicon self exciting system which is under development. Technological completeness, a wide range of product types, and multiplicity of approaches are one of the characteristics of Chinese turbogenerator manufacturing, and in this we cannot be compared to any other country. If we are technologically complete we can draw on each others' experience and reach a decision because selection of the best is easier.

2) Through over 30 years of development, China's turbogenerator manufacturing has developed the features of practical performance, industrial succinctness, structural simplicity, and inexpensive prices. These features are very favorable for competition in foreign markets. Frequently, for the same design demand, domestic processing methods should be much simpler than those abroad. There are many examples of this: in China's rotor inner water cooling technology, water intake through a central hole and debouchure in the rotor's surface both use the self-pumping principle which greatly simplifies the inner water cooling winding structure; China's process for pressure forming primary insulation with multiple layers of jiao compares with VPI abroad, but the process and the equipment are much simpler; China's hydrogen-cooled chassis welding and processing take much less time than the U.S. Westinghouse method; the function of the insulated baodaiji [0545 1601 2623] which China designed is more or less the same as the foreign ones, but its structure is much simpler; the middle frequency welding machine, rotor trough-cutter, guard ring using hydraulic devices, digital-controlled wire steel plate blanking machine, and the gap ventilation copper wire hole-milling machine which we designed are all rather simple and practical and the manufacturing price is much lower than levels abroad. In addition, while similarly ensuring quality, simple structure and succinct processes and economizing on materials can greatly economize on manufacturing time which lowers production costs.

3) After going through technological reform, China's generating equipment production base became even stronger. Plant buildings, test station capacity, key processing equipment, some precision instruments, all reached first class world levels, and increased output and raised levels. This provides an excellent material base, and a high quality staff.

4) Mankind's development of production generally goes through the three stages of labor intensity, energy intensity, and knowledge intensity. The industrially-developed countries have now gone from energy intensity to knowledge intensity and the growth in the demand for electricity has slowed. Thus, beginning in the 1980's, world generating equipment production will be in a very depressed state. Yet China is now in the energy

intensity state and market demand is very optimistic; thus generating equipment manufacturing is now entering a golden age and market forces are very favorable for promoting technological advancement.

## 2. Future Targets

Electric power is the motive power and precursor of the economy and falls within the scope of the energy industry which is one of the strategic keys of China's economic construction. For a variety of reasons, China has a serious shortage of electricity. For the 16 years since 1970, China's electric power supply has been very critical, and industrial and agricultural production is seriously affected when localities repeatedly open the flood-gates when power is in short supply.

The Party's 12th Congress proposed the magnificent goal of quadrupling industrial gross output by the end of this century. On this basis it is necessary to forecast the demand for generating equipment in the future. There is an objective relationship between the average annual growth rate of electric power consumption and the average annual growth rate of industrial and agricultural gross production. The electric power elasticity coefficient is an objective indicator which reacts to this relationship. Reference [1] has studied in detail the electric power elasticity coefficient abroad in different periods and reached the conclusion that the smallest electric power elasticity coefficient for the rate of development of China's electric power industry by the end of this century is 1, that is, to ensure that the growth rate of electric power keeps step with the growth rate of the national economy. Table 3 provides the results of calculations using an electric power elasticity coefficient of 1.

Table 3. Estimate the Rated Capacity of China's Generating Equipment

<u>Time</u>	<u>Av Ann Econ Growth</u>	<u>Growth in 5 Years</u>	<u>Initial gross rated capacity</u>	<u>Final gross rated capacity</u>	<u>New incr in 5 years</u>
Sixth 5-yr Plan	6.0%	133.8%	60,500 (1980)	80,950 (1985)	20,450
Seventh 5-yr Plan	7.0%	140.3%	80,950 (1985)	113,560 (1990)	32,610
Eighth 5-yr Plan	8.0%	147%	113,560 (1990)	166,860 (1995)	53,300
Ninth 5-yr Plan	8.0%	147%	166,860 (1995)	245,170 (2000)	78,310
In 20 Yrs	7.25%	405%	60,500 (1980)	245,710 (2000)	184,670



In addition, China's total rated capacity in the year 2000 calculated according to secondary regression method, includes a hydroelectric rate capacity of approximately 48,000MW, and within 20 years, a new increase in rated demand of hydroelectricity of 31,130MW. Calculated at 1000 yuan/kW for thermoelectric and 2000 yuan/kW for hydroelectric power, this will require an investment of 200 billion yuan within 20 years. It is estimated that in the year 2000 the amount of electricity generated annually may be as much as 1.2 trillion kWh. During the Sixth Five-Year Plan, the new increase in rated capacity was 25,500MW; during the Seventh Five-Year Plan, 35,000MW of domestically-manufactured generating equipment is planned, of which 30,820MW will be thermoelectricity. During the Seventh Five-Year Plan, thermoelectric equipment will be primarily 200MW and 300MW generator sets, and beginning with the Eighth Five-Year Plan will gradually shift to primarily 300MW and 600MW. Within 20 years initial estimates are that thermoelectricity will demand a total of 158 200MW, 241 300MW, and 61 600MW generator sets.

The above arrangements can be achieved. In 20 years, the United States increased from 65,150MW in 1947 to a total rated capacity of 288,190MW in 1967, and the Soviet Union increased from 66,720MW in 1960 to 266,600MW in 1980. Beginning now we should raise the proportion of investment in electric power in order to accelerate electric power construction, and in addition to state appropriations, we can also raise funds locally for operation of electric power. Electric power construction should expand the scale of projects in progress, and there should be a definite ratio between scale of construction in progress and capacity put into production, otherwise we will miss the opportunity, and if we wish to go faster in the future we will not be able to. If only we unite as one and act conscientiously, China's generating equipment manufacturing industry which provides equipment for the electric power industry can definitely accomplish this glorious and enormous mission.

### 3. Some Proposals On How To Complete the Future Tasks

Our tasks are quite formidable, and we strive for "high quality and modest prices; supply according to need." There are a multitude of technological tasks. On the basis of summarizing past experiences, I put forth the following proposals:

#### 3.1 Stabilize Policy, Intensify Planning

Large-scale thermoelectric equipment is a complex system, consisting of the three large primary mechanical, electrical, and boiler parts, as well as large groups of auxiliary and automated equipment such as fuel, water, and ventilation, and in addition there are such sets of equipment as transformers, which make up approximately 50 percent of the total investment in all equipment. The turnaround time from receiving orders, testing and research, and product design to research and development, installation and testing, improvement of equipment, and batch reproduction is very long and there is a great deal of coordination and planning work in each link. The above process for a Chinese-manufactured 200MW thermoelectric generator

is 13 years. If policy is always changing and administrative meddling is excessive, it is bound to disrupt the entire situation. The policy of priority development of large generators was replaced during the "Cultural Revolution" by a strategic direction of "decentralization, concealment, and going underground," and 5 years passed before we knew it; a Chinese-manufactured 600MW generator already took 7 years, and once we started importing, everything was turned upside down; planning for the Dongfang Electric Machine Plant's 300MW generator is not settled and has been going on for 8 years. These examples are sufficient to indicate that if policy is unstable, and keeps changing, in the end we always miss a good opportunity. Today, policy is stable and we urgently need to do some planning. Planning work should stress a scientific nature, should conduct market forecasting, feasibility analysis, and on the basis of needs and possibilities should propose goals which fit the actual situation. Planning work should be comprehensive and with regard to manufacturing plants, development of new products, test research, technological innovation, supply of materials, quality control, and personnel training should be synchronized, and a meticulous overall balance should be maintained in personnel, finances, and materials, by levels and stages, and it should be constantly workable. Planning work should be authoritative, and once a plan is formulated it becomes "law" and should be carried out on that basis. We should not let "authority become greater than law" and let an individual make changes as he wishes. If we require adjustment, we should have automatic regulation through a definite procedure. In the past, once the plan was finished, that was it, the planners did the planning, and the administrators did the administration, which had a bad influence. The departments should be systematically and closely coordinated according to the planning contract. Coordination between departments should be according to the overall plan. The generator set bureau stresses generator set design, institutions of higher education stress theoretical analysis, the plants and research institutes stress application and manufacture, and if each thus has its preferences, through vigorous cooperation it will be easy to create a new situation. As long as we plan well there will be hope that we can bring to an end this strange phenomenon of China's shortage of electric power and the inadequacy of generating equipment manufacture and long-range tasks.

### 3.2 Firmly Stress the Lifeline of Improving Product Quality

Generating equipment must operate continuously and if product quality is low, and the forced stoppage rate is constantly blacking out large areas, the economic losses are considerable. The quality of China's products has undergone two severe shocks since 1949 and the lessons were very profound. The first time was the Great Leap Forward of 1958-1960 when we engaged in exaggeration and made light of quality with manufacture in a rough and slipshod manner. The second time was the decade of chaos during the Cultural Revolution, when scientific research agencies were smashed, scientific and technical personnel were sent down to the countryside, and the system of rational rules and regulations was destroyed, with the result that a crisis of confidence in our products appeared.

Since the Third Plenum of the 11th CPC Central Committee, bringing order out of chaos, manufacturing departments have improved on the idea of quality as the key to survival and development through varieties of products, and in design and manufacture are making reliability primary. After several years of effort, we adopted a series of measures and did a great deal of work before a good situation appeared in which product quality was stable and improving. However, product quality is a comprehensive issue, involving science and technology as well as being linked with level of management. Now we need to improve management. In line with the principle of overall quality control throughout, "quality first" should be carried out throughout from product design straight through to product use, although there are different key points at different stages. To improve product quality now, before the product is developed, manufacturing plants should stress scientific research internally and use this as a standard for promoting scientific research. As a first step, measures should be adopted to achieve national goals, this is the most minimum demand; second, we should combine the situations at all plants and propose several specific projects to exceed national goals. In particular we should make internal control norms of advanced foreign plants the goals for quality control norms which have not yet been made national goals and concentrate forces on organizing key scientific research projects. For example, a chassis vibration limit not exceeding 0.1mm; vibration of stator end winding rating when operating not exceeding 0.25mm; noise not exceeding 90dB; insulation life greater than 40 years; forced shutdown rates not greater than 0.5-1.0 percent; permit generator start/stop 10,000 times during useful life...etc. In the past, expenses for scientific research have been rather low, as a result, products have been modified and supplemented in the power stations, and the stopping and starting has both lost time and cost a great deal of "tuition." Now there is a viewpoint which holds that since we are importing, we no longer need to engage in scientific research, and this is a misconception. In importing technology and directly using the results of foreign scientific research, it is not necessary to rely on our own explorations entirely and the starting point is higher, but absorbing the technology of others still requires that we rely on our own practice, and after absorption, if we wish to make advances it will even depend on experimental research. Otherwise, we will lack reserve strength and after a number of years we will have to import again. We are currently adding some advanced instrumentation to improve our scientific research methods. In the period before developing a product, the manufacturing plant should place demands for raw materials outside the plant and give concerned departments responsibility for resolving this. Raw materials is a weak link in China. In the advanced technology imported from Westinghouse there are 50 insulation materials which urgently need to be domestically manufactured, such as AFLON slip layer, silicon steel plate inorganic coating; C11 lamination; stator winding fixing using fiberglass tapered rings; laminated rotor insulation, etc. In addition, there are over 20 high performance metals that urgently need to be manufactured in China, such as 18 Mn with good ability to resist pressure corrosion, 18 Cr protective rings, and beryllium bronze rotor slot wedges. The domestic manufacture of electronic components is even more important.

Currently, we must stress computer-aided design (CAD) in the production design stage to improve product quality. According to statistics from foreign materials, the use of CAD technology can shorten the machine product design cycle by more than 50 percent and can greatly improve the first time success rate of new products. The first step should be to install computers and test them, establish computer terminals, take about one year to convert all of Westinghouse Company's 76 programs into a program library, then set up a standards library, symbols library, forms library, graphics library, and implement a partial component computer graphics mission. The gap in design between us and Westinghouse is primarily in the use of computers. After the development of CAD, dozens of special analyses which we could not calculate in the past we could now calculate and the design level would greatly improve.

In addition to the above, to improve quality we should stress reliability in operation. Currently, manufacturing plants have improved power station on-site service, and for important products have implemented a system of stationing a representative in the customer's plant and a system of stationing a representative at the construction site. But on the other hand, we must improve reliability statistics. There are many reaction reliability norms, but primarily they are for usability, forced shut-down rate, average intervals between breakdowns, and average breakdown repair time. Manufacturing plants should select typical products and typical generator sets and have specialists take responsibility for collecting statistics, should survey the incidence of generator component breakdowns and their causes in terms of different categories and provide prompt information feedback, conscientiously carry out an ineffectiveness analysis, and adopt corresponding countermeasures to improve the situation and lower the accident rate. In addition, we should get in close touch with the Reliability Statistics Center of the Ministry of Water Resources and Electric Power and compare the data of one plant with other similar plants and with similar foreign generators to discover gaps and constantly move forward.

### 3.3 Improve Economic Results

#### 3.3.1 Reduce Capital Construction Investment

The technological reform structure of the Harbin and Shanghai bases during the Sixth Five-Year Plan has already been widespread and is bound to generate increasing expansion of investment, and must increase the capability progressively in order of importance and by stages with output. Productive capacity during the Seventh Five-Year Plan should be supplemented by Harbin's annual output of 3000MW and Shanghai's 2500MW. We should not always focus only on big and state-of-the-art equipment, but should invest in "bottlenecks." Take Harbin, for example. Eighty-five percent of the parts in a turbogenerator are welded, but the capability the current welding shop is lacking; so we should first resolve the problem of digitally controlled feeding machines and automatic welding machines. To improve equipment use rate, within one plant, hydroelectricity, nuclear electricity and thermoelectricity should be integrally considered and be mutually

complementary. In the past, domestic production plants were distributed in too many places, there was duplicate capital construction which wasted a great deal of valuable investment. From now on, we should reduce investment in capital construction as much as possible and have each plant rely on intensive growth to expand reproduction.

### 3.3.2 Expand Production in Batches

Expanding batch production of leading turbogenerator products is an important measure for increasing economic benefits. The varieties of turbogenerator products are few and there are few restrictions on installation sites, and this is suited to large batch production. As long as we can organize production in a balanced and continuous way we can improve labor productivity, increase profits, and increase the ability of enterprises to carry out technological reform on their own. Domestic machinery, electrical and boiler production capability is now temporarily out of balance. Boilers are in short supply, but we must not arrange production on the basis of the short supply. We should fully exploit the special features of high productive capacity of turbogenerators and deal with the short supply portion through imports for the time being. The large gap in raw materials is an important contradiction of current batch production, and ways must be found to resolve it.

### 3.3.3 Organize Specialized Production

Organizing specialized production and coordinating production is a problem in improving economic benefits that urgently needs to be resolved. Some plants even now still are large and comprehensive: they can handle main machinery, auxiliary machinery, metal-working, electrical engineering, casting, forging, punching or welding on their own, and the harder it is to find people to do these things, the more it affects production. Independent parts should be as decentralized as possible, organizing specialized production and coordinated production to increase output. In short, stressing planning, quality, and economic results involves the overall situation and promotes overall completion of the mission.

## 4. On Product Development

Here I mean primarily the development of future 200, 300 and 600MW turbogenerators.

### 4.1 Improving 200MW Turbogenerators

From 1972 to the end of 1984, China produced 41 200MW turbogenerators of which 27 were put into operation. For 200MW turbogenerators which are currently in stable operation, the forced shutdown rate due to accidents is less than 1 percent, and after-operation tests improvement measures are always being taken with regard to problems that appear. Reference [2] gives 66 major improvements adopted by the Harbin Generator Plant for the QFQS-200-2 generator to reduce hydrogen leakage in the generator, improve the end fixing of the stator winding, improve rotor winding ventilation

performance, decrease noise, and improve the reliability of the exciter systems and the operation of the hydrogen, water and oil auxiliary systems. According to the analysis of Reference [3], the gap between the Chinese-produced 200MW generator sets and the similar foreign model generator sets is primarily in the turbine and the boiler, and taking into account that in the future the numbers of 200MW generators produced will still be fairly large (under the Seventh Five-Year Plan alone no less than 80 sets), the Harbin region has issued a mission statement for improving the design of 200MW generator sets. The primary direction of improving models is to improve generator thermal efficiency by 1-1.5 percent and improve generator peak performance: ensuring 10,000 start-ups, load variation of as much as 3-5 percent of rated load per minute, reaching rate load in 1.5 hours after hot start and 6 hours after cold start, and a minimum load of 30-40 percent. The key to the problem is speed. The 200MW generator sets must be improved from the Seventh Five-Year Plan to the Eighth Five-Year Plan to be able to go into batch production, any later and it will lose its significance. We must pay attention to matching price and performance after improvement, otherwise it will lose its attraction. As concerns the level of generator automation, there can be two different levels of design provided to the customer for his selection. In addition, we should try as hard as we can for 100MW and 200MW generator sets for exports in order to expand our source of foreign exchange.

#### 4.2 On 300MW Turbogenerators

The capacity of the electric power network in northeast, north, east and central China exceeds 10,000MW, and a single generator capacity of 200MW clearly is pretty small. Thus, we urgently need generator sets with rated capacity of 300MW and more. There is no great disagreement with manufacturing Chinese 300MW and 500MW boilers using imported GE technology or turbines using imported Westinghouse technology, but there is still a problem with turbogenerators. The author agrees with the viewpoint in Reference [4] concerning how to evaluate Westinghouse turbogenerator technology. Comrades who go on field trips to Westinghouse generators frequently go through three stages: before they go they think that Westinghouse is an old firm which has been around for nearly 100 years, that the technology is advanced and their position is strong, ranking first or second in the world, so Westinghouse technology is definitely pretty good. Once they come in contact with the 300MW and 600MW kaohe [5072 2702] generator sets they discover that this is not so. As everyone knows, their efficiency is low, they are very heavy, their structure is complex, they require many man-hours, and are also quite expensive. On further study they feel that there are definitely many merits in terms of design, technology, materials and inspection and testing that warrant study, they have the design, manufacture and operational experience of over 250 200MW and more large scale turbogenerators, and the issue is considered very carefully. Why is there partial progress and we are always falling behind this situation? The biggest weakness is in the Westinghouse ventilation cooling system. The stator coil inner hydrogen cooling technology is complex and the rejection rate is high. The rotor high-pressure fan technology is complex, there are many parts and loss is considerable.

In the early 1950s when the Westinghouse Company began to develop internal cooling of turbogenerators, they started with a stator and rotor axial inner hydrogen cooling system. They used high pressure and multiple level fans to provide the necessary air pressure and used dual circulating ring type oil seals to take care of the high hydrogen pressure. Thus, in the 1950s and 1960s, in single generator capacity and output they always were ahead of the GE Company. Starting in 1953 after the GE Company adopted gap air drawn self ventilation hydrogen inner-cooled rotors, high-pressure fans were not necessary, but the stator winding had gone through various setbacks of inner hydrogen cooling, multibranch path winding, and inner oil cooling before finally finding inner water cooling which made an excellent match with hydrogen water cooling, GE claimed to be the front runner after 10 years of ups and down. Our general attitude is to study their good points and avoid their bad points. Thus, we should adopt an attitude of absorb, digest and reform imported Westinghouse technology. We should absorb, digest and transplant as appropriate to other Chinese manufactured machines the excellent Westinghouse technologies such as vertical spring plate structure, stator winding trough and end-fixed structures, rotor coil manufacture technology focused on processing, sectional ceramic bearings, stator water connection welding technology, rotor axle neck processing technology, aluminum phosphate manufacturing technology, brushless exciter system, dozens of materials with excellent performance, and dozens of advanced instruments such as the fast Fourier analyzer (FFA). We should resolutely improve the Westinghouse ventilation cooling system. As a matter of fact, the Westinghouse Company itself is improving the traditional ventilation cooling system. In China there are six types of 300MW turbogenerators which we are currently manufacturing or preparing to test manufacture, three of them by Shanghai Electric Machine Plant alone. Thus we must pay attention to "birth control" and "eugenics," for not engaging in "birth control" is not good for us and for others. For us (manufacturing plants), strength is scattered, the burden is excessively heavy; and for others (users) there are too many models, and this increases the unnecessary complexity for power station design, forging supply, auxiliary systems, spare parts, etc. What we call "eugenics" is superior quality and modest price. In addition to satisfying national norms, the Ministry of Water Resources and Electric Power's primary demand for improvement of 300MW turbogenerators is a maximum continuous capacity of 110 percent of the rated capacity, efficiency of 98.7 percent; double the top value voltage, acceleration speed of two-fold/seconds, generator sets can adapt to peak needs. For 300MW turbogenerators from now on, we can make the following predictions.

1. Although the performance of the original Shanghai 300MW dual water-cooled turbogenerator does not meet the improvement demands of the Ministry of Water Resources and Electric Power, the industrial processing is simple, it is easy to use, and furthermore the price is low, the product is well known and fairly practical and there may continue to be some market demand.

2. Stop production of the imported Westinghouse kaohe 300MW turbogenerator.

3. The overall structure of the stator winding water cooled and rotor winding radial secondary trough ventilation hydrogen cooling generator which the Shanghai Electric Machinery Plant and the Westinghouse Company (with the participation of the Harbin Electric Machinery Plant) are just getting together to develop is very close to the French A-A Company's 300MW turbogenerator. The Harbin, Dongfang, and Beijing Heavy Electrical Equipment companies are just now getting together to develop a rotor gap ventilated 300MW turbogenerator. These two products can satisfy the improvement demands of the Ministry of Water Resources and Electric Power. Their performance and price are similar and can be offered to user departments. After producing a certain number of the QFQS-300-2 turbogenerators being manufactured by the Dongfang Electric Machinery Plant, it may be possible to make the transition to a 300MW generator developed jointly within China.

#### 4.3 On the 600MW Turbogenerator

Although the technological level of the WH600MW kaohe generator set's turbogenerator is higher than that of the 300MW, there are still problems in dropping from 60Hz to 50Hz, lowering stator voltage from 24Kv to 20Kv, reducing primary insulation thickness, improving the ventilation system, and external diameter of the primary stator chassis is too big, and it cannot be shipped on Chinese railways. In view of the manufacturing plants' actual strength and that the Harbin area is in a hurry to develop a 300MW product, improvement of the imported 600MW generator should be divided into two steps. The first step is to make our goal improving the degree of domestication and lowering the price of the kaohe generator set. We will accumulate some experience in making several according to Westinghouse technology. The second step is to wait until domestically we have jointly designed a 300MW generator, and then concentrate our efforts on improving a 600MW generator. The urgent matter now is for manufacturing departments to lower costs, lower the price of the 600MW generator set and for the electric power departments to strengthen arrangements for 600MW generator sets. Otherwise it will be difficult to give play to the benefits gained from importing technology and from the huge investment in technological transformations, and the above mentioned goals for the year 2000 will be difficult to realize.

#### 4.4 Stress Development of Even Larger Capacity Generator Sets of 900MW

The variations of matching thermal generator sets and air cooled generator sets for areas which lack water is not very great. Since the development cycle is long, we must make our arrangements as early as possible and stress development of generator sets with even larger capacities of 900MW. This is extremely necessary for thermoelectric and nuclear-electric development in the Ninth Five-Year Plan and afterwards. The development of 900MW generator sets will present many new research topics for design, industrial processing, materials and operation, and will comprehensively spur on scientific and technical advances in the thermoelectric area.



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CSO: 4013/35

NEW TECHNOLOGY

5MW HEAT-SUPPLY REACTOR TO BE COMPLETED IN 1988

Beijing KEJI RIBAO in Chinese 19 Mar 87 p 1

[Article by reporters Feng Zai [7458 0375] and Dong Zhixiang [5516 1807 5046]: "Qinghua University's Nuclear Energy Technology Institute's Nuclear Heat-Supply Institute Makes New Advances; China's 5MW Low-Temperature Heat-Supply Reactor To Be Finished Next Year; Will Form Practical Base for Studying Nuclear Heat-Supply Technology"]

[Text] A 5MW low temperature heat-supply prototype reactor construction project is making major headway. This is another new development in the nuclear heat-supply research area after Wingham University's Nuclear Energy Technology Institute used a swimming pool type test reactor in 1983 to carry out heat-supply tests.

The reactor civil construction is now being stepped up at the Nankou construction site in Beijing. A three-story-high reactor safety shell has been moved to the site and is ready for installation. According to specialists of the Qinghua University Nuclear Energy Technology Institute, this 5MW low-temperature heat-supply prototype reactor will be completed and go into operation in 1988. Its construction will give China a complete test base for studying nuclear heat-supply technology.

Development of a low-temperature heat-supply reactor has been made a key project in the state's Seventh Five-Year Plan. The construction and operation of the 5MW low-temperature prototype heat-supply reactor will become the comprehensive test installation for promoting application of nuclear heat-supply technology developments. Harbin is planning to construct a 450 MW low-temperature heat-supply reactor to supply thermal energy to part of the city. This low-temperature heat-supply reactor proposal design is based on the 5MW prototype reactor and related technological, safety and economic test data will be obtained from the test process of the 5MW low-temperature heat-supply prototype reactor.

Specialists of the Nuclear Energy Technology Institute feel that the low-temperature heat-supply reactor is a structurally simple and inherently safe low-pressure reactor, has the advantages of technical practicality, low investment, and fast construction. As it not only can substitute for boiler supplied

heat, save on fossil fuels (such as coal and oil) reduce pollution, and reduce transportation bottlenecks, the economic and social benefits are obvious. From the viewpoint of China's present economic situation, however large the one-time investment in constructing low-temperature heat-supply reactors, this type of installation can bring obvious long-term benefits; in China, especially in the northern cities and oil fields, development of low-temperature heat-supply reactors have vast markets. Currently, in addition to Harbin, the Fuyu Oil Field is also in the process of studying the feasibility of constructing a low-temperature heat-supply reactor.

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## NEW TECHNOLOGY

### DEVELOPMENT OF CHINA'S GAS TURBINES CHRONICLED

Beijing HANGKONG ZHISHI [AEROSPACE KNOWLEDGE MAGAZINE] in Chinese No 2,  
Feb 87 pp 14-15

[Article by Tang Ding [2768 0002]]

[Text] Gas turbine is a highly efficient, advanced, and energy-conserving power plant. Since the 1950's, gas turbines have been used not only in aviation but also in other areas such as petroleum, electric power, motor vehicles and ships. Aviation gas turbines are considered the most advanced; their special features include: 1) high thermal efficiency, which results in fuel savings; 2) ability to use different types of fuel; 3) small in size, light weight, and easy to operate; 4) long life and high reliability; 5) low investment, high pay-off.

In the past, aviation gas turbines were primarily designed for military use. In recent years, under the guideline of military-civilian cooperation, gas turbines are increasingly being used on the ground, and efforts have been initiated to develop non-aviation gas turbines. After many years of dedicated hard work, breakthroughs in new technologies have been achieved, and applications in the non-aviation areas are expanding. A team of technical personnel devoted to gas turbine development has been formed and is constantly growing stronger. However, there also exist some major problems whose solution requires serious study and immediate attention.

#### Development of China's Light Gas Turbines

Since 1976, the Ministry of Aviation Industry has developed 5 different types and 11 different models of modified aviation gas turbines. Three different types and four different models are already in production; a total of 65 modified turbo-prop (TP) and turbo-shaft (TS) engines have been produced; they are used for oil field power generation, water injection, energy conservation, heat supply, fire extinguishing in coal mines, air-cushion boats, and for powering railroad cars. The year 1985 deserves special mention because significant achievements were made during that year, as summarized below.

A Combined System for Generating Heat and Electricity in Operation for the First Time. In 1985, the Li Ming Co. of Shenyang successfully developed the

TJ-6G gas turbine which uses natural gas as fuel for generating heat and electricity; it was later put into service at the Da Qing oil field. By January 1986, it had accumulated 8,917 hours of operation, generated 34.76 million kilowatt-hours of electricity, and produced 90,531 tons of steam. The operating efficiency is maintained at above 91 percent. At the product certification conference sponsored jointly by the Ministry of Aviation Industry and the Ministry of Petroleum Industry, it was agreed that this type of combined heat and electricity generator units are superior in terms of structural simplicity, operational reliability, and ease of maintenance. It is capable of not only conserving energy resources and increasing steam production, but also providing residential hot water; the total benefits on both the supply side and the demand side are estimated to be 4,003 yuan per year. After installing two generator units and two water pump units, the Da Qing oil field has signed a further agreement with the Li Ming Co. to purchase four such units; the Zhongyuan oil field has also signed an agreement to install new generator units.

Water Injection in Oil Fields. On the basis of the TS-6G design, the Jiangxi No 370 Factory developed an industrial gas turbine which uses natural gas as fuel. In April 1985, they began water injection tests at the Zhongyuan oil field; by the end of that year, they had accumulated 2,400 hours of operation, and the total amount of water injected exceeded 170,000 cubic meters. Based on an estimated saving of 10 kWh of electricity for each cubic meter of high-pressure water injected, the annual saving of electric power per generator unit is approximately 8 million kWh.

Use of Inert Gas Fire Extinguishers in Mine Pits. In a joint effort between the No 608 Bureau of the Ministry of Aviation Industry and the Wushun Coal Research Institute, the DQ-1000 inert gas fire extinguisher was successfully developed. It is based on the principle that by burning the exhaust gas from the TS-5 gas generator in the newly developed auxiliary combustion chamber, the oxygen content is reduced to less than 3 percent, and an inert gas is produced which can suppress combustion. The gas is then water-cooled to a temperature below 90°C and sprayed into the fire zone; by isolating the open fire from fresh air and sealing the fire zone, the fire can be readily extinguished. A positive evaluation of this unit was reached by the inspection committee organized jointly by the Ministry of Aviation Industry, the Ministry of Coal Industry, and the Coal Research Institute. On 27 December 1984, the unit was transferred to the Qingshan coal mine of the Pingxiang Bureau of Mines for underground simulation tests; the test results showed that this unit was stable in performance, met the fire extinguishing requirements, and was suitable for underground use.

New Breakthroughs in Burning Heavy Oil. The Nan Fang Power Machinery Co. has made new breakthroughs in testing a TP-6 gas turbine with a modified heavy-oil combustion chamber. Tests show that by using No 60 heavy oil in place of the No 20 mixed heavy oil, combustion actually improves in spite of the degradation in oil quality. Currently, the TP-6 heavy oil combustion experiment is proceeding at full speed; the plan is that by the first quarter of 1987, an integrated unit will be developed for further testing.

As a result of the work done during previous years, significant progress was made in several major areas last year. These included the following: modifying the WJ-6G2 into a power plant for air-cushioned landing craft; using the WS9G1 6,000-hp gas turbine for power generation; and developing the WS9G2 13,000-hp ship-borne gas turbine.

#### Expanding the Range of Application of Gas Turbine in China

To apply the mature technology of aviation gas turbine to the areas of transportation and energy exploration is an urgent problem facing us today. To achieve this goal we should take the following steps:

We should designate the work of developing modified aviation gas turbines as part of the national economic development plan, and allocate the necessary funds. Currently, due to the lack of a clearly defined leadership relation, there is no identified source of funds. The Ministry of Aviation Industry is forced to explore different means to raise funds, but it is difficult to satisfy the enormous needs of gas turbine development. If this situation is allowed to continue, China's development program will undoubtedly be affected, and foreign gas turbines will eventually take over the Chinese market. Therefore, we suggest that the national economic commission assume direct responsibility for the gas turbine development work, and for solving all the related problems. This will benefit both the military and the general public.

As in the case of civilian aircraft, the state should establish a policy to protect the gas turbine industry. In recent years, many organizations have imported gas turbines from other countries. According to preliminary statistics, between 1983 and 1985, China had purchased 22 gas turbines in 6 different models of the 10,000-kW class. On the one hand, importing these machines will benefit China's development and production; on the other hand, large number of imports will adversely affect or even suppress the domestic gas turbine industry. Furthermore, because of the lack of import control and a unified import policy, the importing organizations are completely uncoordinated. As a result, not only do we suffer economic losses from imports, but the variety of imported models will lead to problems in maintenance, repair and supply of spare parts. A comparative study has shown that domestic gas turbines produce higher economic benefits than imported units because the amount of investment and operating costs are lower, and significant amount of foreign exchange can be saved. For this reason, we suggest that as a measure to protect the growth of China's gas turbine industry, in the future we refrain from purchasing the gas turbine models which are being manufactured domestically. Also, the Ministry of Aviation Industry should be given authority to manage and control the importation of all gas turbine technologies and products from abroad.

We should also promote international and domestic cooperation, and establish lateral economic connections. In 1985, at an international gas turbine exhibit organized by this ministry, 34 different manufacturers from the United States, Great Britain, and France displayed a variety of different products. Such exhibits promote technical exchange and international friendship, hence we should continue to expand international contacts and encourage

international cooperation. There is currently a joint effort between the Ministry of Aviation Industry and a U.S. manufacturer to develop the FT8 30,000-hp gas turbine; we should use this as basis to develop a complete product line ranging from 600 hp to 30,000 hp. At the same time, we should also promote international cooperation in developing unit-level products such as regenerators and compressors for a regulating system, in order to enhance the competitiveness of domestic products.

We must also establish lateral connections within China and promote internal cooperation. Currently, there are 10 gas turbine production plants and 7 design institutes; 90 percent of the production capabilities are under the control of the Ministry of Aviation Industry, the remaining 10 percent are distributed among the Ministry of Machine Building, the Ship Building Co., and the Academy of Sciences. These technical resources including personnel and technical facilities should be united so that the potentials of individuals can be fully utilized to achieve breakthroughs in key technical problem areas. Also, funds should be properly allocated to accelerate the manufacturing of gas turbines in order to satisfy the needs of the petroleum, chemical, coal railroad and ship building industries, thus making further contributions to the national economy.

The State Planning Commission and the State Economic Commission have already approved a "Light Gas Turbine Development Center" to be established by the Ministry of Aviation Industry. But an intelligent decision on how to organize such a center is urgently needed so it can begin operation and provide its service to the industry as soon as possible.

3012/6091  
CSO: 4008/36

## POWER NETWORK

### SUCCESS OF EASTERN GRID IN GENERATING POWER DETAILED

Shanghai JIEFANG RIBAO in Chinese 23 Mar 87 p 1

[Article: "East China Grid Successful in Raising Funds To Generate Power"]

[Text] The east China grid has made great strides in raising funds to generate power. The funds raised by the grid last year alone surpassed the amount raised during the entire Sixth Five-Year Plan. In addition, according to the plan, this year's figure will be nearly twice as large. By the end of the Seventh Five-Year Plan, Jiangsu, Zhejiang, Anhui and Shanghai will have raised 5.7 million yuan, and will have 5 million kW in newly installed capacity. These figures are the equivalent of a 46.5 percent increase in installed capacity for the entire grid.

The east China grid began quite early to raise funds to generate power. In the early 1980's, the Taizhou power plant in Zhejiang, Jianbi in Jiangsu and Minxing in Shanghai first implemented the method of "whoever invests will receive a share of electricity and will share in the profits." They raised 386 million yuan for an installed capacity of 332,000 kW, and paved the way for localities to manage power operations. This has helped break through the 30-year-old traditional method of the state alone generating power and also avoids such disadvantages as the high cost for localities in managing power plants, high coal consumption, and difficult macroscopic management. In the Seventh Five-Year Plan, the state has already gathered great momentum in raising funds to generate power, and the size of power plants is getting larger and larger. Most of the 29 generators that Jiangsu, Zhejiang, Anhui, and Shanghai plan to put into operation during the Seventh Five-Year Plan will be large generators with a capacity greater than 200,000 kW. Energy-hungry Jiangsu Province will raise 2.4 billion yuan to build or expand large power plants at Jianbi, Yangzhou, Xinhai, Qishuyan, Ligang, Nantong and Yancheng, for a total of 12 generators and 2.4 million kW in installed capacity.

The east China grid also reports that last year it conserved 1.9 billion kWh in electricity, thereby exceeding state targets by 31 percent.

CSO: 4013/67



## POWER NETWORK

### STRATEGY FOR WEST-TO-EAST POWER TRANSMISSION OUTLINED STRESSED

Beijing GUANGMING RIBAO in Chinese 20 Mar 87 p 2

[Article by Senior Engineer Song Zemin [1345 3419 2404]: "The Transmission of Power From West to East Should be Addressed as Soon as possible"]

[Text] The shortage of energy is an acute problem in China's economic development. The distribution of coal and water resources in China is uneven. Fifty-five percent of the coal resources are concentrated in north China, mostly in Shanxi and Nei Monggol, and 21 percent are concentrated in the four provinces (regions) of Shaanxi, Gansu, Wingham, and Ningxia in the northwest region, but mostly in Shaanxi. Seventy percent of the water resources are concentrated in the southwestern region, mostly in Sichuan and Xizang. The economically developed region of China, however, is concentrated in the east coastal region where nationally the total value of industrial production of 15 provinces and municipalities in 1984 accounted for 71.2 percent of the total but the energy resources amounted to only 10 percent of the total. This is a big problem and the situation necessitated the shipping of coal from the north to the south and from the west to the east, and the transmission of electric power from the west to the east. The transmission of electric power from the west to the east is strategically important in the long run and significant in the short term.

With regard to the technical feasibility of power transmission from the west to the east, a few years ago it was believed that the technology of ac transmission was not yet in place and it could not be achieved. As for dc power transmission, there were concerns about the reliability of the current conversation stations. However, there have been major advances in the technology of dc power transmission in recent years and the reliability of transformer stations has been greatly improved. Moreover, the developments in silicon control has resulted in a factor of two reduction in the price of the silicon controlled switches, a major device for dc power transmission. Therefore, not only has the technical feasibility of DC power transmission been improved, the economic feasibility has also been improved.

The transmission of power from the west to the east can also cause some problems. For example, the electrical power from the major hydroelectric facilities in the west to be developed must be transmitted over 1200-1500

kilometers of transmission lines. These facilities, located in remote regions with complex geological environments, will have high capital construction costs. Another problem is the difficulty associated with the construction of large reservoirs. These problems can be addressed and solutions found step by step.

Recently, this author compared the "hydroelectric plan" of building seven major hydroelectric stations including those on the Jinsha Jiang, Yalong Jiang, and Dadu He and transmit the power produced to the eastern region of China, and the "thermal electric plan" which calls for the transportation of coal from northern Shanxi to thermal power plants in the east. In the hydro plan, the total investment to transmit 1000 kWh of electricity to eastern China is 3,587 yuan which includes 2,400 yuan on power generation equipment, 900 yuan for power transmission, 287 yuan for line losses. In the thermal plan, the total investment for transmitting 1000 kWh of electricity is 3,535 yuan including 1,781 yuan for thermal power plant investment, 555 yuan for coal mining and 1,199 yuan for railroad transportation. However, the operating cost for the hydro plan is 55 yuan per 1000 kWh, whereas the corresponding figure for the thermal plan is 225 yuan. The hydroelectric plan is not only superior to the thermal plan economically, but also expands the base of renewable resources, alleviates pressure on railway transportation, and reduces environmental pollution. The hydroelectric plan is obviously superior to the thermal electric plan.

We therefore recommend that the responsible departments assess the plan for transmitting power generated in west China to eastern China, so that the water resources in the west can be developed as soon as possible. This plan will speed up the process of providing electric power to the industrially developed region and contribute to the economic development of China.

9698/12851  
CSO: 4013/55

POWER NETWORK

XINJIANG CONFERENCE FOCUSES ON POWER SHORTAGES

HK300305 Urumqi Xinjiang Regional Service in Mandarin 1300 GMT 28 Mar 87

[Excerpts] A 4-day regional conference on electric power concluded today. The meeting proposed that the work this year must be centered on easing the power shortages, deepening the reforms, launching an extensive drive to increase production and practice economy and increase revenue and cut spending, opening up an electric power market, striving to generate and supply more power with fewer shortfalls, and making efforts to improve social and economic results.

The meeting pointed out that serious power shortages remain the main problem facing the region's electric power industry this year. Hence, the power industry must launch a major drive to increase production and practice economy and increase revenue and cut spending, actively open up an electric power market, and improve management over power consumption.

The meeting pointed out that speeding up capital construction in electric power is the fundamental way to resolve the contradiction of power shortage. This year we must speed up the construction of a number of key hydroelectric and thermal power stations and strive to put them into commission at an early date.

The meeting pointed out that this year the electric power enterprises must implement the plant manager responsibility system and the system of setting targets to be met during a manager's term of office, perfect and firm up various economic responsibility systems, deepen the enterprise reforms, and further invigorate the enterprises.

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CSO: 4013/59

## POWER NETWORK

### HUNAN ADDRESSES CHRONIC POWER SHORTAGE PROBLEMS

Changsha HUNAN RIBAO in Chinese 18 Feb 87 pp 1, 2

[Article: "Questions About the Current Energy Shortage; Responsible Persons of Provincial Economic Commission Answer Reporter's Questions"]

[Text] On 16 February a reporter of this paper interviewed a responsible comrade of the provincial economic commission concerning the problem of the current energy shortage.

[Question] What is the current energy shortage situation? What factors lead to the energy shortage?

[Answer] Currently the assigned load of the province-wide power network is only 1.27 million kW, which is over 200,000 kW less than in January, and the same period last year, and over 600,000 kW less than during the high water period. Since the electricity supply load has been greatly reduced, since the beginning of February only a few enterprises could carry on normal production, while the majority of industrial and mining enterprises are in a stop-and-go situation and the civilian use of electricity by both urban and rural households has also been seriously affected.

The basic reason behind the unusual shortage of electricity are abnormal weather and long-term drought. Since August 1986, the province has been without a soaking rain and winter temperatures were abnormally high, a rarely-seen situation. According to weather statistics, rainfall has been 40-50 percent less than in the same period last year, and the Xiang, Zi, Yuan, and Li rivers and Tongting Lake are lower than in the same period in previous years. Last year, in mid-February, our province began to enter the rainy season, but this year there has been no sign of rain. Because of long-term drought, since the middle of January, the water level at Fengtan, Shuangbei, Shatian, Ouyanghai, Centianhe, and agricultural and industrial power stations has dropped below the level of stagnant water and cannot generate electricity. Only the Zhexi hydroelectric power station has 2 m of safe water. The 1.2 million kW hydroelectric facilities of the province's electric power network now produce only 60,000 kW. To ease the province-wide shortage of electricity, thermal power plants are making every effort to operate all generators and are generating 930,000 kW of electricity. The Jinzhushan Power Plant, in particular, with the active cooperation and support of railway, communication, coal,

and petroleum departments has produced on the average over 430,000 kW of power since January, setting a record and making a major contribution for the province at this critical time. The Central China Power Grid has also provided us with 240-310,000 kW of power during this difficult time. In this way we have managed to maintain the current 1.27 million kW electric power supply load.

[Question] Can the current electric network supply be stabilized? When can the critical situation be alleviated?

[Answer] The Provincial Electric Power Bureau is currently organizing all employees to adopt a variety of measures, trying to find ways to stabilize output, and doing all they can so that power supply load will not be reduced again. However, it should be noted that since hydroelectricity no longer has any margin for regulation, thermoelectric power generators have been operating at full load for a long time and if the necessary inspection and repairs are delayed any longer there is the possibility of an accident stopping the generators or temporary cuts of electricity. If the drought continues and hydroelectricity cannot come back on line, there will be no way to alleviate the electric power shortage in the near term.

[Question] What measures must be taken in the current electric power shortage?

[Answer] First of all, we should intensify management of electric power usage and use electric power strictly according to the plan. Districts, departments, and enterprises should consider the overall situation and while ensuring the safe use of electric power, re-arrange production use of electricity in line with the electric power usage allocation norms. What I mean by ensuring the safe use of electric power primarily refers to ensuring the safety of equipment which cannot have its power supply shut off or production stopped, ensuring the safety of mines and essential communications, necessary urban municipal government and domestic uses of electricity, and electricity used by institutions of higher learning. Productive uses of electricity (including the use of electricity for production in chemical fertilizers, light industry, and textiles) must be selectively arranged in line with the principle of not exceeding allocation or excessive use. No unit is permitted to exceed the planned use of electricity in order to avoid overloads.

Second, mobilize society to economize on the use of electricity. A variety of measures for economizing on electricity usage should be established in productive uses of electricity so that the limited electric power will generate maximum benefit. We should vigorously cut down on non-productive usage of electricity and mobilize the masses to temporarily stop using such domestic electric appliances which use a lot of electricity, as air conditioners, electric water heaters, electric rice cookers, and electric woks.

Third, at all times we should prepare for both eventualities to keep outages down and delivery of electricity up. Currently, those units which are

ensuring electricity should stress time and energy to increase production and increase income and at the same time should ensure the safety of equipment which can cause accidents and power reductions; units which currently are not getting electricity should stress such tasks as necessary preparations as inspection and repair, delivery of raw materials to plants and employee education and training as well as making preparations for electricity to be delivered and production resume at any time.

8226/12851

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## POWER NETWORK

### GUANGDONG STEPS UP PACE OF ENERGY CONSTRUCTION

Guangzhou NANFANG RIBAO in Chinese 3 Feb 87 p 1

[Article by Kuang Ji [05620679]: "Accelerating the Pace of Energy Construction; Building Up the Staying Power of Economic Development"]

[Text] Since the Third Plenary Session of the Eleventh Party Central Committee, Guangdong has developed its economy at a rapid pace, as has the rest of the nation, while improving the people's standard of living at the same time. There have been sizeable increases in the quantity of items which use electricity, and a correspondingly sharp increase in the amount of electricity used. For a variety of reasons, Guangdong's electric power construction dropped below standard. In addition, for several years now an insufficient water supply has led to a decrease in the amount of hydroelectricity available. This has made our hydropower supply deficiencies a prominent problem, and has made the electricity shortage daily more serious. Incomplete statistics indicate that the present shortfall in supply requirements throughout the province may be as high as 6 to 7 billion KWH. The present facilities are capable of supplying only about 60 percent of requirements. Due to the severe shortage of electrical power, many plants which have been built cannot be put into production, or are only in partial production. This has prevented maximum benefit from investments, has meant that goods could not be paid for on schedule, and has affected the people's livelihood. The shortage has restricted more rapid development of Guangdong's economic construction and has become the most prominent weak link in the province's economic construction.

This grim state of affairs has led to our understanding that the building of electric power is the foundation for building the economy, as well as an important factor in the continued improvement and raising of the people's living standard. Because electric power is characterized by large investment and long construction time, it is essential that we give its development a higher priority than that for other industries, and that we prioritize the transmittal of energy to key projects. We should adopt "special policies and flexible measures," concentrating more financial and material resources on stepping up the pace of electric power construction. Only then will we satisfy and promote the development of those departments involved in the national economy. Only then will we be sure that our economic construction will have the reserve strength it needs for sustained development. Otherwise, if electrical construction is not moved up in priority, the development of other industries will be

directly affected, and vigorous development of the economy will be nothing but empty words.

Besides incomplete knowledge and planning errors, there were other factors which created Guangdong's electric power shortage, such as matters of system and policy. Therefore, to improve construction of electric power and fundamentally resolve Guangdong's shortage, it is necessary to adopt a policy of using electricity to provide electricity, stressing the following major reforms in our system of organization:

First, we should implement a policy of handling electricity through a single managed economy and multiple pooling of financial resources. Electric power is the type of commodity which requires special policies. It cannot be stored up, its generation, supply and use are all carried out in a twinkling, and its safety requirements are very stringent. All the world's nations handle electric power as a special industry and a special commodity, regulating it by special laws and regulations, and applying special management to it. For these reasons, Guangdong's electric power must be run under the unilateral management of the Guangdong Electric Power Department. In addition to amassing funds and building several key power plants, Guangdong, must also open up a variety of funding channels, adopt many fund-raising methods, and encourage many to become involved in electricity. At the same time, the province should formulate relevant preferential policies, attract enthusiasm and finances to the treatment of all aspects of electricity, determining who manages electricity and who benefits from it, so that many invest and many profit.

Second, we must put into effect floating prices for electricity. In determining price, the principle should be that enterprises involved in management of electric power will have those capabilities, both already acquired and in development, which make it an attractive investment. If the cost is profitable, the profits will be transformed into funding for electric power construction, using prices as a lever to further this construction.

Third, we should implement a policy of low taxation on electric power. This will increase the number of electrical power enterprises. We should also set up special funds earmarked for electric power construction, and thereby assure the expanded reproduction of funding needs.

Fourth, we should implement a goals and responsibilities contract system for managers of electric power in the Guangdong Electric Power Department. These will include the goals for electric power construction already determined for the Seventh Five-Year Plan, including scale of construction, newly installed capacity and generating capacity. These goals will be in the Provincial Electric Power Department's contracts, and will give electric power enterprises the power to act on their own initiative within the scope of contractual objectives.

In order to resolve Guangdong's electric power shortage, the provincial government has arranged for a buildup in electric power construction. The



total installed capacity of electric power going into production during the period of the Seventh Five-Year Plan will be 4,500 megawatts (MW). This means that during this same period we must build and put into full operation, large and medium-sized thermal generators of 2,500 MW and hydraulic turbines of 500 MW, which would equal the total capacity of the entire electric power construction for the entire province over the last 30 years. At the same time these power stations are being built, we also plan to build a power transmission network throughout the province. This would involve the new construction of more than 4,000 km of 110, 220, and 500 kilovolt-ampere transmission lines, and the new construction of 11 MW and 22 MW substations. By mid-1987, the Shajiao A Plant's No. 1 unit will join the power grid. The newly added installation for the entire year will be 1,000 MW. When this is achieved, the province's energy shortage will be eased somewhat.

Fundamental resolution of Guangdong's energy shortage requires not only a continuous link in the use of electricity, its rational use, and improvement in the output of currently existant power plants, but also requires that all future 5-year plans continually plan for a definite number of electric power construction projects, so that this construction will go on continuously, and move electric power, the "vanguard," truly into the forefront. The hope is that the leadership and masses of every locality, every industry, every enterprise through the province will conscientiously support and stress the handling of electricity, turning on the green light for electric power construction. At the same time the province will enthusiastically raise funds for the management of electricity and speed up Guangdong's development of electric power construction. This will cause the continual steady development of Guangdong's economic construction, and give a further boost to the people's standard of living.

12625/12851  
CSO: 4013/52

## POWER NETWORK

### USING 20KV VOLTAGE WOULD GREATLY ACCELERATE RURAL ELECTRIFICATION

Beijing DIANLI JISHU [ELECTRIC POWER] in Chinese No 12, 5 Dec 86 pp 66, 67

[Article by Sun Xihua [1327 6007 7520] of the Ministry of Water Resources and Electric Power]

[Text] On 14 October 1986, a rural electrification special committee of the Chinese Electrical Engineering Society convened in Huhhot for a symposium on the use of 20 kV distribution voltage for rural network electrification. The committee read out a 20-section treatise concerning grounds for, and economic analysis of, the rural electric network use of 20kV distribution voltage technology (Footnotes 1, 3, 4, 5). Pingyu County in Henan Province gave a detailed introduction to a program on the use of 20 kV distribution system for that county (Footnote 2). After earnest discussion, the participants generally considered that the use in the rural network of the three level mode of voltage supply, 110/20/0.4kV, compared to the currently used 110/35/10/0.4kV four level mode of voltage supply, no matter whether speaking of the waste of its deficiencies, the increased transport power, or subterranean construction costs, the economic benefit of the former is clearly superior to that of the latter.

#### I. China's rural electric network is rapidly developing

Along with the vigorous rise of village and town enterprises, China's rural electric utilities have undergone very fast development in recent years. The rural electric usage rate of increase has all along been higher than the national average and has suddenly increased (the annual rate of increase is greater than 8.9 percent). In 1985, the nation's rural electric usage had reached 105.2 billion kWh, corresponding to 30 percent of the national electric usage; the nation's more than 2000 counties were by and large all electrified; throughout the country, there were approximately 1.5 to 1.6 million miles of rural electric distribution lines; the capacity of distribution transformers had reached 120 million kVA. Even though the rate of development cannot be considered slow, China's rural electric usage still has several outstanding problems. The main ones are:

1. The coverage of rural electric lines is still not universal; the nation still has 37 percent of its rural households without electricity. These areas

not able to use electricity are mostly impoverished areas classified as "old, lacking, and peripheral." Thus, the task of universal electric usage is still very formidable.

2. In the areas already having electricity, due to irrational planning in which distribution lines often have electricity that cannot be used. Also important is that in areas of low load density, the range of electric supply cannot be expanded due to low voltage distribution and the distribution transformers take a long time in moving a low load.

3. The present rural electric distribution system not only distributes low voltage and has many levels of voltage change, but also in its initial construction wantonly chose some mismatched or high energy utilizing equipment. Thus, regarding the network losses of the rural electric network, particularly high losses for low voltage networks below 10kV, the national rural network losses reached an average of 15.7 percent, nearly twice the network loss for thermal power.

In view of the above problems, the leading electric departments practically each year advance measures to "overhaul and reorganize low voltage networks and strengthen the rural electric network program." But it is difficult to be successful all at one time. To solve the above problems, the key measure is to raise the distribution voltage of the rural electric network and also to progressively diminish, and even eliminate, the 35 kV level of voltage change. As everyone knows, the line voltage loss is inversely proportional to the voltage at the starting point, and the line power loss is inversely proportional to the square of the distance. Thus, when the distribution voltage is raised from 10kV to 20kV, the distance over which the voltage can be sent is increased 72-92 percent, the area covered can be increased 3-4 times, and the distribution network loss is only one-half that of a 10kV network.

II. Raising the distribution voltage of the rural electric network is an inevitable trend

Along with the increasing expansion of the rural electric network and the continual increase in average electric usage, raising the distribution voltage is an inevitable trend and also the successful experience of the developed nations of the industrialized world. From the historical system of development of the electric power industry, the principle from the beginning was mainly to consider the local level, not to bring up the task of regional long distance transmission. Later, following the increase in generator capacity, local power plants emerged, and progressively became local power networks. The voltage level gradually became equivalent with the distribution voltages of 2.3, 3.3 and 6.6kV raising to 10kV. But considering a large area rural electric network which also has a very dispersed usage load, the use of the 10kV distribution voltage was from the beginning not rational. Following the development of rural enterprises, the rural electric usage increased, causing some 10kV distribution lines to extend without limit. Often, a 10kV distribution line's transmitting distance reached more than 20-30 km. Thus, the

interconnecting load was limited to a very low level. Also, in certain developed area of electric usage, one county often had to construct 30 (in the case of Dalian) or 40 (in the case of Changzhou) 35kV or 66kV rural transformers, with more than 10 power lines, and they still must take measures to increase and expand. A change to 20kV distribution voltage would increase the transmitting distance and the number of 35kV grade transforming facilities can be greatly reduced. Today, the developed industrialized nations of Europe, the U.S., and Japan are taking steps to raise the urban distribution voltage to 20kV or 33kV. Also, the Soviet Union, which originally had a voltage level base equivalent to that of China, is now establishing 20kV distribution systems in their European sections.

### III. The Pingyu County program merits attention

From the example of the Pingyu County program it can be seen that if a 110/20kV voltage supply is used in place of a 110/35/10kV voltage supply, the former is superior to the latter by far. Pingyu County, Henan Province, has an area of 1,282km<sup>2</sup>, a population of 570,000, a per capital income of 159 yuan, and is one of the impoverished counties in the province. The yearly electric supply is 24.79 million kWh, the highest load is 5,900 kW. Of the 18 towns in the county, 16 have electricity, but the peasant households which use electricity number only 12 percent of the total households. The load density is 4.6 kW/km<sup>2</sup>. Electric usage is 35 kWh per person per year. It is also a country of relatively low level electric usage. The investment for construction for transforming the 110/35/10kV and the 110/20kV distribution voltage schemes and the annual transport costs are compared in the accompanying table.

Comparison table of construction, transforming investment and annual transport costs (Footnote 2)

<u>Item</u>	<u>1980</u>		<u>2000</u>	
	<u>I</u>	<u>II</u>	<u>I</u>	<u>II</u>
Two Schemes	110/35/10	110/20	110/35/10	110/20
Construction and transforming investment	807	869	790	617
Annual transport costs	109.6	82.4	135.5	74.8
Investment recovery period; profit	2.3 years		6,70,000 yuan	

Due to the increase in the cost of transforming the 35kV and 10kV voltage systems, the transforming investment cost for Scheme II during the Seventh 5-Year Plan is as high as that of Scheme I. By the year 2000, newly developed

20kV distribution systems will have an investment savings of 1.73 million yuan compared to systems still using the 35/10kV two level voltage distribution system.

IV. Rural electric networks which adopt the 110/20kV direct distribution mode have clear superiority

Rural electric networks which adopt the superiority of the 110/20kV direct distribution eliminate their link with 35kV single level voltage transmission, save the 35kV investment costs, and diminish the 35/10kV transformer losses. Taking the Henan Province rural electric network as an example, the 110kV network losses are 2.5-5 percent; the 35kV and 10kV network losses are 13-18 percent. Changing to the use of 20kV direct distribution mode could reduce the network losses to 8-10 percent. In this way, it is possible to reduce the demand placed on the hydroelectric portion of the rural electric companies by the rural electric network losses to a level less than 12 percent. The symposium also inquired into the transformation of the 10kV voltage system and the supply and construction costs of 20kV distribution facilities. Everyone felt that this 20kV single level distribution voltage, whether in terms of transmission lines or transformer equipment, could make improvements on the 10kV voltage level bases. This could easily be accomplished, let alone that right now is just the time for the rural electric departments to set about changing from high energy consuming transformers and consider the possibility of changing the distribution transformers to a voltage of 20kV, or, at least, for sections of newly constructed transmission lines, connect to the 20kV supply line. In this way, early benefit for early investment can be achieved or the same investment can result in greater benefit.

#### FOOTNOTES

1. Opinions on China's rural electric network supply mode, special meeting on national rural electrification (1984.9)
2. Research report on the feasibility of 110/20kV electric network in Pingyu County, Henan Province; Cai Shen [5591 3234], Yuan Hefeng [0626 3109 1496], et al.
3. Simplified voltage levels, reducing substations administrative levels, and increasing the electric supply radius are the basic ways to reform China's electric network; Tan Wenhua [6151 2429 5478], Xu Jiawei [6079 1367 5588], et al.
4. The combined superiority of the change to 110/20/0.4kV voltage as a rational distribution voltage for the rural electric network; Wang Xiangyun [3769 3276 0061].
5. Combined safety, economics and long range transmission of distribution voltage levels; Dalian Rural Electric Department, Cai Ruowu [5591 5387 0710].

13226/12851  
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## POWER NETWORK

### BRIEFS

WORSENING SICHUAN POWER SHORTAGE--Vice-Governor Ma Lin answered reporters' questions about why Sichuan Province has been experiencing severe power shortages. He pointed out that Sichuan's power situation has always been a bit tenuous, and that things recently have just gotten worse. One reason for this is that during the 6th FYP, only a small amount of power generating equipment was put into service, and this new capacity came far from meeting the demands of Sichuan's burgeoning economic development. In addition, since the power from Gansu Province's Bikou power plant, most of which Sichuan was to have received, has been diverted to the northwest grid, not only has there not been an increase in power, but the output has been reduced by 30,000 kW. Sichuan's power supply can now supply only 50 to 60 percent of production needs. The second reason for the power shortage is the effect of the drought on hydropower. Hydropower capacity has decreased every year for the past few years. Third, thermal power equipment has been getting old and cannot be used at full capacity. Fourth, Sichuan's capability for purchasing power from the northwest grid and Guizhou grid has decreased in the past few years. Additionally, some of the natural gas originally intended for power generation has been allocated to fertilizer production. Enterprises in some areas have exceeded their power supply so egregiously that shutdowns and power outages have increased continuously. [Summary] [Chengdu SICHUAN RIBAO in Chinese 19 Mar 87 p 1] /9738

SHANXI OUTPUT GROWS--Shanxi Province generated 6.476 billion kilowatt-hours during the first quarter, an increase of 26.53 percent over the same period last year. Income from power supply rose by 31 million yuan. [Summary] [Taiyuan Shanxi Provincial Service in Mandarin 2200 GMT 16 Apr 87 HK] /8309

XICHANG SUBSTATION OPERATIONAL--13 Mar--Following a 24-hour test period, the Ma'anshan No. 1 substation in Xichang City became operational, allowing electricity to flow via the Southwest 220kV high-tension power line. The Southwest transformer project is a major construction project for Sichuan Province in the first year of the Seventh Five-Year Plan. The project consists of a single power line running from the Nanyahe power plant in Shimian County to the Xichang City transmission line and the Ma'anshan transformer station. The line can supply surplus electricity to the provincial grid--up to 1.2 million kilowatt-hours a day--to greatly alleviate the chronic power shortage experienced by our province. [Excerpt] [Chengdu SICHUAN RIBAO in Chinese 19 Mar 87 p 1] /9738

CSO: 4013/56

## HYDROPOWER

### STATE COUNCIL APPROVES ANOTHER BIG HUANG HE PROJECT

Zhengzhou HENAN RIBAO in Chinese 5 Mar 87 p 1

[Article by Deng Xiushen [6772 0208 6500] and Zheng Xiuyun [6774 4423 0061]]

[Excerpts] The State Council recently approved the "Design Plan of the Huang He Xiaolangdi Hydroelectric Project" and the project will begin in the 7th FYP.

Xiaolangdi is located 40 kilometers from Luoyang on the main course of the Huang He in Mengjin County in Henan Province. The controlled area of the river above the dam site is 694,000 square kilometers, or 92 percent of the total Huang He river valley area. The total reservoir volume will be 12.65 billion cubic meters, the long-term effective reservoir volume will be 5 billion cubic meters, and the project will be a key construction for controlling silt in the lower reaches of the Huang He. The project is designed to prevent flood and to reduce silting, but will also provide water for irrigation and power generation. It will have the following benefits when it is completed:

1. It will reduce the frequency of major floods in the lower reaches of the Huang He from once every 100 years to once every 1000 years. The reservoir will prevent major floods, protecting 1.25 million people and 2.42 million mu of farmland from flooding. It will also prevent major losses to the Zhongyuan oil fields. For extraordinarily large floods, the Xiaolangdi dam will work with the Sanmenxia reservoir to regulate and store the water so that the lower reaches of the Huang He can be free from the threat of floods.
2. It is expected that 10 billion tons of silt can be stopped and the downstream build-up will be reduced by 7.7 billion tons. This will save two to three height increases to the big dikes over a period of 20 years.
3. The water supply will be increased by 4 billion cubic meters per year. This will not only benefit industrial water users in the cities along the river but also irrigation water users during the low-water season. Water may also be supplied to Beijing, Tianjin, and Qingdao.
4. The hydroelectric station will have six generators with a total capacity of 1.56 million kilowatts and a annual power production of 5 to 6 billion kilowatt-hours. It will be the largest hydroelectric power station in Henan

and it will play the role of peak regulation in the Henan power grid in central China and improve the conditions under which the thermal power stations operate.

In 1986 the State Planning Commission commissioned the China International Consulting Company to organize more than 50 experts for a full-scale evaluation of the Xiaolangdi hydroelectric project design.

Today, designing departments of the Huang He Committee are working hard to propose a preliminary engineering plan by the end of this year.

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HYDROPOWER

WAY CLEARED TO BEGIN WORK ON MAIN PART OF SHUIKOU

Fuzhou FUJIAN RIBAO in Chinese 5 Jan 87 p 1

[Report by Liu Yi [0491 3015] and Liu Lunan [0491 7627 0589]; "Order To Commence Work on Shuikou Power Station Project Officially Issued; Huatian Joint Operations Group Will Occupy Site"]

[Text] The order to begin construction of the main part of the Shuikou Hydroelectric Power Station principal project was officially issued from the Meicheng guesthouse in Minqing County, and location of the project, on 29 November [1986]. At 10 a.m., Ma Zhongheng [7456 6988 3801], senior engineer at the Shuikou Hydroelectric Power Station Project Construction Company, was authorized by the provincial power authorities, to represent the engineering unit at the Shuikou power station in officially issuing the project commencement order to the Huatian Joint Operations Group, lone winner, and lowest bidder, in a competition among 10 firms. The Huatian Joint Operations Group, which is composed of the association of the No 12 Engineering Bureau of the Ministry of Water Resources and Electric Power, the Min Jiang Office of Engineering, the No 4, Engineering Bureau, and the Japanese Maeda Construction Company, sent the Shuikou project manager Toshiyuki Horiuchi (Japanese side) to the meeting to accept the project commencement order.

Beginning on 9 August last year, the Shuizhang highway of the first phase of the Shuikou Hydroelectric Power Station project was diverted and preparations for construction got off to a good start. Now after 17 months, the first stage of the project is in complete accordance with the provisions of the international bids on the principal part of the project. In all, projects that have been completed include the transmission and transformer equipment for the construction project, the Shuizhang highway, and the freight yard, and housing is also being completed. Other first-phase construction projects under way include a large construction bridge, the Anrenxi road bridge, and the temporary dam site railway, special lines to freight yards which will be turned over for use as required by the progress of the principal part of the project. Today, the groundwork has been laid to begin the principal part of the Shuikou Hydroelectric Power Station project.

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CSO: 4013/45

## HYDROPOWER

### SHUIKOU PROJECT SLATED FOR COMPLETION IN EARLY 1995

Fuzhou FUJIAN RIBAO in Chinese 10 Mar 87 p 1

[Text] Located in Minqing County, on the main stream of the Min Jiang, the Shuikou hydropower station will impound water with a surface area of 52,438 square kilometers. According to the experts, geologically speaking, the dam site for the Shuiko hydroelectric power station is one of the best in China.

Primarily designed for the generation of electricity, this hydropower station will also improve navigation, log rafting, irrigation, etc. The station will have a total installed capacity of 1.4 million kilowatts with a guaranteed output capacity of 260,000 kilowatts. Average yearly output will be 4.95 billion kilowatt-hours. The reservoir will have a capacity of 2.6 billion cubic meters, enough for partial seasonal regulation. The upper end of the reservoir will increase the navigable portion of the river by almost 100 kilometers so that 500-ton vessels can sail all the way from Nanping to Fuzhou. After completion, the electricity generated by the station will be transmitted to Fujian and the East China Grid.

According to the engineering plans, the Shuikou key water conservancy project consists of the dam itself, the powerhouse, ship locks, switching yard, and log chutes. The flood diversion tunnel, ship locks, and log chutes are all situated on the right bank while the powerhouse is located on the left and below the dam. The 220kV and 500kV switching yard is located on a slope below the powerhouse. The dam is of the concrete gravity type.

Seven axial-flow turbine generators will be installed in the powerhouse, each with a capacity of 200,000 kilowatts. The main buildings are positioned below the dam while the auxiliary structures are located above and below the main buildings; a control center for the hydropower station will also be set up.

According to the provisions of the construction contracts for Shuikou, which is being built with the assistance of World Bank loans, the Huatian Management Group was to have entered the site in mid-January 1987 to begin work; the work to reroute the Waiyang-Fuzhou railway will be completed and the line open to traffic in early November 1989; the dam will begin to impound water in March 1993 and on 31 May of that year the No. 1 generator will start producing electricity; all of the civil engineering projects are to be completed by 31 March 1994; the last generator will be completely installed and go on stream on 1 March 1995. The total construction time will be 8 years, 3 months.

## HYDROPOWER

### BIG PUMPED-STORAGE STATION TO BE BUILT IN GUANGDONG

Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 22 Apr 87 p 1

[Text] The Ministry of Water Resources and Electric Power, the Ministry of Nuclear Industry, and the Guangdong Provincial People's Government have recently decided to prepare to construct the Guangzhou pumped-storage hydropower station. The power station will be built in the Lutian District of Conghua County in Guangdong Province.

A pumped-storage power station takes advantage of the load "valleys" in electric power systems to pump water from a lower reservoir to a higher one. When there is a "peak" in the power load, some of this water is released to generate electricity. In this manner the peaks and valleys in an electric power system may be regulated, thus satisfying consumers' demands.

The first stage of construction on the Guangzhou pumped-storage power station will call for the installation of four 300,000-kilowatt generators for a total installed capacity of 1.2 million kilowatts. The generators will be of the reversible type. This power station will go on stream the same time as the Daya Bay nuclear power plant.

/8309

CSO: 4013/60

HYDROPOWER

YUNNAN ACCELERATES WORK ON TWO MAJOR STATIONS

OW011556 Beijing XINHUA in English 1540 GMT 1 Mar 87

[Text] Kunming, 1 Mar (XINHUA)--Yunnan Province is speeding up the construction of two hydropower stations commissioned to supply other provinces in 4 or 5 years, officials here said today.

The Lubuge station on the border of this province and Guizhou Province will eventually have a generating capacity of 600,000 kW. It is the first built in China with World Bank loans and its first generating unit should be put into production by the end of 1988.

The Manwan station with a generating capacity of 1.5 million kW is the second largest in China. Its building began 1 May 1986, and the first generating unit there will be put into operation by the end of 1991.

When the stations are put into production, Yunnan will double its present generating capacity to become a major hydroelectric power base, able to supply 17 billion kWh of electricity a year to industrial regions in south China, the officials said.

/8309

CSO: 4010/35

HYDROPOWER

MORE BANK LOANS FOR SMALL-SCALE OPERATIONS

OWL71330 Beijing XINHUA in English 1258 GMT 17 Mar 87

[Text] Beijing, 17 Mar (XINHUA)—The Agricultural Bank of China has promised to provide an additional loan of 80 million yuan (21 million U.S. dollars) to support local townships and rural industries in their efforts to build small hydroelectric power stations.

An official from the loan section of the bank told XINHUA that the new loan is in addition to the planned 200 million yuan in loans already allocated.

This is part of the effort to encourage rural industries and townships to build their own power plants to ease power shortages, the official said.

"The small hydropower stations, usually less than 5,000 kW in generating capacity, will have a significant social effect," the official said. "The construction of such power stations is exempt from taxation and the terms of the loans are favorable."

The new power stations will go a long way to ease the power shortage facing rural industries, which is acute and has driven local rural industries to use diesel generators to produce electricity, which is far more costly.

According to the official, 16 small hydroelectric power projects in Shanxi, Henan, Hunan, Shandong and other provinces have obtained loans from the Agricultural Bank.

/9274  
CSO: 4010/38

## HYDROPOWER

### BRIEFS

**TIANSHENGQIAO PASSES INSPECTION**--The Tianshengqiao hydropower station, which was designed by the Kunming Survey and Design Academy of the Ministry of Water Resources and Electric Power [MWREP] and which is a key state construction project of the Seventh 5-Year Plan, passed a preliminary design review on 26 February on site by the State Planning Commission and the Planning and Design Institute of the MWREP. Concerned departments from Yunnan, Guizhou and Guangxi participated in the examination. The Tianshengqiao hydropower station is the first of the cascade hydropower stations on the Hongshui He. Construction will mainly be in Longlin County, Guangxi Province, and Xingyi County in Guizhou and is 62 km downstream from the Lubuge hydropower station. Tianshengqiao will have an installed capacity of 1.3 million kW and will produce 5.38 billion kWh per year. The dam is 180 meters tall, the tallest of its type in the world. The reservoir has a capacity of 10.88 billion cubic meters. Tianshengqiao's power will be transmitted to Guizhou and southern China. [Text] [Kunming YUNNAN RIBAO in Chinese 2 Mar 87 p 1] /9274

CSO: 4013/65

## THERMAL POWER

### WORK ACCELERATED ON BIG PINGYU PIT-MOUTH PLANT

Hefei ANHUI HUABAO in Chinese No 1, 1987

[Excerpts] The Pingyu power plant, a large-scale thermal power facility, is a major construction project for Anhui Province during the Seventh 5-Year Plan and is listed by the State Council as an important technological undertaking.

Pingyu is a 2.4 million kilowatt power plant covering an area of more than 1,700 mu. The already approved first stage is a 1.2 million kilowatt project using imported U.S. technology and Chinese-manufactured 600,000-kilowatt generators, the largest such generators now being made in China; the estimated budget is 2.09 billion yuan. Construction of the Pingyu power plant began on 25 September 1984. According to the plan, "debugging" of the No 1 generator set will begin in the first quarter of 1988. To date, a sum of more than 90 million yuan has been spent and more than 1.1 million cubic meters of earth excavated; 140,000 cubic meters of [concrete] have been poured and over 28,000 tons of steel used. The foundations for the main buildings, boilers, and steam turbine generators have already been poured, and two 210-meter-high stacks completed. The 80-meter-high, 5,000-ton boiler frames have been assembled, and all parts that will be subjected to heat are now being installed. Work on other projects, such as the turbine equipment, the feedwater and coal conveying systems, the steel structure of the main plant buildings, the control room and the electric dust scrubbers, is being accelerated.

The Pingyu power plant is just 17 kilometers from the huge Huainan Panji coal mine, which has only recently gone into production. The first phase of the power plant will supply close to 8 billion kilowatt-hours of electricity a year which will be fed into the East China Grid via 500kv high-tension power lines. This power will ease the shortage in the East China region and give a boost to Anhui's economy.

The Pingyu power plant is a construction project with strategic significance. The experience gained in its designing, building, and operation will be of great value when China builds large-scale thermal power plants in the 1990's.

/9274

CSO: 4013/58

THERMAL POWER

SHAJIAO-B POWER PLANT LIGHTS OFF ITS NO. 1 BOILER

Guangzhou NANFANG RIBAO in Chinese 16 Mar 87 p 1

[Summary] On 15 March, the Shajiao-B power plant in Shenzhen, China's first thermal power plant to be built as a joint Chinese-foreign cooperative effort, activated its No. 1 boiler. The "lighting-off" ceremony was attended by, among others, the director of the China Water Conservancy and Electric Power Construction Company, Zhao Qingfu, the deputy head of the capital construction department of the Ministry of Water Resources and Electric Power, and Sato, head of the business section of Japan's Ishikawajima-Harima Heavy Industries.

The Shajiao-B power plant represents a joint undertaking by the Shenzhen Electric Power Development Corporation and a dozen or so domestic and foreign construction and installation companies. Total investment is 3.2 billion yuan. Two 360,000-kilowatt turbine generator units are to be installed with complete sets of equipment being supplied by the Japanese. Work began on this plant in July 1985 and the generators will be on stream by June of 1987--an installation speed as fast as anywhere in the world.

The Shajiao-B power plant will have a yearly output of 3.8 billion kilowatt-hours, or 8 times the power consumption of the Shenzhen area today.

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CSO: 4013/54



## THERMAL POWER

### DAWUKOU POWER PLANT TO BOOST NORTHWEST GRID

Yinchuan NINGXIA RIBAO in Chinese 13 Jan 87 p 4

[Excerpt] At 5:50 on 15 December 1986, Wan Haigen [5502 3189 2704], vice chairman of the switch-on committee and on-site director of the Dawukou power plant, gave the order to put the No 3 unit in operation. Instantly the turbogenerator started to roar. Instrument needles went straight up. And a powerful electric current flowed into the northwest power grid. The tired faces of control room workers broke into smiles.

They should be happy and proud for their outstanding achievements. Two 100,000-kW generating units were put into operation within 1 year. It was an unprecedented feat in the history of power construction in the northwest, a seldom seen achievement in the whole country, and the only success of its kind in 1986. It shows that power construction in this region has moved on to a higher level.

What's the meaning of putting two units into operation in 1 year? What social significance does it have? Wang Xu [3769 2485], controller of the power plant construction command and deputy chief engineer of the Ningxia Power Construction Co, explained for us in simple mathematical terms. He said that normally it takes 2 years to install two 100,000-kW generating units, but they did it in only 1 year. By putting two units into operations ahead of schedule, they could gain at least 5,000 hours of effective running time and produce about 500 million kWh more electric power, which, going into the northwest power grid to support industrial and agricultural production, could produce more than 1 billion yuan in social benefits. The completion of the two units at the Dawukou power plant not only produces significant economic results, but, more important, meets a pressing need of the people in the northwest. On 15 October 1986, the Longyangxia hydroelectric power station closed its sluice gates to store water, and the Huang He was virtually cut off. The generating units at Liujiaxia, Bapanxia, Yanguoxia, and Qingtongxia stopped running, and the northwest grid had a serious power shortage. Many factories were forced to stop production. Residents in many cities had to use candles for lighting. When Dawukou's powerful 200,000-kW electric current flowed into the northwest grid, the power shortage was alleviated. With this 200,000 kW, 144 of the large factories requiring 1 million kWh of power a month can resume production, and 7.08 million households consuming 50 kWh of electricity a month can turn on their lights again. Of course, the most benefited is Ningxia. Despite the closing of the sluice gates at Longyangxia, Ningxia has experienced no power shortage, and no effect has been felt by industries and households in urban and rural areas.

## THERMAL POWER

### SICHUAN PURSUES AMBITIOUS THERMAL POWER CONSTRUCTION PROGRAM

Chengdu SICHUAN RIBAO in Chinese 30 Mar 87 p 2

[Excerpt] Sichuan is exceptionally rich in hydropower resources and its development of these resources has been fairly rapid. But more than 90 percent of the local facilities are flow-through, small-scale stations and there is a shortage of power during the low water season. In order to correct this situation, in recent years thermal power construction has been promoted in those areas with abundant coal resources.

According to the figures, there are now 20 thermal power projects in the initial phase of construction with an installed capacity of 258,000 kilowatts. The provincial electric power planning departments handling these projects are also promptly reviewing and approving preliminary plans as quickly as possible. Eight small-scale hydro and thermal projects have already been approved for a total of 120,000 kilowatts [installed capacity]. Next, the number of thermal power plant construction projects is growing, and the scale of these projects is larger. Among the power plants (heat/power) now under construction are the Xuanhan, Kaijiang, Linshui, Xingwen, and Leshan plants for a total installed capacity of 96,000 kilowatts, representing 31 percent of the province's generators with single unit capacities of 500 kilowatts and above. This corresponding to a 1.5-fold increase in installed capacity over 1985. The single-unit capacity is also growing larger, now commonly between 6000 and 12,000 kilowatts. Finally, there has been a surge in new construction. This year, in 11 counties, including Rong Xian, Peng Xian, Shifang Xian, and Gong Xian, 22 generators are being installed in small-scale thermal power plants for a total of 177,000 kilowatts.

CSO: 4013/69

## THERMAL POWER

### BRIEFS

JILIN 2400MW PLANT--A huge thermal power plant will be built in Shuangliao County. The first phase of construction calls for the installation of 1200MW and when completed, the total installed capacity will be 2.4 million kilowatts, 900,000 kilowatts more than the current largest power plant in Jilin Province. Construction of this plant will formally begin in 1989 and it will become operational during the period of the Eighth Five-Year Plan. Initial feasibility studies have been examined and approved and hydrogeological surveys are now being conducted and pre-construction preparatory work is also under way. [Text] [Changchun JILIN RIBAO in Chinese 16 Mar 87 p 1] /9738

JIANGYOU EXPANSION PROJECT--On 5 March, bidding was opened on the project to expand the Jiangyou power plant, a major energy construction item for Sichuan Province. Six construction outfits, including units from Henan, the north-east, Sichuan, and the State Construction Corporation, joined in the heated bidding. The expansion project calls for the installation of two 330,000-kilowatt thermal generators imported from France. These generator sets represent advanced levels of the 1980's and are the first China has imported from a foreign country; they are the largest thermal generators in China today. After the completion of this project, the power shortage in Sichuan Province will be considerably relieved. [Excerpts] [Chengdu SICHUAN RIBAO in Chinese 10 Mar 87 p 1] /9274

CSO: 4013/58

COAL

COAL EXPORTS TO INCREASE 62 PERCENT IN 1987

OWO30318 Beijing XINHUA in English 0207 GMT 3 Mar 87

[Excerpts] Beijing, 3 March (XINHUA)--China will export 16 million tons of coal this year, up 62 percent from last year, according to the overseas edition of today's PEOPLE'S DAILY.

The paper quoted Zhou Shanxun, a leading official of the China National Coal Import and Export Corporation, as saying that China will also launch a drive to export coal mining equipment this year.

Zhou said, "quite a few Chinese-built coal mining machines have met advanced international standards, but they are now used mainly to replace outdated Chinese equipment rather than for export."

As coal mines in China usually involve complex geological structures, China's coal mining technology and equipment are advanced and its underground mining technology is "superior to that of developed countries."

According to Zhou, China mined 852 million tons of coal in 1986, making it the second largest coal producer in the world.

/12232

CSO: 4010/39

COAL

NATION'S VERIFIED RESERVES GROW BY 8.3 BILLION TONS

Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 13 Apr 87 p 4

[Text] China's coal field geological exploration work is producing tremendous results. According to the latest figures, in 1986, some 8.36 billion tons in new reserves were verified, 5.36 billion tons of which are recoverable.

ZHONGGUO MEITAN BAO [CHINA COAL NEWS] reports that in 1986 in the strip running from Juye to Yuncheng in Shandong Province, a huge field of coking coal was discovered with estimated reserves of 5 billion tons.

In the strip running from Fengtai to Yingshang south of the Panxie mining district in Huainan, Anhui Province, new coal reserves have been discovered with estimated reserves of 2 billion tons. The Xiacang mines of Tianjin estimate that they have some 270 million tons of recoverable reserves.

In addition, progress has been made in the exploration of deep and peripheral sections of old mining districts. Five hundred million tons in verified reserves have been found in the Shizui Shan mining district in Ningxia Province, and a new field with 128 million tons in reserves has been verified in the Fengcheng mining district in Jiangxi Province, the largest such reserves found in the region in the past few years.

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CSO: 4013/60

## COAL

### PROGRESS BEING MADE IN COMPREHENSIVE USE OF COAL

Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 10 Mar 87 p 3

[Article by Liu Xiaojie [0491 2556 2212]: "China Progressing in Comprehensive Use of Coal; 430 Million KWH Produced Last Year From Coal Waste"]

[Text] The work of increasing production while practicing economy is being seriously developed in China's coal industry, through the comprehensive use of coal waste, bone coal and coal intergrowth. These, plus associated mineral product resources, have led to notable economic benefits.

The coal industry annually discards 100 million tons of coal waste, and a total of 1.3 billion tons have now been stockpiled. This has become a major problem, in that besides taking up a large amount of farmland, it pollutes the environment as well. In recent years, the coal industry has been using waste which has a calorific capacity of more than 1,000 kilocalories per kilogram in boilers for electric power generation. Waste with a capacity of less than that is used to make brick and cement. Today, 136 concentrated heat-supplying projects have been built, along with 12 coal waste electric power plants, 200 waste brickyards, and 100 bone coal cement plants. In 1986, waste was used to produce 430 million kilowatt-hours of power, and in the manufacture of 1.4 billion bricks and 1.7 million tons of cement. Noteworthy results have also been obtained in the use of high sulfur coal waste. Ten sulfuric iron reclamation facilities have also been constructed, which last year recovered 150,000 tons of sulfuric refined sand.

Through the comprehensive use of energy sources, the coal industry's work of increasing production while practicing economy has spread from the single activity of "producing coal" to a wider sphere. There has been particular progress made in the comprehensive development of coal-associated, mineral-intergrowth energy sources--"the one vanadium, the two stones, the three earths and the four charcoals" (that is, vanadium pentoxide, granite and marble; bentonite, kaolinite and fire-resistant clay; activated carbon, coke, peat and carbon black). In the past year, exports of products made with vanadium pentoxide, coke, and fire-resistant clay, have earned US\$6 million. In order to supplement this foreign trade pattern, an aluminum-vanadium plant and a granite processing plant will be constructed.

This year, the principle items on the coal industry's comprehensive resource use agenda are: to develop new products for export; make progress in extending the use of coal waste for electric power stations; build a million-ton bone coal cement plant; and come to grips with the key problems of sulphide combustibles and vanadium multi-level baking derived from bone coal.

12625/12851  
CSO: 4013/52

COAL

MORE STRIP MINES SLATED TO OPEN IN NORTH

OW261149 Beijing XINHUA in English 1129 GMT 26 Feb 87

[Text] Beijing, 26 February (XINHUA)--The opening of six large strip mines in north China is under way, today's overseas edition of the PEOPLE'S DAILY reported.

The coal mines, including Shengfu in Shaanxi, Pingshuo in Shanxi, and Jungar, Yuanbaoshan, Huolinhe and Yiminhe in Inner Mongolia, received approval in recent years, the paper said.

The Shenfu mine in north Shaanxi Province boasts the largest deposits, with high-quality coal reserves.

The mine's first phase projects production capacity at 10 million tons annually, and the railway and power plant for the mine are also under construction.

The mine's first phase projects production capacity at 10 million tons annually, and the railway and power plant for the mine are also under construction.

The Pingshuo mine in Shanxi, a Sino-U.S. joint venture, will be extracting coal by the end of this year. With an investment of 650 million U.S. dollars, the mine will turn out 15 million tons of coal a year, and is the largest strip coal mine under construction in China.

Preparatory work for the Jungar mine in Inner Mongolia has begun, with first-phase work scheduled for completion in 1993. The mine has an estimated annual capacity of 12 million tons.

The paper also said, in addition to these mines, some mid-sized strip coal mines will be developed in Xinjiang and Yunnan.

/12232  
CSO: 4010/39



## COAL

### NEED TO CHANGE SHANXI COAL PRODUCTION POLICY STRESSED

Taiyuan SHANXI RIBAO in Chinese 6 Jan 87 p 1

[Report by Zhao Keming [6392 0344 2494]: "How Is Coal Production To Be Handled in 1987?"]

[Text] Shanxi has huge coal reserves, high volume output, and rapid production growth. During the early period of the "Sixth Five-Year Plan" production exceeded 100 million tons, and last year reached 210 million tons. In last year's output, aside from state unified distribution coal mine production, local coal mine output of various categories was more than 130 million tons.

How is coal production to be managed this year? Will there be a continued increase in output or will another course be taken? It is easy to increase output and increased production of several million tons would not be a problem. But we cannot take this course. First, what is produced cannot be shipped out, and the product cannot be made commercial. Of the 106 million tons of coal produced from January through October 1986 by local coal mines throughout the province, 52 million tons were shipped by rail, 15.84 million tons were shipped by highway, and if local sales are not counted, by the end of October there was an overstock of more than 36 million tons of coal. By the end of the year, the surplus was estimated to be more than 50 million tons. Sadly enough, after production day in and day out, the final product cannot earn money. This sort of situation cannot continue. Second, because more is produced than is sold, the price of coal has been declining, and the profits from coal production are getting smaller. In 1983, production of one ton of coal could generate a profit of 3 yuan, but by last year that had declined to 1.5 yuan. Third, our transportation capacities this year, either rail or highway, will not greatly increase. Therefore, we must continue to produce in accordance with shipping and sales.

Some comrades are not happy about limits on coal production, and there is resentment about the responsible management. Many regional leaders have taken it upon themselves to go to other provinces for sales opportunities, with the result that, with each side pressuring the other, the coal has become less and less valuable. We should recognize that production should be based on results rather than quantity; we should look at results in terms of both production and operations. Coal is a dominant factor in Shanxi, and if we want to make the most of this advantage, we should strengthen our

overall management, arrange our production well, unify our thinking, and intensify our marketing.

Coal production cannot be increased, but neither can income be reduced. So which course shall we take? We should upgrade processing. When Comrade [Hu] Yaobang came to this province on an inspection, he brought up this problem, and we, too, have done much work on this, but not enough. This year, there will be a great breakthrough in upgrading processing. We should concentrate on processing and increasing value. The upgrading could at first be small in scale and preliminary, and include screening, washing, coking and the development of the three-material industries.... Upgrading processing will focus on townships. Even more state funds are being invested township enterprises, and the upgrading will be jointly funded and run with the townships. Generally speaking, for an equal amount of money, the state will only be able to handle one enterprise, while townships can manage three or four, with a faster return on the investment. If economic committees, planning committees, and all functionary departments are to get into the right track, they cannot allow themselves to be one of the management departments of state-run enterprises. These departments must be responsible to the state, to groups, and to individuals. Currently, there are some departments holding the "theory of the unique importance of class origin," and take on that which is state-run with no concern for townships. This is not correct. Some preferential policies should be formulated to encourage the development of coal processing. This should be in accordance with the principle of whoever processes and whoever runs it should benefit, thus encouraging the state, the group, and the individual at the same time. As long as they are economically reasonable and technically feasible, all projects dealing with the upgrading of coal processing will be given preferential consideration and support by concerned departments. After they are in operation, preference should be given in the form of policies, as well as for goods and materials and transportation. Much should be written about upgrading coal processing so that there can be increased income when coal output has not risen.

12856/9835  
CSO: 4013/45

## COAL

### PINGDINGSHAN MINES CHALK UP RECORD FOR OUTPUT, SALES

Beijing RENMIN RIBAO in Chinese 28 Mar 87 p 3

[Article by Guo Xianwen [6753 3759 2429] and Sun Yanxing [1327 1693 2946] of XINHUA]

[Text] The Pingdingshan Mines, one of China's three largest coal mines, chalked up a record 750,000-ton coal production increase and had a profit of 40 million yuan last year while most of the coal industry in China suffered losses. They achieved this by internal reform and developing latent potential. They also had large increases in production and profit in the first 2 months this year.

In 1985 the Pingdingshan Mines encountered two distinct difficulties in carrying out their contracted production and capital construction. First, they had a large increase in expenditures; the increases in expenditures in raw materials and wages alone were more than 60 million yuan in 2 years. Second, the coal market turned from a seller's market to a buyer's market. Under these circumstances the administration of the Pingdingshan Mines simultaneously worked on internal reform and systemization and productivity improvement. Efforts in the two areas allowed them to meet the contract obligations. The specific measures are detailed below.

They simplified the administration procedures and delegated power in their tiered management scheme. After reviewing the specific conditions of each coal mine and the base of the previous 2 years, they reached agreements with each mine on the amount of production, profit, and the wages per ton of coal production. The number of workers was reduced but production and total wages were not. The coal mines were permitted to sell the overproduction at a higher price according to regulations of the Ministry of Coal Industry. The above-quota production could also be sold by the Mining Bureau and the mines were then reimbursed. The extra profits were divided between the Bureau and the mines on a 20/80 basis. In the meantime, the Bureau delegated 27 decision-making powers on personnel, money, and materials to the mines. These new administrative measures had changed the mines from purely production units to relatively independent economic entities with integrated responsibility, power and profit. These actions have spurred higher production and better economic efficiency of the individual mines. The Bureau reduced its work force by 6,200 people last year but production was increased significantly.

To meet changing market needs, the mines have also diversified their products from only raw coal to different grades of coal for industrial and civilian uses. Sales have been improved and prices increased.

The wages per ton of coal production were linked to costs and product quality. The effort to cut costs and improve the economic efficiency of the enterprise was linked to the personal benefits of the workers. To address the new problems that appeared after the first implementation of the wage contract system (such as the mining teams paying attention only to the output and ignoring the product quality and material usage, and the excavation teams caring only about the footage advance and not the costs), the Pingdingshan Mining Bureau took a bold step last year. It incorporated the cost and coal quality indicators into the wages per ton contract, which used to be based solely on the output. Part of the total wage and the floating portion of the workers wages is linked to output and part of that is linked to other evaluation indicators. After the implementation of the reform plan, the teams and the workers cared not only about the output but also the coal quality, the efficiency and the costs. The Pingdingshan mines chalked up the best records last year and saved 7.4 million yuan on lumber alone.

9698/12851  
CSO: 4013/55

## COAL

### GROUND READIED TO DEVELOP ENORMOUS SHAANXI FIELD

Beijing LIAOWANG in Chinese No 7, 16 Feb 87 pp 21-22

[Article by Huang Changlu [7806 2490 4389] and Jiang Wenrui [5637 2429 3843]:  
"Shenfu Coal Field Coming to Life"]

[Excerpts] The Shenfu coal field is a Jurassic coal field. Stretching like a belt across Yulin, Shenmu, Fugu, Hengshan, and Qingbian counties, it occupies a 13,000-square-km area in the northernmost part of Shaanxi. At present, the coal field's proven reserves total more than 150 billion tons, more than 11 million tons under each square km of land. The coal has a low sulphur content, a less than 10-percent ash content, and therefore a high calorific capacity. Exploitation of the coal field is rather simple technologically. It has become one of the world's seven largest coal fields. After an observation tour of the coal field, the vice president of the Universal Tanker Co. of the United States, exclaimed: "Here is a coal field rarely seen in the world today."

It has been known for a long time that there is coal in northern Shaanxi. The local people have always dug their own coal for cooking and heating, even using lumps of coal to build walls and livestock pens. However, because of the harsh climate and poor transport facilities, no one had ever gone there to find out how big the coal reserves were until the 1920's or 1930's when geologist Wang Zhuquan, went there for a geological survey. He laid the theoretical foundation for those who came later looking for coal. In the years that followed, some college teachers and students and geological teams came one after another to make on-the-spot surveys, but none accomplished anything significant enough to attract attention. In 1981, the Shaanxi Provincial Coal Field Geological Prospecting Co's Team 185 was ordered to prospect for coal in northern Shaanxi. After much hard work with other geological teams, the secrets of this treasure land were finally revealed.

Coal is food for industry. In the Seventh Five-Year Plan period, China will increase by a rather large margin its thermal power installed generating capacity, and it is estimated that more than one-third of China's coal output will be used for power generation. Coal used by the 250,000 existing boilers, for industrial and general purposes, and coal exports will also increase. China's existing non-coking coal mines

have been producing for a long time, and their capacities have begun to drop. None of the 10 coal fields under state consideration for development is ideal because of coal quality, mining conditions, distance, and other reasons. In contrast, the Shenfu coal field has some exceptional advantages. Its coal is of unusually good quality and easy for mining. It can free the coastal cities from air pollution caused by burning high sulphur coal and can be highly competitive in the international market. Therefore, this coal field should be developed first to meet the needs of China's socialist modernization.

#### New Development Policy

Development of this "black treasure house" will not follow the old practice of the state "assuming full responsibility" for everything, but will follow a new policy: The state will build roads; the masses will do the mining; and the state, local governments, collectives, and individuals will all play a part.

This is a mining policy based on China's conditions and relying on the masses and on hard work. It is of great significance to the development of the mining industry.

In the past, new coal fields were always developed by the state. Investment had to be made first, and coal production would come later. However, the state did not have that much money, and work at new coal fields had to be suspended from time to time. According to estimates by a coal mine designing institute, based on the 1986 state development investment of 150 yuan per ton of coal, if Shenfu is to be developed by the state, the construction of a large open-cut mine with an annual output of 10 million tons in the Huojitu section of Shenfu alone will require more than 1 billion yuan, not including the costs of dormitories, schools, kindergartens, bathhouses, and other welfare facilities, and the construction will take 10 years to complete. This kind of investment is obviously too much for the state. Nor will it help the local people get rich as quickly as possible.

A new way is being followed in developing the Shenfu coal field: Let the masses engage in coal mining and achieve common prosperity.

Now, in Shenmu and Fugu counties alone, both in a 7,000-odd-square-km area in Shenmu under detailed surveying, 180 small coal mines have been established, producing nearly 1 million tons of coal a year. Tongchuan City, several counties in northern Shaanxi, and units in northeast China are applying or permission to mine for coal at Shenfu.

Wang Lin, a 36-year-old peasant, and his uncle, both of Shayan Village, Gaoshiya Township, Fugu County, invested 90,000 yuan last year to open a small coal mine. He has hired retired veteran coal miners as technical advisers, who make safety and coal-quality checks at the coal face during each shift. The mine's 80 workers earn wages by fulfilling output quotas,

and are paid extra for above-quota production. The entire coal mine is managed in an orderly manner. Although coal is mined by hand-drilling and blasting and hauled out by pushcarts, the average daily output per miner is as high as 2.5 tons. Each miner is paid 6 to 7 yuan per day. The mine has an annual production capacity of more than 40,000 tons. This young man pays attention to gathering information and has good business acumen. Learning that nearby iron smelting mills needed coke, he built furnaces to make coke by indigenous methods. The first 1,500 tons of coke produced were sold out and orders have kept coming in. Since last year, the coal mine has made a profit of 90,000 yuan. Wang Lin spent 40,000 yuan for expanded reproduction. A new ventilation shaft was sunk. He plans to open another coal pit to further increase production.

Daliuta Township, in Shenmu County, has two township-run coal mines and 13 joint-household coal mines. It plans to set up a coal mine each in 14 villages this year. Last year, more than 7,000 tons of coal were sold to other parts of the country, which helped improve the local people's living standard. The small coal mines have also stimulated the growth of the township's building material, wickerwork, and transport industries. The township's per capita income increased sharply from the original 150 yuan to 300 yuan in 1986. Zhao Changfu, the township head, said: "At this rate, the per capita income will increase to 1,000 yuan by 1990, and the township will have the label of poverty removed." The coal mines run by counties, townships, villages, and joint-household are full of vigor and vitality for the following reasons: 1. They require less investment and produce coal sooner. Seams of easily accessible coal can be mined everywhere in this area. There are also many outcrops. There is no need to dig vertical shafts. The roof of the coal seam is very hard with no gas and little water, making mining very safe. 2. Their production cost is low, and work efficiency high. The production cost of the township and joint-household coal mines is 6 to 7 yuan per ton, and they generally have an average daily output of about 2 tons per miner, twice as efficient as the local state-owned and county-run coal mines. 3. They produce good social benefits. The small coal mines of various types in Shenmu County have so far employed nearly 10,000 otherwise idle farm laborers, paying each 5 yuan per day. This has become an important way to bring prosperity to the poor rural villages. The advantages of the small coal mines have greatly increased the masses' interest in coal mining. It is estimated that when 15 pairs of coal pits now under construction in Shenfu are put into production this year, the area's overall coal output will be raised to more than 4.3 million tons a year. With continued efforts, it is possible for the area to further increase its coal output to 10 million tons a year.

Shenfu is located in a remote wind-swept region with poor transport facilities. In mining for coal, the masses' biggest problem is how to move the coal out. Many coal mines often have to suspend production because of transportation problems. Said the secretary of the Shenmu County CPC Committee, "If the problem of transport and marketing can be solved, coal output can be doubled." Therefore, transportation holds the key to the development of the Shenfu coal field.

Now, it is encouraging to know that a major railroad will soon be laid across the middle of the coal field. Construction of the Baotou-Shenmu Railway, in which the China Huaneng Coal Co. has invested 300 million yuan, is making rapid progress. This northern railway line, which can transport 10 million tons of coal a year, will be completed in 1988. The state will invest 1.9 billion yuan to build an eastern line, the Shenmu-Shuoxian Railway. The designing has been completed, and construction will soon begin. Several highways are now under construction or being widened in the mining area. Civil construction has begun on a power plant with an installed capacity of 24,000 kW, for the mining area's exclusive use. Installation of the power transmission lines has been completed.

The development of the Shenfu coal field will create good conditions for Shaanxi's economic take-off. Zhang Boxing [1728 0514 5281], acting governor of Shaanxi, envisions the following picture. By the end of the century, Shenfu will become a coal production base with an annual output of 32 to 40 million tons. On the railways, 10,000-ton special coal trains move high-grade coal to seaports for shipping abroad. In pipelines, coal-water mixtures will flow in a steady stream to power facilities as a substitute for fuel oil. On the Huang He ships fully loaded with coal sail downstream all the way to Tongguan. By that time, Shaanxi will no longer be poor and backward, and its economic situation will be greatly improved.

Ren Guojun [0117 0948 6874], head of Shenmu County, said that according to plans, 20,000 people, or one-third of the labor force, in Shenmu County will be directly engaged in coal mining by 1992.

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CSO: 4013/48



COAL

BRIEFS

SHANDONG 1986 OUTPUT--Shandong Province's raw coal output reached 50.17 million tons in 1986, overfulfilling the production plan by more than 4.9 million tons and setting a record. [Summary] [Jinan DAZHONG RIBAO in Chinese 1 Feb 87 p 1 SK] /12624

SHAANXI PROSPECTING--Xi'an, 10 Apr (XINHUA)--Shaanxi Province has for the first time called for tenders to undertake prospecting at the Huojitu open coal mine, a key national project. Situated in the northwestern part of Shaanxi's Shenmu County, Huojitu has been verified as having deposits of over 508 million tons of coal. Prospecting began in 1985 by the Shaanxi Provincial Coal Prospecting Company. It has completed its task a year ahead of schedule, thus saving an investment of more than 1.5 million yuan. [Summary] [Beijing XINHUA Domestic Service in Chinese 0814 GMT 10 Apr 87 OW] /8309

CSO: 4013/62

## OIL AND GAS

### INDUSTRY CONFIDENT OF EXCEEDING 133-MILLION-TON ANNUAL QUOTA

HK270325 Beijing CHINA DAILY in English 27 Feb 87 p 1

[Article by staff reporter Ding Lisheng]

[Summary] China's oil fields pumped 11.3 million tons of crude oil in January, 5.3 percent more than in the same month last year, making the Ministry of Petroleum Industry optimistic about over-fulfilling this year's state target of 133 million tons, a ministry spokesman told CHINA DAILY.

The ministry decided to strive to produce 1 million tons more than the state quota through increasing production while practising economy and without breaking the state-fixed capital construction scale, he said.

The ministry also planned to increase the daily supply of natural gas to Beijing to 400,000 cubic metres and that to Tianjin to more than 400,000 cubic metres by the end of this year. It required Zhongyuan Oilfield to complete a pipe project on schedule and regularly provide natural gas to Cangzhou City in Hebei Province this year, he said.

"The industry is facing two serious problems this year," the spokesman said. "The state needs more oil for ever-expanding agricultural and industrial production. At the same time, funds needed by the oil fields for capital construction are in short supply because of the low oil prices on world markets."

So the ministry decided to rely on advances in science and technology and better management to further tap the industry's potential. In this way, it hoped to maintain steady growth in the outputs of crude oil and natural gas, he said.

To help develop the economy in the former base areas of the communist party and the party-led armies, areas where ethnic minorities live, frontier and poor areas, the ministry had decided to quicken the exploration of oil and natural gas resources, he said.

An oil field in Zepu area of the southern Xinjiang Uygur Autonomous Region is under construction. By the end of this year, an oil refinery and a natural gas liquefaction plant will be completed. By 1989, a synthetic ammonia plant will be put into operation.

In the next 2 years, the infrastructure including an oil-transport pipe for an oil field in the western Qaidam Basin of the Qinghai Province will be completed. By 1990, the Golmud Oil Refinery will be put into operation.

During the Seventh 5-Year Plan period (1986-90), the ministry will also quicken the construction of oil fields in the Erlian area of Inner Mongolia Autonomous Region, Baise in Guangxi Zhuang Autonomous Region and Ansai in Shaanxi Province.

Last year, China produced 130 million tons of crude oil, 5.7 million tons more than in 1985. The growth rate was 150 percent of the average annual growth for the Sixth 5-Year Plan (1981-85), the spokesman said.

The country also produced 13.4 billion cubic metres of natural gas, 600 million cubic metres more than in 1985.

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CSO: 4010/39

## OIL AND GAS

### OIL EXPORTS MAINTAIN 'NORMAL TREND'

HK180201 Beijing CHINA DAILY in English 18 Apr 87 p 2

[Article by Staff Reporter Xie Songxin]

[Text] China's petroleum exports in the first quarter of this year maintained a "normal trend" and the country's crude oil sales this year will not exceed last year's volume, which totalled 28 million tons, according to Vice President Chen Haoran of the China National Chemicals Import and Export Corporation.

Chen, however, declined to disclose the exact amount of oil exports between January and March. But he expected that the country's foreign exchange earning from oil will be expanded this year because of stable world oil market.

The corporation, which is China's sole oil importer and exporter, lost more than \$3 billion last year due to the sharp drop in oil prices and reduced overseas shipments.

"Our policy is not to increase exports, but to seek a stabilized world market to assist the efforts of the organization of Petroleum Exporting Countries (OPEC)," Zhang Xisheng, a section chief of the corporation, told CHINA DAILY yesterday.

Another factor which forces China to reduce oil exports is the increasing demand from the domestic market and the severe shortage of energy, which hinders the further development of the economy, Zhang said.

To increase foreign exchange earnings, the corporation plans to export more chemical products, Zhang said.

It has exported \$183 million worth of products in the first quarter of this year, 29 percent more than the corresponding period in 1986.

The figure is 28.5 percent of the corporation's export target of this year, which is set at \$640 million, compared with the export volume of \$530 million in 1986.

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CSO: 4010/41

OIL AND GAS

DAQING'S VERIFIED NATURAL GAS RESERVES INCREASE

OW270412 Beijing XINHUA in English 0200 GMT 27 Feb 87

[Text] Harbin, 27 Feb (XINHUA)--The Daqing oil field, China's No 1 oil field, verified 3.98 billion cubic meters of natural gas last year, a spokesman for the oil field said today.

"In the past, we only paid attention to exploring for oil. But beginning from last year, we stepped up verifying natural gas reserves and drilled a number of fertile gas wells," he said.

In the western part of the field, workers have drilled a gas well which is able to produce 200,000-cubic meters of natural gas daily, he said.

Natural gas reserves have also been verified in the eastern part of the field, an area covering 900 square kilometers. There are nine wells which are producing gas and the largest can produce 80,000 cubic meters per day, he said.

The experts from the field predicted that progress will be made in verifying natural gas in the oil field, located in the Songliao Basin, in the coming years.

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CSO: 4010/35

OIL AND GAS

DAQING COULD MAINTAIN PRESENT OUTPUT LEVELS TO 1995

OW111948 Beijing XINHUA in English 1535 GMT 11 Mar 87

[Text] Daqing, 11 Mar (XINHUA)--The Daqing oil field, China's largest, can sustain its present output of 380 million bbl up to 1995 as it has launched all-round exploitation of 20 satellite oil pools.

"Preliminary work started in the early 1980s," said Tang Zengxiong, chief geological engineer of the Daqing Oil Administration. "The geological structures of these oil pools are more complicated than those of the main oil field, but they hold out broad prospects for development. If proper measures are taken, the present output level of Daqing may continue into 1995."

The Daqing oil field in China's northernmost province of Heilongjiang was opened in 1960. It produced 388.5 million bbl last year, about half of the country's total.

According to the administration's 5-year plan (1986-1990), the satellite oil pools are to produce 17.5 million bbl. "But this figure is conservative," the chief geological engineer said. "It can be outstripped as more and more satellite oil pools are being opened."

The Putaohua oil pool, 100 km from Daqing, and two other oil pools about 80 km from Daqing, which started toward the end of 1984, have produced a total of 10.29 million bbl so far and are expected to produce 7.35 million bbl this year.

The Chaoyanggou oil pool, 160 km from Daqing, verified to be the biggest among the satellite oil pools, has produced 140,000 bbl since it was opened in 1985 and efforts will be concentrated on this oil pool in the next 3 years. The Shengping oil pool, 80 km from Daqing, is expected to start producing in the second half of this year.

The funds for exploiting the satellite oil pools have come from the Bank of China and the Japanese Import and Export Bank, the engineer said, adding that there is no problem paying back the loans as these oil pools have begun to produce in such a short time.

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CSO: 4010/35

OIL AND GAS

AMOCO SAID ENCOURAGED BY SOUTH CHINA SEA STRIKE

OW090909 Beijing XINHUA in English 0850 GMT 9 Mar 87

[Text] Beijing, 9 Mar (XINHUA)--A well gushing 356 cubic meters of crude oil daily has been tapped at the mouth of the Pearl River Basin in the South China Sea, the China National Offshore Oil Corporation (CNOOC) announced today.

"Liu Hua 11-1-1 a," 354 kilometers southeast of Guangzhou and 305 meters underwater, was drilled by the AMOCO petroleum company of the United States in line with contacts signed with CNOOC.

A corporation official said, "so far, the outcome is encouraging to both sides, and AMOCO plans to drill another well this year."

In the past 2 years, AMOCO and CNOOC have signed three oil drilling contacts which cover an area of 9,712 square kilometers, the official added.

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CSO: 4010/35

OIL AND GAS

OIL-GAS STRUCTURE FOUND OFF FUJIAN COAST

HK020418 Hong Kong ZHONGGUO XINWEN SHE in Chinese 0950 GMT 17 Feb 87

[Report: "Oil-Gas-Generating Geological Structure Discovered on Fujian's Off-shore Continental Shelf"]

[Text] Fuzhou, 17 February (ZHONGGUO XINWEN SHE)--The Chinese Geological Prospecting Department recently discovered an oil-gas-generating geological structure on Fujian's offshore continental shelf and proved that the prospects were favorable for finding an oil-gas flow in the sea waters. Two days ago marine geologists from the Ministry of Geology and Mineral [Resources] made a special trip to Fuzhou to report this result to the Fujian Provincial Government.

Being short of energy resources, Fujian Province relies on other provinces for all its energy consumption. Whether or not there are prospects for oil-gas prospecting on Fujian's offshore continental shelf is a question attracting people's attention.

The Ministry of Geology and Mineral [Resources] has conducted marine geological investigation over the past 10 years and more. The results show that there is an oil-gas-generating geological structure in both the Dong Hai and Nan Hai. In recent years, in particular, our offshore drilling teams have drilled a number of oil-gas wells on the continental shelf in the Dong Hai and Nan Hai, proving that there is indeed a rich deposit of oil-gas in both seas. In recent years, the Min Jiang depression, the Jiulong Jiang basin, and the Jin Jiang basin have been discovered on Fujian's offshore continental shelf. The year before last, crude oil gushed from a well only 200-odd km from Fuzhou.

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CSO: 4013/59



OIL AND GAS

JAPANESE CONSORTIUM MAKES STRIKE IN PEARL RIVER BASIN

HK050028 Beijing CHINA DAILY in English 5 Mar 87 p 2

[Article by staff reporter Xu Yanchao]

[Text] An oil strike by a group of Japanese companies in the South China Sea can produce an estimated 927 tons of crude oil a day, the China National Offshore Oil Corporation (CNOOC) announced yesterday in Beijing.

The Lufeng 13-1-1 well is in the 16/06 contract block of the Pearl River Mouth Basin, about 250 kilometres southeast of the Shekou District in Shenzhen, Guangdong Province, a CNOOC official said.

The official said the crude oil was tested in two oil reservoirs under 2,300 metres, proving that the "Huizhou Depression is an area with a rich oil and gas accumulation."

The 3,223-metre test well was drilled by Japex Nanhai Ltd., Huanan Oil Development Company, Ltd., and NMC Pearl River Mouth Oil Development Company, Ltd., of Japan.

The drilling started in 150-metre-deep water on 6 December and finished on 23 January.

A second well in the contract block will be drilled 27 kilometres northwest of the first.

The official said this was the first contract in the second round of bidding for China's offshore areas, which began in March 1985.

Japex Nanhai Ltd. has a 40 percent investment share in the exploration, Huanan Oil Development Company, Ltd., 40 percent and NMC Pearl River Mouth Oil Development Company, Ltd., 20 percent.

The Huanan and Japex Nanhai companies have participated in both of China's first and second bidding for offshore oil exploration.

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CSO: 4010/39

## OIL AND GAS

### ZHUJIANG BASIN PROVING RICH IN OIL RESERVES

HK210711 Hong Kong ZHONGGUO XINWEN SHE in Chinese 0359 GMT 17 Apr 87

[Report by Jin Guolin (6855 0948 2651) and Xu Yuming (6079 3768 2494): "Rich Oil Reserves Have Been Discovered in the Zhujiang Basin on the South China Sea"--- ZHONGGUO XINWEN SHE headline]

[Text] Beijing, 17 Apr (ZHONGGUO XINWEN SHE)--Over the last 6 months, a series of important finds in oil prospecting in the basin at the mouth of the Zhu Jiang in the South China Sea have fully proved this region to be a promising large, rich oil and gas field.

The three oil wells of Lufeng B-1-1 and Liuhua H-1-1a successfully drilled on the concave belt of Huizhou and the convex belt of Dongsha in the eastern part of the basin at the mouth of the Zhu Jiang not long ago have greatly inspired people in Chinese and foreign petroleum circles.

The Huizhou concave belt is about 200 kilometers southeast of Hong Kong and covers 8,000 square kilometers. It has an oil-bearing formation of 6,000 square kilometers and a large number of sandy layers and rocks. Therefore, it possesses ideal oil bearing and storing conditions. Of the total 40 concave structures, 16 are now being drilled and 9 have already produced oil. With a success rate of 56 percent or more, it is one of the more successful areas [of] Chinese offshore oil prospecting. Chinese offshore petroleum workers thus place great hopes on this concave belt of Huizhou. At present, two oil fields here have already finished their trial drillings and are now conducting feasibility studies.

China National Offshore Oil Corporation experts maintain that the discoveries made on the convex belt of Dongsha contiguous to the concave belt of Huizhou prove the existence of a large oil field in this area. Being 350 kilometers southeast of Guangzhou, the convex belt of Dongsha developed in long geological history. On the convex belt, there are a large number of big rocks. As these rocks occupy a vast area and are well covered, it is conducive to absorbing the petroleum produced in the concave zones around the convex belt to form a large oil field. This demonstrates the good prospects for petroleum prospecting on the convex belt on the central continental shelf in the northern South China Sea, including the petroleum prospecting on the numerous convex belts in the area from the mouth of the Zhu Jiang to the Yingge Sea which are similar to the convex belt of Dongsha. At present, the U.S. Armo [a mo ke 7093 5459 4430] Oriental Petroleum Company is drilling its second well on the convex belt of Dongsha.

Some large rock formations have also been found on the Baiyun-Kaiping concave belt in the central part of the Zhujiang basin. The results of physical prospecting have also proved the existence of petroleum in this area. A new oil field has also been newly found on the Wenchang concave belt.

The basin at the mouth of the Zhujiang has become "a region of many discoveries" in Chinese offshore oil and gas prospecting. The 14 joint ventures operating in this region have already found 13 oil-bearing structures. At present, some foreign companies are negotiating with the Chinese side to sign some new contracts for expanding the cooperation zones in this region.

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CSO: 4013/62

## OIL AND GAS

### JILIN FIELD NOW NATION'S EIGHTH LARGEST

SK171230 Changchun JILIN RIBAO in Chinese 31 Mar 87 p 1

[Excerpts] Since 1970, when it initiated the comprehensive development of the Fuyu oil pool, it has developed six pools in the four counties of Baicheng Prefecture. Its daily crude oil output has ranked eighth in the country since the beginning of this year.

In 1970, Jilin mobilized forces from various quarters and organized a campaign to develop the Fuyu oil pools in a comprehensive manner. Some 10,000 educated youths and PLA soldiers assembled in Fuyu to begin a 3-year arduous struggle. Crude oil output increased from some 200,000 tons in 1969 before the campaign to 800,000, 1 million, and even 1.26 million tons, building the Fuyu oil pool into a medium-sized one in its initial form. Despite the influence of the "leftist" line at that time and afterwards, the masses of workers overcame difficulties and continued to progress. After the 3d Plenary Session of the 11th Party Central Committee in particular, the oil field readjusted its leading body in 1980, established an oilfield administrative bureau, held its first party congress, and clarified the orientation of its development. Following the implementation of the policy of reform and economic invigoration, the oil field expedited its prospecting and development. It opened up the Honggang, Xinmu, Xinbei, Xinli, Yingtai, and Qianan oil pools in Daan, the Qian Gorlos Mongol Autonomous Region, Zhenlai, and Qianan counties of Baicheng Prefecture. Its crude oil output increased by more than 100,000 and even 200,000 tons every year for 4 years in succession. Last year its total output reached 2.37 million tons, ranking ninth in the country. In January, February, and early and mid-March of this year, its daily output stabilized at some 7,100 tons, ranking eighth in the country.

In this year's campaign to increase production, practice economy, increase revenues, and reduce expenditures, the Jilin oil field took the initiative in increasing its assigned 2.6-million-ton production target by 100,000 tons. On 10 March, at a telephone conference of oil departments held by the Ministry of Petroleum Industry, a leading person of the Jilin oil field was invited to speak. In response to the call on all oil fields in the country to increase their total output by 1 million tons, the Jilin oil field voluntarily added another 200,000 tons to its output target, making its target only 50,000 tons less than the Daqing oil field. Its spirit of increasing the burden voluntarily and making more contributions has evoked strong repercussions among the departments of the same trade in the country.

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CSO: 4013/62

OIL AND GAS

SHENGLI RAPIDLY DEVELOPING BINHAI OIL, GAS FIELD

Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese, 29 Mar 87 p 3

[Text] The Binhai oil exploration task of the Shengli Field is coming into full swing. Converging on the north bank of the Huang He are 25,000 petroleum workers engaged in drilling, testing, construction, recovery, and research, and 10,000 civilian workers along with various drilling equipment. Some of the wells in the new field are already producing oil.

The Binhai field is west of the Bohai and north of the Huang He and covers 2,400 square kilometers. After many years of hard work, 11 oil deposits have been found and 400 square kilometers have been explored and controlled. The Shengli field has stepped up its exploration activities in this area since last winter, making new discoveries at Bonan, Gunan, and Kendong. Data collected show that this is a large area of oil and gas collection.

This task will take 3 years. The emphasis in 1987 is to explore the four areas at east Bonan, Chengti, Kendong, and Gunan, to develop eight locations including Bonan, Gudong, and Gunan, to improve two existing oil fields, and to increase the crude oil production by 60,000 tons.

At the end of the 3-year task, the crude oil production of this area will be increased from the 10 million-ton level of last year to 20 million tons and a number of new large and medium oil fields are expected to be found. This task is highly significant in boosting petroleum reserves and crude production of the Shengli field.

9698/12851

CSO: 4013/53

OIL AND GAS

BOHAI OIL FIELD BEGINS COMMERCIAL PRODUCTION

OW231334 Beijing XINHUA in English 1322 GMT 23 Mar 87

[Text] Tianjin, 23 March (XINHUA)--A decade after its discovery, an oil field in the Bohai Sea has entered a stage of "sustained, stable" commercial production, said an official at the Bohai Petroleum Corporation of China (BPCC) here today.

Two oil platforms have been built in the Chengbei oil field, which was discovered by Chinese experts in north China's Bohai Bay in the 1970s and is being developed jointly by BPCC and the Japanese Chengbei Petroleum Co. Ltd.

Platform B has yielded 1.4 million bbl since it began commercial production 1 October 1985, and platform A, with 28 wells, will go into full production by the end of June.

The total investment in the oil field--expected to annually produce 2.8 million to 3.5 million bbl--is 200 million U.S. dollars, and the joint exploration period is 15 years, the official said.

China and Japan have also started joint development of a 20,000 sq km zone in the south and west of the Bohai Sea. Under a 1980 contract, the Japanese side will bear all the economic risks in the joint project.

Seven years after prospecting began in the zone, "promising" oil seams have been found, and BPCC has decided to develop the BZ28-1 oil field, which will begin operation in September 1988 to become the second oil field in Bohai Bay.

BPCC has also opened up new development zones near Liaodong Bay. So far, 14 prospecting wells have been sunk there, resulting in the discovery of some oil-bearing structures.

The official said the exploration of Liaodong Bay, already listed in the development program of the corporation, will be completed by 1989. Trial production will start the same year.

The World Bank has agreed to provide a loan of 30 million U.S. dollars for the operation in Liaodong Bay, he said.

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CSO: 4010/36

## OIL AND GAS

### AGREEMENT SIGNED ON DEVELOPING QAIDAM BASIN

HK231101 Xining Qinghai Provincial Service in Mandarin 2300 GMT 22 Feb 87

[Text] On the morning of 21 February, the Qinghai Provincial Geological and Mineral Resources Bureau and the Qinghai Provincial Petroleum Management Bureau signed in Xining an agreement on strengthening lateral ties in cooperative technological projects.

Governor Song Ruixiang and Vice Governor Wu Chengzhi attended the signing ceremony and delivered speeches.

The main tasks of the two bureaus, namely, petroleum exploitation and sylvite prospecting, will be carried out in the Qaidam Basin. In a bid to give full play to their strong points, to learn from each other, to avoid duplicate prospecting and scientific research, to reduce investment, and to improve economic results comprehensively, the two bureaus have reached after negotiations an agreement on cooperation in exchanging geological findings; sylvite prospecting, hydrological, geological, and engineering prospectings in the capital construction for the petroleum industry of oil and gas resources in the (De Ling Ha) basin. After negotiations, the two bureaus have decided to transfer technological personnel to each other on a employment contract basis. The two bureaus have also decided to set up a lateral ties coordination group consisting of leaders and specialists, whose duty is to be responsible for routine work.

The leading comrades of the provincial government affirmed the lateral ties and cooperation between the two bureaus and also pointed out what the two bureaus are going to do will be of great importance to giving full play to the province' latent power in natural resources, to vigorously developing local mining industry, particularly the exploitation and development of the petroleum and sylvite industry, and to enhancing the province's reserve economic strength.

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CSO: 4013/49

OIL AND GAS

QINGHAI TO DEVELOP GAS HURE OIL FIELD

OW051155 Beijing XINHUA in English 1118 GMT 5 Mar 87

[Text] Beijing, 5 Mar (XINHUA)--Northwest China's Qinghai Province will develop the Gas Hure oil field this year, according to the petroleum industry ministry today.

The oil field lies in the western part of the Qaidam Basin and its oil reserves have been verified as exploitable.

According to a preliminary plan, basic projects, including a 400-km oil pipeline from Gas Hure to the industrial city of Golmud, will be completed within 2 years and by 1990 a production capacity of more than 7 million bbl will be formed.

The construction of an oil refinery will begin simultaneously in Golmud.

Preparations for developing the oil field are in full swing. Living quarters for oil workers, a power plant and a 22-km 350,000-volt power transmission line, as well as roads are under construction.

An official from the oil ministry said that the oil field will mainly supply Qinghai and Tibet with more oil products.

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CSO: 4010/35



OIL AND GAS

EFFORTS UNDER WAY TO DEVELOP NATION'S HIGHEST OIL FIELD

OW242235 Beijing XINHUA in English 1724 GMT 24 Mar 87

[Text] Xining, 24 Mar (XINHUA)--China is developing an oil field on the Qinghai-Tibet Plateau, the "roof of the world," where drilling of 140 oil wells will begin this year, Qinghai provincial officials announced today.

The Gaskol oil field in the Qaidam Basin in the northwest China province of Qinghai is located some 3,000 meters above sea level. It will be the highest oil field in China, the officials said.

It is expected to eventually turn out 8.4 million bbl of crude oil a year to meet the needs of the economic development in Tibet and the 120,000 sq km Qaidam Basin, which is known as "China's treasure bowl" for its abundant natural resources.

Work will begin in the second half of this year on a 429 kilometer pipeline between the oil field and Golmud, where an oil refinery will be built to process 7 million bbl a year.

Golmud is a rising industrial city in central Qinghai and the hub of Qinghai-Tibet communications.

The oil field, scheduled to go into full operation in 1990, will cut the oil transport route to Tibet by 1,100 kilometers.

At present, oil used in Tibet is transported by rail or truck from the Lanzhou oil refinery in Gansu Province, which is supplied by the Yumen oil field several hundred kilometers to its north.

The development of Gaskol oil field is part of the national program to tap the natural resources in the Qaidam Basin, where oil deposits are estimated at 140 billion bbl.

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CSO: 4010/38

OIL AND GAS

LUOYANG OIL REFINERY IS MAJOR 7TH FYP PROJECT

Zhengzhou HENAN RIBAO in Chinese 10 Mar 87 p 1

[Article by Ma Fenglu [7456 7685 6922] and Jiao Zucai [3542 6398 2087]]

[Excerpts] These reporters learned on 7 March from the first meeting of the Luoyang oil refinery leading group that China's largest oil refinery with five integrated installations will be built in Luoyang during the 7th FYP.

The Luoyang refinery originally designed for a production level of 5 million tons per year began its construction in 1977. In March 1985, a 1.3-million-ton-per-year facility was completed and put into production. At the end of last year, a total of 1.67 million tons of crude oil had been processed, resulting in a total value of production of 536 million yuan which generated 187 million yuan in revenue. This is a substantial economic benefit.

Prompted by the urgent need of controlling oil exports and boosting production in 1986, the task of completing the entire 5-million-ton-per-year facility took on some urgency. The State has made this project one of its priority construction projects in the 7th GYP. A leading group, headed by Deputy Governor Hu Tiyun [5170 1879 0061] and in collaboration with the National Petrochemical General Company and associated departments of Henan Province and Luoyang Municipality, actively prepared for full-scale construction.

The total investment budget of the project is 695 million yuan and the project consists of 102 tasks to be completed in three stages. The first stage will complete the first and fifth integrated facilities and provide a 3-million-ton crude processing capability by the end of 1988. The second stage is to complete the second integrated facility and the associated auxiliary construction by the end of 1989. The final stage is to complete the third and fourth integrated facilities and complete the entire project by the end of 1990.

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CSO: 4013/53

OIL AND GAS

DAQING DEVELOPS TECHNOLOGY TO EXPLOIT OIL IN THIN STRATA

OW140832 Beijing XINHUA in English 0711 GMT 14 Apr 87

[Text] Harbin, 14 Apr (XINHUA)--Geologists in Daqing have discovered, in recent years, oil reserves of more than 7 billion barrels, equal to a huge oil field, in thin strata of the earth's crust.

Wang Demin, chief engineer of the oil field, told XINHUA that the oil field used to ignore the oil in thin layers before they developed the technology to exploit it.

After 27 years of exploitation, most of the easily accessible oil at Daqing now contains water which was injected into the ground during the early stages of the oil field's development in order to maintain pressure.

"Now each barrel of oil we pump out from the thick strata contains more than 70 percent water," Wang said. To dehydrate the oil and treat the waste water consumes a lot of energy and funds, the engineer noted.

As a result, scientists turned their attention to thin oil seams. They developed new prospecting devices which can monitor oil-bearing strata that are just 0.2 meters thick.

The oil field has managed to increase its output by 3.5 million barrels annually.

"The new technique of exploiting the thin strata are up to advanced world levels, visiting foreign experts have told us," Wang said.

Daqing oil field is characterized by numerous oil seams with different thicknesses. Drilling may pass through more than 100 oil-bearing seams. The biggest might be as thick as a five-story building and the thinnest less than half a meter.

Daqing has pledged to realize another 10 high-yield years from 1986 to 1995. Last year the field yielded 388 million barrels of oil, the engineer said.

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CSO: 4010/40

OIL AND GAS

GALAXY COMPUTER PROCESSES SEISMIC DATA FOR OIL EXPLORATION

OW140445 Beijing XINHUA Domestic Service in Chinese 1308 GMT 12 Feb 87

[By RENMIN RIBAO reporter Wang Xiyuan and XINHUA reporter Huang Fengchu]

[Excerpts] Beijing, 12 Feb (XINHUS)--In a spacious computer room of the Petroleum Geophysics Exploration Bureau, the seismic sectional drawing of the Liaohe oil field was clearly displayed at the touch of a young lady's fingers on the computer keyboard. This was the first formal document of seismic data provided by the "Galaxy Seismic Data Processing System" that commenced operation in Zhuzhou City, Hebei Province, today.

The "Galaxy Seismic Data Processing System," which uses the Chinese-built giant electronic Galaxy main computer has been successfully developed by the Commission of Science, Technology, and Industry for National Defense in collaboration with the Ministry of Petroleum Industry. This great achievement in scientific research and application has reached international standards of the early 1980's. It not only provides a powerful instrument for the exploration of petroleum, but has also trained a group of personnel for the development of software, signifying a new level attained by China in the application of software to petroleum exploration and development.

State Councillor Kang Shien, Minister of the State Economic Commission Lu Dong, Minister of Petroleum Industry Wang Tao, Minister of the Commission of Science, and Industry for National Defense Ding Henggao, and leading comrades from departments concerned under the Central Committee were present at today's ceremony marking the commencement of the operation.

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CSO: 4013/49

## OIL AND GAS

### ROLE OF OIL SHALE IN CHINA'S ENERGY PICTURE DISCUSSED

Beijing KEJI RIBAO in Chinese 9 Feb 87 p 3

[Article by Lei Shitai [7191 0013 3141]: "China's Present Energy Situation and the Development of Oil Shale"]

[Text] In 1985, the composition of China's energy was as follows: coal 72.8 percent, oil 20.9 percent, natural gas 2 percent, and hydroelectricity 4.3 percent. It is estimated that there will be little change in this energy picture by the year 2000. In order to resolve China's present and future energy problems, experts have put forth many suggestions, and, as the saying goes, "different people have different views." This writer understands that in any discussion of energy problems, the fundamental, overall consideration must be the state of affairs as regards resources. What follows is a simplified analysis of the various categories of energy sources.

With a current annual production of 850 million tons, and verified deposits of more than 700 billion tons, coal is China's most important form of energy. China's coal resources are characterized by abundant deposits but uneven distribution. There are major concentrations in the provinces of East China and the southern areas of Yunnan, Guizhou, and Sichuan, while deposits also lie in Shanxi, Inner Mongolia, and Shaanxi. This distribution pattern has created severe transportation problems. Today, there are from 250 to 280 million tons shipped from all parts of China to the East every year, which takes up more than 40 percent of the total rail capacity. One-fourth of Shanxi's annual production total cannot be shipped out, but must be stockpiled where mined, where it could dry out and spontaneously ignite. Moreover, in some of the southern provinces, energy shortages cause 25 percent of equipment to be kept out of production.

The situation for oil is even tighter than that for coal. The older oil fields have been pumped for many years, and a tremendous effort is required just to maintain present output. The new fields are predominantly medium and small sized, with little chance of increasing production. In the short term, there is really no way to resolve the "fuel crisis."

What is China's natural gas situation? If we calculate these reserves only in terms of biogas, then we may be optimistic, yet we cannot neglect future

problems of storage and container integrity. A natural gas survey conducted during the period of the Sixth Five-Year Plan turned up no areas which showed promise for development of large gas fields in the long run, although there were some which might become medium and small fields, and possibly of benefit to some areas.

Hydropower supplies less than 5 percent of China's energy, even though it has many advantages. However, it has considerable geographic limitations, requiring a large investment over a long period of time. In the 37 years which followed the founding of the nation, the total installed capacity reached 26.24 million kilowatts, only 7 percent of the potential capacity. Even if this could be doubled within 10 years, it still would be less than 10 percent of our total energy capacity. Therefore, hydropower is totally inadequate to rely on to resolve our energy shortages.

How are we to ease this critical energy situation? We know that energy sources of low heat value, such as oil shale, bone coal and coal waste can be put to great use. This is especially the case with oil shale, which has abundant deposits and enormous potential.

China today has 31,567 billion tons of proven reserves of oil shale, distributed over 55 mining regions. In recent years there has been considerable progress made in oil shale technology utilization, and it is now used not only in oil extraction but also in boilers to generate power directly. Construction of a shale plant with a generator capacity of 100 megawatts would require 1.5 million tons of shale ore annually. If the national power generation capability were increased by 10 million kilowatts (about one-fifth of the present national capacity), then these shale plants would call for an annual outlay of 150 million tons of oil shale ore. Our present deposits could be mined for at least 150 years.

A gigawatt shale power plant could generate 8.8 billion KWH annually, so figuring 0.16 yuan per KWH sold, and deducting a cost of 6 fen per KWH, an annual profit of 800 million yuan would be realized, recouping the entire capital outlay. If localities were encouraged to set up small-scale shale power stations, revenue would be increased and the energy shortage eased.

At present, China's utilization of oil shale is very inadequate. Of the 31.5 billion tons of proven deposits, industrial departments have plans for using only 1.7 billion. If we compare two producing areas, Fushun and Maoming, we see that the former has deposits of 3.6 billion tons, of which its plants use 1.4 million tons, while 9 million tons are mined there annually. Maoming has deposits of 5.4 billion tons, of which it uses only 0.31 billion while it mines 3.5 million tons. Moreover, they have been using the shale only for oil refining. These two areas are now planning to build shale boiler power plants in order to make full use of oil shale, and it is expected that the results will be satisfying. Other areas have still not made full use of shale. The development of oil shale use abroad has developed very rapidly in recent years. The Soviet Union, regarded as a nation with great resources, has stressed the

use of oil shale. In 1978, its output reached 36 million tons, of which 75 percent was used for generating electrical power, and 25 percent for oil refining. At present, it has 14 fields being mined, of which 4 are open-pit mines and 10 are underground. The United States government has also encouraged development of the oil shale industry. In 1985 the production cost of oil shale was 36 U.S. dollars a barrel; the government then purchased the entire output for 42.5 U.S. dollars per barrel. The U.S. and Japan are now jointly developing a mine in the Australian state of Queensland. This mine is scheduled to go into production in 1987, and will mine 165 million tons annually. The German Federal Republic produces 3 million tons of oil shale annually, for both oil refining and power generation. Six percent of this is used for oil refining, and the balance for generating power. In that country's Ruhr region, a cement plant has comprehensively used oil shale for 20 years. The calorific capacity of the oil shale used is only 930 kilocalories per kilogram. At present, they have researched and developed a boiler which uses a calorific capacity of only 720 kilocalories per kilogram (China averages 1,500 kilocalories per kilogram). Other nations, such as Sweden, Brazil, Italy, Jordan, Morocco, Israel, Zaire, Turkey, Thailand, Burma, and Czechoslovakia are all developing their oil shale industries.

Given the composition and distribution of energy resources in China, development of oil shale use and other low heat value energy sources is an effective way of easing the energy shortage.

12625/12851

CSO: 4013/51

## OIL AND GAS

### BRIEFS

SOUTH CHINA SEA DRILLING--Guangzhou--The first offshore oil field in the South China Sea has produced 1 million barrels of crude since it went into production in October 1986, according to Wang Yan, general manager of the China Nanhai West Petroleum Corporation (CNWPC). Discovered and developed jointly by the China National Offshore Oil Corporation and TOTAL of France, the field Wei 10-3, is located southwest of Weizhou Island. Wang said since oil exploration began here 6 years ago, one large gas field and six medium-sized and small fields have been discovered. They are located mainly in the [Beibu wan] and [Yinggehai]. In addition, the U.S. Esso Group has drilled two oil wells and one exploratory well in the Wenchang area. Off Hainan Island, CNWPC and ARCO of the U.S. are jointly exploring a gas field which can produce 100 million m3 of natural gas. CNWPC will start to explore a new oil field in the northeastern Beibu gulf, Wang added. It is estimated that this field, Wei 11-4, can produce 2.2 million barrels of crude a year. Wang also disclosed that Statoil of Norway has entered negotiation with CNWPC on the exploration of oil southeast of Hainan island. [Report by Wang Jian] [Summary] [Hong Kong TA KUNG PAO in English 26 Feb 87 p 4 HK] /12913

CSO: 4010/36



NUCLEAR POWER

SHANGHAI'S HEAVY INDUSTRY PRODUCING NUCLEAR POWER EQUIPMENT

HK050155 Hong Kong ZHONGGUO XINWEN SHE in Chinese 0258 GMT 2 Mar 87

[Report: "Shanghai Has Built Up Its Nuclear Power Equipment Manufacturing Industry"]

[Text] Shanghai, 2 Mar (ZHONGGUO XINWEN SHE)--Shanghai Municipality has built up a nuclear power equipment manufacturing industry system, the first of its kind in China. This system is capable of manufacturing 1 million-kilowatt complete sets of equipment and of designing, manufacturing, and installing, on a contract basis, large, medium-sized, and small nuclear power plant equipment.

Shanghai Municipality has spent 10 years in building up this system.

The Shanghai Mechanical and Electrical Industries Bureau is responsible for the equipment of the Qinshan Nuclear Power Project. Seventeen noted machine-building factories in Shanghai have participated in the manufacturing of 136 items of important equipment totaling 1,366 sets and pieces for the project. With the exception of a small number of parts and components, most of these items are designed and made by China, making use of the advanced experience of foreign countries. The state has invested 130 million yuan in the project and has built new shops with a total floor space of more than 70,000 square meters. The Shanghai Heavy-Duty Machine Plant has built the world's largest electroslag smelting furnace that holds 200 tons of molten steel. The Shanghai Boiler Plant has built a 400-ton grade heavy-duty vessel workshop specially for developing and manufacturing evaporators and pressure shells, which are very difficult to make. At present, more than 300 technological experiments have been carried out and a complete system for industrial installation and a complete set of nondestructive flaw-detecting equipment have been built. A powerful design, manufacturing, and management technical contingent has been organized. These measures for capital construction and the technological strength available not only can meet the needs of the Qinshan Nuclear Power Plant but also can provide complete set of equipment for 600,000-kilowatt and 900,000-kilowatt large nuclear power plants in future.

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## NUCLEAR POWER

### SOUTHEAST COAST MOST LIKELY NUCLEAR WASTE DUMP SITE

HK300839 Hong Kong HONGKONG STANDARD in English 30 Apr 87 p 7

[Article by Chan Wai-fong]

[Text] China's southeastern coastal area has been identified as the most probable dumping ground for highly radioactive nuclear wastes from the nuclear power plants to be built in the region.

Geological as well as geographic conditions existing in the provinces of Fujian, Zhejiang, and Guangdong provide a favourable environment for the burial of these wastes, according to a Chinese official.

At present, China is working on the second phase of the Qinshan nuclear power plant located in Hangzhou Bay about 140 kilometres South of Shanghai in Zhejiang Province. And preparation work for the Daya Bay nuclear power plant in Guangdong is continuing.

Mr Chu Zhanchang, an engineer with the Hydrology Department of the Ministry of Geology and Minerals said yesterday that experts from the department had visited Fujian's Danyang area twice and plans for the launching of a comprehensive investigation into the feasibility of the area as a nuclear waste dump-site are to be formulated soon.

He said that the area--along the southeastern coast--is favourable because there are granite formations with simple structures and few cracks.

Aside from geological considerations, Mr Chu was emphatic in saying that other factors, such as transport and population densities in the region also favour its being chosen as the dumping ground.

These factors will be studied and investigated before making a final decision, he added.

Because of its relatively low relief and favourable weather, the coastal provinces are where most of China's population is concentrated.

Along the southeastern coast, the province of Guangdong alone is home to 5.6 percent of the country's population. And some 13 percent of the population (about 130 million people) live in the provinces of Zhejiang, Fujian, Jiangsu and Anhui according to 1986 statistics.

In view of this situation, and with growing urban development, it would seem inappropriate to select localities in this region as permanent rest houses for radioactive nuclear waste.

Mr Chu, however, argued that China's two new nuclear plants--the Qinshan plant and the Daya Bay plant--are located in the region providing an important and favourable factor of proximity.

"We have refrained from choosing localities in the interior because of the anticipated problems in transportation. It is not advisable to transport radioactive materials over such long distances," Mr Chu said.

It is also dangerous to dump nuclear waste from these plants into the sea, he added.

The ministry is considering storing the waste in thick lead-coated capsules and then burying them at a depth of more than 1,000 metres.

A professor from the United States is now working together with experts from the ministry to prepare for a large-scale study and investigation, which, once started, will go on at least for the next decade.

"It is a very complicated issue. And experts in the United States and Canada are also working in the same direction," Mr Chu said maintaining that cautious and thorough studies will be conducted before making a final decision.

And the ministry is also considering conducting the study jointly with the Nuclear Industry Ministry, the highest body overseeing the construction and operation of China's nuclear establishments.

Meanwhile, a Chinese geological academic report--published in 1985 and only available in Hong Kong last month--suggests that the site for the Qinshan power plant may be unsafe.

Chinese geologist Wang Jinxing, one of the report's authors, concludes that all the sites proposed for nuclear power plant construction on the northern side of Hangzhou Bay, including Qinshan, "could be faced with the serious danger of unsafe geological phenomena and should be avoided."

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CSO: 4010/41

SUPPLEMENTAL SOURCES

QINGHAI-TIBET PLATEAU IS LEADER IN SOLAR, GEOTHERMAL RESOURCES

OWO31430 Beijing XINHUA in English 1335 GMT 3 May 87

[Text] Xining, 3 May (XINHUA)--China's Qinghai-Tibet Plateau, sometimes called "the roof of the world," leads the country in solar, hydro, and geothermal energy resources, the Qinghai Energy Research Institute announced.

The plateau, at an average altitude of 4,500 meters above sea level, covers 2.3 million square kilometers.

"The plateau gets 2,300 to 3,500 hours of sunlight annually, and solar thermal radiation per square centimeter equals 10 to 200 kilo-calories," Luo ZANJI, the institute's director said, adding conditions like this are rare.

In Lhasa, capital of the Tibet Autonomous Region, experiments show solar thermal radiation per square meter equals that put out by a 1-kilowatt electric stove.

"The Lancang, Nu and [Yarlung Zangbo] rivers, all originating in the region, have a combined generating capacity of 220 million kilowatts, about one-third of the country's total," the director said.

Also a geologically active area, the plateau has over 700 hot springs and geothermal zones, and annually heat emitted from the earth in Tibet's Yangbajain basin is the equivalent of the energy produced by burning 470,000 tons of coal, Luo added.

"The plateau also has great potential in windpower, because each year winds blow at speeds of over 3 meters per second during 200 days of the year," an institute engineer said.

According to Director Luo, the institute is now busy developing projects to better utilize the plateau's renewable energy resources.

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CSO: 4010/41

SUPPLEMENTAL SOURCES

DACHEN ISLAND: FUTURE SITE OF NEW ENERGY RESOURCE STUDIES

Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 10 Feb 87 p 1

[Article by Shao Tong [6730 1749]: Dachen Island Will Become a New Energy Demonstration Area; China and the EEC To Strengthen Cooperation in Energy Fields"]

[Text] China's New Energy Sources Delegation recently visited the European Economic Community (EEC), during which the two sides concluded an agreement to become partners in this year's Dachen Island new energy sources project, jointly furnishing engineering progress and cooperation.

Dachen Island is a small island off southern Zhejiang. Its principle industry is fishing. Annually, during the peak fishing season, there are between 50,000 to 100,000 fishermen there. However, the island's marine products are often spoiled or damaged, because of an inadequate supply of energy. It is also difficult to guarantee that the residents have sufficient electricity for everyday living. Therefore, China has chosen this island as a comprehensive development demonstration area.

In 1985, a committee of the EEC's development directorate decided to enter into a mutual supply system with China, which would establish on Dachen a comprehensive base for new and renewable energy sources, utilizing wind power, solar power, tidal energy and bioenergy. The EEC will provide new models of wind power generators, solar cells, bioenergy gasification equipment and technology. This will mean the electric power stations supplying these new energy sources will provide about 50 percent of the island's total energy supply.

The EEC on several occasions has sent people to Dachen to conduct surveys, and through the efforts of experts on both sides, a detailed feasibility study has been completed. At this time, the two sides have fixed a project schedule for 1987. The EEC's development directorate has decided that this year they will start to furnish Dachen with appropriate equipment, as well as to assist the Chinese side in training technical personnel.

The Chinese delegation's leader told reporters that the Dachen project will be conducted jointly by both sides, with each side supplying one-half of the investment. The first phase of the project will take about 3 years. After projects are completed, they could become models for the energy-poor areas

along China's southeast coast, and could even be extended to other areas of Asia and the Pacific.

He went on to further explain that, starting in 1987, China and the EEC will begin S&T cooperation in energy areas, and from these initial contacts personnel will progressively develop joint research and new technologies, and jointly set up a technical training team in China.

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CSO: 4013/51

## SUPPLEMENTAL SOURCES

### RURAL AREAS DEVELOP ALTERNATIVE ENERGY RESOURCES

OW191045 Beijing XINHUA in English 0922 GMT 19 Mar 87

[Text] Beijing, 19 Mar (XINHUA)--By using solar, wind, and geothermal resources, China's rural areas saved the equivalent of 9 million tons of coal last year, today's overseas edition of PEOPLE'S DAILY reported.

Last year an additional 15 million families installed energy-efficient stoves, and 400,000 households switched over to using biogas, according to the statistics released by the Ministry of Agriculture, Animal Husbandry and Fisheries.

China's rural energy replacements are beginning to be used in the production sectors such as in farming, livestock production, and rural factories.

Rural areas are now using all available sources to develop energy supplies. Residents of Inner Mongolia use wind and solar power to generate electricity, pump water, and for cooking and heating. The area now boasts over 30,000 wind generators and solar units.

Many provinces and cities have installed energy-saving furnaces for producing tea, tobacco, and other agricultural and sideline products. Enterprises involved in the production of agricultural machines, aquatic products and farming are also focusing on saving coal and electricity.

Energy-saving equipment production and service is a growing industry in the countryside. Last year, 1,500 such companies at the country and village levels employed over 100,000 workers and technicians, showing a business turnover of 100 million yuan (27 million U.S. dollars), and profits of 10 million yuan (2.7 million U.S. dollars).

According to the ministry, "energy for China's rural areas will be in short supply for a long time, and construction of energy-related projects will remain a hard task."

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CSO: 4010/38

SUPPLEMENTAL SOURCES

BRIEFS

GEOHERMAL PLANT EXPANSION--On 25 April 1987, ground was broken at China's largest geothermal power plant--the Yangbajing power plant in Xizang--on an expansion project. This is a major project during the Seventh Five-Year Plan to relieve the tight energy situation in Lhasa. The project calls for the installation of two 3000-kilowatt generating units. After the added units begin to generate electricity in 1988, the entire plant will have a power generation capacity of 19,000 kilowatts and the Lhasa grid itself will grow by 25 percent [Text] [Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 28 Apr 87, p 1]

CSO: 4013

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10

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