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CHINA: ENERGY

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Experts Comment on China's Changing Energy Structure

Expansion of Nuclear Power

40130011 Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 28 Sep 88 p 2

[Article: "Circumstances Require an Alteration of China's Energy Structure"]

[Summary of speech by member of State Planning Commission Integrated Research Institute Yang Hongnian [2799 3163 1628]: "Developing Nuclear Power Will Have Profound and Far-Reaching Effects in Improving the Transport Situation"]

[Text] Coal is the mainstay of China's energy structure. In 1987 coal accounted for 76.14 percent of China's total energy consumption and for 78 percent of fossil-fired power production. The fact that the economically developed, densely populated East China region lacks conventional energy resources results in a major flow of coal from west to east and from north to south. Coal accounts for 40 percent of all railroad haulage. The large amounts of coal hauled and the great distances involved have placed heavy pressure on the transport system. Transport facilities have long been in short supply, and one major manifestation has been a shortage of energy transport. In addition, China's energy resources are in short supply, there is insufficient electric power, and the creation of transport capacities is greatly insufficient. Since this August, 40 percent of centrally controlled generating units in Jiangsu Province have been idle, and there is a critical shortage of coal for power generation because [lack of] transport has limited the coal supply. In the next few years, nearly 10 million kilowatts of generating capacity will become operational, and the amount of coal to be used in power production will increase by more than 3,000 tons a year, so that the already serious coal transport situation will be aggravated still further.

Power production in eastern China is expanding rapidly, and the conflict with coal transport has already become acute. It is predicted that the amount of coal to be used in power production will reach 550 million tons in the year 2000 and more than a billion tons in 2010. If we do not develop nuclear power, this coal transport requirement will be unthinkably burdensome.

Vigorously developing nuclear power while giving priority to the development of hydroelectric power is one major way of solving the transport problem. The Beijing-Shenyang and Beijing-Hankou railroads, which have heavy coal hauling tasks, are also the lines with the busiest passenger transport. If we expand nuclear power and decrease coal haulage, we will be able to increase transport capacities greatly and expand passenger transport. In addition, expanding nuclear power so as to increase the availability of electric power to eastern China will help accelerate the conversion to electrified railways. In the case of the Beijing-Shanghai line, electrification will increase passenger transport capacity by 50 percent and freight capacity by 20 percent. These changes will improve the transport situation.

Nuclear power will require only minor transport capacities and expenditures. But the annual transport cost of each kilowatt for coal-fired electric power is 60-78 yuan in Shanghai, 65-98 yuan in Xiamen, and 97-115 yuan in Guangzhou; the transport construction investment for each kilowatt-hour of coal-fired electric power production is 500-650 yuan in Shanghai, more than 1,000 yuan in Xiamen, and 750-880 yuan Guangzhou. The benefits to transport that will result from the development of nuclear power will partially compensate the rather high construction investment on nuclear power production. Nuclear power plants can supply electricity locally and can eliminate investments on long-distance electric power transmission.

As a result, nuclear power plant construction in China's coastal zone should proceed from south to north.

Petroleum, Natural Gas

40130011 Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 28 Sep 88 p 2

[Summary of speech by Professor Hu Jianyi [5170 6015 5030], deputy director of Beijing Petroleum Exploration and Development Institute: "Strengthen Prospecting for and Development of Petroleum and Natural Gas"]

[Text] World recoverable petroleum reserves in 1987 were 250 billion tons, proved reserves totaled 188 billion tons (including a total of 78 billion tons that has already been extracted), undiscovered reserves totaled 62 billion tons, and current annual output is about 2.89 billion tons. Recoverable reserves of natural gas are estimated to be 265 trillion cubic meters, proved reserve total 145 trillion cubic meters (including 37 trillion cubic meters that has already been extracted), and undiscovered reserves total 120 trillion cubic meters. The current annual output is about 1.9 trillion cubic meters. In 1979, Ma Jieti [7456 2212 2748] estimated that the share of petroleum and coal in world energy consumption would gradually decline, that before the year 2020 the share of natural gas would increase rapidly to a peak, after which it would decline again, and that the share of nuclear power and renewable energy resources would rise continuously and might account for respectively 50 percent and 16 percent of total energy consumption in the year 2050. Although the specific figures are debatable, some experts believe that they currently express the world energy trends.

In 1987 China produced 134 million tons of oil and 13.5 billion cubic meters of natural gas, constituting respectively 21.5 percent and 2.1 percent of the country's total energy output and placing China respectively 5th and 19th worldwide.

For 25 years China's petroleum industry has developed rapidly, but starting in the 1980's its expansion has slowed. The average annual petroleum output increased by an average of 59 percent in 1962 to 1970, by 25 percent from 1970 to 1980, and by 3.7 percent from 1970 to 1980. Our annual output of natural gas has showed essentially no increase over the last 10 years, and we now produce only 0.71 percent of world output. This output is not keeping pace with China's prospecting activity and is not commensurate with investments.

China has abundant oil and gas resources, but owing to the complexity of geological conditions, major technical difficulties, and the presence of the desert plateau in western China, expansion of oil and gas output will be gradual: we will not be able to make oil our main energy source as some countries have done. But there is much unused potential, particularly in the case of natural gas.

China's output of oil and gas will reach peak values respectively in 2010-2020 and 2020-2030, after which they will gradually decline. As China's total energy consumption rises, it is estimated that oil and gas consumption will remain at respectively 23 percent of total energy consumption before the year 2000, then will gradually decline to about 15 percent in the year 2000. Because oil and gas are not readily replaceable by other energy resources, for a rather long period it will be both necessary and possible to maintain oil and gas consumption at a fixed percentage of the overall energy structure.

Controlling Greenhouse Effect

40130011 Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 28 Sep 88 p 2

[Summary of speech by Huang Yinghui [7806 2837 6540], member of the Atmospheric Physics Institute, Chinese Academy of Sciences: "The Greenhouse Effect Cannot Be Ignored"]

[Text] With the large scale use of coal, petroleum, and natural gas, the concentrations of carbon dioxide and other gases that are likely to cause an increase in the surface temperature of the earth are rising sharply. According to the last investigations made by the late deputy director of the Chinese Academy of Sciences Zhu Kezhen, the air temperature in China has changed by 2°C over the course of 5,000 years. In 1985, a conference of the World Meteorological Organization, the World Federation of Scientists and the United Nations Environmental Office held in Austria concluded that the concentration of atmospheric carbon dioxide will double by the 2030's, causing a rise of 1.5° to 4.5°C in the global air temperature over the course of 50 years. At the world environmental conference held in Canada this June, experts and governmental officials from various countries warned that

a large, rapid rise in the global air temperature would cause disasters second only to a nuclear war and that when the governments of all states plan their economic development, they must take account of the environment's tolerance.

The reason is that such a rise in air temperature would cause the sea level to rise by 0.2 to 1.4 meters, with grave effects on economic development in coastal areas. At present, unlike China, many advanced countries have begun to move urban construction away from the coast.

Changes in the distribution of rainfall resulting from climatic change will cause semitropical and equatorial regions such as water-poor north China and northwest China to become even more arid, thus accelerating their desertification, and the expansion of desert area and the shift in the rain belt caused by so rapid a change in air temperature would hinder coordinated development of industry, agriculture and municipal construction.

Forests are capable of absorbing carbon dioxide from the atmosphere and thus can control the greenhouse effect. But excessive cutting of forests is sharply decreasing the global forested area, resulting in a loss of the ability to regulate the atmospheric concentration of carbon dioxide.

The only currently available measure is to decrease the consumption of fuels such as coal, oil, and natural gas in order to decrease emissions of carbon dioxide into the atmosphere. The world environmental conference held this June in Canada called upon all governments to decrease the consumption of fuels capable of producing carbon dioxide, such as coal, oil, and natural gas, to one-fifth the 1988 level and to draft a series of international treaties to the purpose.

Coal will be the mainstay of China's energy consumption, and coal consumption is expected to increase greatly. By the year 2005, rather than falling to one-fifth of the 1988 level, coal combustion will nearly double. For our own sake and that of our descendants, we must vigorously develop nuclear power, which does not produce carbon dioxide, make thorough use of such renewable resources as hydropower, and protect the forests.

8480/9365

Mid-Year Energy Production Statistics

40100002b Beijing CEI Database in English 1 Sep 88

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

Item	Unit	1-7/88	7/88	Percentage compared with 1-7/1987
Total output (10,000 tons of standard coal)		52,905.0	7,891.0	104.86
A. Raw coal	10,000 tons	53,378.0	7,855.0	105.00
Including: Output under unified central planning	10,000 tons	25,939.0	3,736.0	103.02
B. Crude oil	10,000 tons	7,851.0	1,145.0	102.36
C. Natural gas	100 million m^3	84.0	12.0	101.56
D. Hydropower	100 million kWh	607.0	121.0	117.42

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Chronic Power Shortage Analyzed, Solutions Offered

40130014 Beijing JINGJI GUANLI in Chinese No 7, 1988 pp 48-50

[Article by Zhou Ruyan [0719 1172 3508] and Feng Yongping [7458 3057 1627] and edited by Li Fei [2621 7326], responsible editor: "Establishing a Bidirectional Restraint Mechanism To Alleviate the Electric Power Shortage"]

[Text] The long-term electric power shortage has seriously impeded China's economic construction. We attempt in this article to sum up the experience of Yancheng City, Jiangsu Province, in adopting, on a trial basis in 1987, the contracted responsibility system of planned power consumption, and to investigate conditions for establishing a bidirectional restraint mechanism of electricity supply despite the power shortage, so as to coordinate and balance the supply and the consumption of electric power, and to alleviate as much as possible the contradiction in power shortage.

I. Dualism of Power Shortage and Possibility of Alleviating Contradiction in Power Shortage

Like anything else, the power shortage, taken as a comprehensive social environment, is marked by dualism, that is, the objectivity and subjectivity of having a power shortage. Objectively, the construction of the power generation industry has fallen behind the growth of the national economic development. Though the state has recently adopted an inclined policy, the aggregate supply and aggregate demand of electric power can hardly be balanced, and this contradiction has become very acute, so that the objectivity of having a power shortage is quite obvious. In order to basically put an end to this situation, we must speed up the construction of the power generation industry, which is by no means easy. The crux of the problem is that when analyzing the contradiction in power supply, people often stress its objectivity but neglect its subjectivity. They never realize the position of and the role played by subjectivity in the shortage of electric power. Therefore, it develops a phenomenon in which the extent and scope of the power shortage gets worse while the number of power generators is increasing.

What is the subjectivity of the power shortage, that is, factors for the purely man-made power shortage or intensifying the power shortage?

First, the order of power consumption is so unstable that restrictions are often imposed on the consumption and large-scale blackouts frequently occur. In the first half of 1987, the East China Power Supply Network imposed on 2,205 occasions restrictions on the power supply to Jiangsu Province, as well as cities and counties under the provincial authorities. The voltage classes that were subject to restrictions were 110 kilovolts and more. In other words, at least a whole county had no power supply whenever the power supply restrictions are in effect. Between January and March 1987, the power consumption of Yancheng City, Jiangsu Province, at its peak period reached beyond its assigned level by 24 million kWh, so that the power consumption restrictions were imposed on the city on 88 occasions, and its total blackout time was 208 hours. Dongtai and Daifeng Counties of the city, with a population of 1 million each, experienced in a single month a countywide blackout on more than 10 occasions. The generation and consumption of electricity must be absolutely balanced, and consumption beyond the assigned level is strictly forbidden. If the consumption of power beyond the assigned level continues despite repeated restrictions so that the power network operates at a low cycle and the safety of the network is under threat, the power authorities at various levels will inevitably be forced to impose restrictions on the power supply. The result of frequently imposing restrictions on the power supply is that, on the one hand, areas and units that consume power within the assigned level suffer from blackouts and, on the other, it helps people develop the mentality of striving to get more and trusting luck, thereby developing the vicious cycle of "grabbing whatever is given, exceeding the quota, imposing restrictions on whatever exceeds the quota, and developing chaos whenever restrictions are imposed." Moreover, unstable factors were recently developed in the operation of the power network. When the power generation and consumption plans do not balance with the distributed power consumption plan, they had to frequently readjust and reduce the distribution plan of power consumption. This kind of unstable power consumption imperceptibly intensified the power shortage, and enlarged the extent and scope of the power shortage.

Second, the power supply is not flexible enough for the comprehensive economic results of electric energy to be given full play, and it even develops the phenomenon of unrevealed electricity. The generation and consumption of electricity should be carried out at the same time without any interruption. However, under the influence of the traditional concept of "working from sunrise until sunset," there is both the peak and nonpeak periods in everyday power consumption. The power shortage is very serious during the peak period, and the same is true for unused electricity during the nonpeak period. According to the statistics, in Jiangsu, some 150,000 kilovolts of electricity has yet to be tapped during the nonpeak period of power consumption. This means that more than 500 million kWh of electricity was unused each year. As the East China Power Supply Network has the potential of supplying 500,000 kilovolts of electricity during the nonpeak period, the annual amount of unused electricity was 1.8 billion kWh. If the same situation applied to the whole country, some 30 million kilowatts of electricity has yet to be tapped, and the annual amount of unused electricity totaled more than 10 billion kWh. This is an enormous figure. In order to increase the power generation capacity of generators and boost the annual capacity, the state must make an investment of a couple of

billion yuan. If the value per kWh of electricity generated for industrial use was 5 yuan, it would create 50 billion yuan of industrial output value for society. It is indeed a pity that such an enormous fortune was wasted for no purpose. At the same time, as the potential of power generation was left unused during the nonpeak period, some highly efficient large generators of the network were frequently switched on and off, thereby increasing the production cost, affecting their liability, and reducing the profits derived from power consumption. Besides, the situation has further intensified the power shortage during the peak period, and thereby threatening the safe operation of the power network.

Third, the ideology of self-control is so weak that the planned consumption of power is not realized, thus bringing about a spiral increase of power consumption. The tenser the situation of power supply, the greater the demand of power consumption. Consequently, power generation departments at all levels become very busy. The demand for power supply is also increased under various kinds of pretext, such as electricity for key projects and electricity for fighting against disasters and for the poor, in addition to the mandatory "unified distribution of electricity" and the guiding "electricity for processing." This mechanism has undermined the seriousness of the planned power consumption, helped the development of anarchism in power consumption, and, to a certain extent, further intensified the power shortage.

From the above-mentioned analysis, we can see that the existence of subjectivity of, or man-made factors for, the power shortage is rather common. Since these man-made factors can enlarge the extent and scope of the power shortage, factors for eliminating these man-made factors can also completely check the expansion of the power shortage, and alleviate to the greatest extent such shortage. Provided that we study the above-mentioned three man-made factors, we shall discover that the crux of the problem is the state of imbalance between the power supply and power consumption. Therefore, when power shortage develops because the supply and power consumption becomes acute and there is no balance between the generation and consumption of electricity, it is possible for us to balance and coordinate the supply and consumption, and to alleviate the serious power shortage.

II. Bidirectional Restraint and Stability of Balance and Coordination

To tackle the power shortage by adopting various means to establish an effective restraint mechanism, in order to balance and coordinate the power supply and consumption and to alleviate as much as possible the shortage, is basically a way of striving for more output without increasing the input, or "making big profits with little capital." The core of this kind of thinking is the establishment of a restraint mechanism.

Is the current administration system for planned power consumption a restraint mechanism? We hold that the present administration system for planned power consumption is really a restraint mechanism, but neither is its form perfect nor its extent of restraint complete. We should review our current administration system for planned power consumption in order to clearly explain this issue.

The current administration system of planned power consumption is marked by three features:

First, unidirection, that is, the one who supplies electricity controls the power consumption so that there is a firm "seller's market." As there is no equality or unity in duty, rights and interests of the supplier and the consumers, it is impossible to realize the supervision by society.

Second, being monotonous, that is, the use of administrative means is the major source of regulation, while the planned distribution and its implementation are, in fact, essentially enforcement of administrative intervention, which artificially excludes this commodity from the economic rules.

Third, unitary, that is, the charges for electricity by the network are at a flat rate. The same charges are levied during the peak period, in which the consumption is greater than the supply, and during the nonpeak period, in which the supply is greater than the consumption. As the power generation and consumption have violated the law of value, it is impossible to give guidance on consumption, which objectively stimulates an inflation of demand.

These three features are actually disadvantages, whose existence becomes obstacles in our move to eliminate the factors for the power shortage. Obviously, we must reform the current administrative system of power consumption, practice comprehensive administration, and quickly establish a perfectly formed restraint mechanism in order to alleviate the shortage.

To deal with the above advantages, we suggest developing a restraint mechanism marked by the features of multi-direction, diversification, and different pricing.

The feature of multi-direction is to make the supplier and the consumers subject to mutual restraints by rationalizing the relations between them. Electricity is a special and important means of production and livelihood that must be monopolized by the state. However, its property of being a commodity is an objective existence. In the final analysis, the relations between the supplier and the consumer are the one between supplier and purchaser, which is the relations of commodity economy. Therefore, there is no contradiction between the planning and the social nature of power generation and consumption. Besides, the shortcomings of "government-backed businessmen" in the power generation industry can be overcome.

The feature of diversification is to utilize a variety of means, such as economic, technological, administrative, and legal means, to administer the planned consumption of electricity. Under the circumstances in which there is a serious shortage in electricity, we must promptly utilize economic means and technological means, and really "impose restrictions on anyone whose consumption exceeds the assigned level" and "impose restrictions down to every household."

The feature of different pricing is to respect the law of value and reform the charges for the supply of electricity. We should charge a higher rate during the peak period, while charging a lower rate during the nonpeak period. We should use the economic lever to guide the consumption of electricity, to tap the potential of the network, and to maximize the comprehensive economic results of electric energy.

The features of diversification and different pricing of this new type of restraint mechanism can be easily accepted by people. In fact, many areas have recently conducted investigations and implemented them in varying degrees and have achieved certain results. We are afraid that people seldom know about the bidirectional feature of this restraint mechanism, and it is just this feature in which the core of this mechanism lies.

The bidirectional feature refers to the restraints on consumers by the supplier and the restraints on the supplier by the consumers, which include the economic obligations on planned consumption of power mutually undertaken by the two parties. The supplier imposes restraints on the consumers and urges them not to consume power beyond the assigned level, so as to strive to balance the generation, supply, and consumption of electricity, which is understandable and indisputable. Meanwhile, the consumers also impose restraints on the supplier, which we think necessary as well as practical. Proceeding from the characteristics of the whole process of generation, flow and consumption of electricity, the consumption of electricity is determined by its generation and flow. Therefore, the administrative system of the planned consumption of power should include the generation and flow of electricity, rather than being limited to its consumption. Besides, proceeding from the economic rules on exchange of commodities at equal value, consumers have an absolute right to lodge protests or even file claims for any sudden blackout due to human liabilities in the course of generation and flow of electricity, or any restriction on electricity supply as a punishment against them. Moreover, the generation of electricity is also marked by the characteristic of social benefit, which is related to tens of thousands of households, each and every trade. Consumers therefore have the absolute right to require the supplier to maintain the stability of the power supply, and put the power generation departments under the supervision of society. The self-construction of two civilizations by these departments also objectively requires them to improve the services and to voluntarily submit themselves to supervision by society. As the current power shortage is very serious, they are obliged to painstakingly organize the generation and flow of electricity, and to create prerequisites for establishing a coordinated order of power consumption by maintaining a continuous and stable generation and supply of electricity. Thus, we can see that it is absolutely correct that the electricity consumers should impose restraints on the supplier. Only when there are mutual restraints between the parties can we stabilize and maintain a balanced and coordinated order of power supply and consumption. This point was demonstrated by the experience of Yancheng City, Jiangsu Province, in implementing on a trial basis the contracted responsibility system of planned power consumption.

II. Competitiveness of Contracts, Reality of Alleviating the Power Shortage

In order to establish a new restraint mechanism, to balance and coordinate the power supply and consumption, and to alleviate as much as possible the power shortage, we should break through the regional and departmental boundaries, and urge the supplier and consumers to enter into contracts according to the Economic Contracts Law, thereby making the bidirectional restraints rational, equal, and legally binding.

Yancheng City's contracts on the planned consumption of power was divided into three levels.

First, it rationalized the relations with the network. The city planning committee, acting on behalf of the consumers, entered into a contract with the provincial power supply bureau, acting as the supplier, witnessed by the provincial planning and economic committees. The principle of the contract was to assign monthly power consumption plans on the basis of mandatory centralized distribution plans and to forbid the imposition of restrictions on the consumption if it did not exceed the assigned level. That portion of power consumption which exceeded the assigned level was levied an additional charge of 0.5 yuan per kWh. During the nonpeak period, that portion of power consumption which exceeded the assigned level was used as a guiding figure to increase the power supply rather than being settled against the quota under the centralized distribution plans. The network should make up for the amount of electricity not being supplied or make compensation at a rate of 0.5 yuan per kWh if any imposition of restrictions or blackouts took place because of the network. Second, the city power supply bureau, acting as the supplier, entered into several contracts with various counties (districts), acting as the consumers, witnessed by the city planning and economic committees. The principles of the contracts were the same as the above. Third, the city and county power supply bureaus separately entered into several contracts with their major consumers of electricity for industrial use. The contracts "assigned quotas and concluded agreements in three ways, and provided penalties," that is, the determination by the power supply bureau on the load of electricity, the quantity of electricity during the peak and nonpeak periods, and the power consumption per unit product by an enterprise; whereas the enterprise entered into contracts with the competent department on the output value, quantity and profits. This department was responsible for punishing enterprises that could not perform their obligations. Contracts were also entered into with other industrial enterprises according to their actual conditions. Therefore, self-control by cities and counties was increased to more than 70 percent.

The execution of contracts between the suppliers and consumers means that both parties must undertake the economic responsibilities for planned consumption of power, and that their duties, rights, and interests were equal and united. These bidirectional restraints were competitive. This is because nobody wants to be in an embarrassing position and undertake his obligations because of his breach of contract. Proceeding from the results of the system since its introduction by the city in April 1987, we can see that it has played a significant role in alleviating the power shortage.

First, it established a balanced and coordinated order of power consumption. In the 9 months following its introduction, the city imposed only on 21 occasions restrictions on the power supply because the consumption level exceeded the assigned level, which showed a monthly drop of 87.3 percent compared to the number of occasions on which restrictions were imposed before the introduction of the system. At the same time, it succeeded in maintaining a balance in the planned quantity of electricity. Following the introduction of the system, localities had the initiative in power consumption could really "safeguard the key projects, and supply power to the prior ones," and improved the social benefits brought about by the consumption of electric power. A number of core enterprises making fist products no longer worried about the risk of having restrictions on their consumption and of blackouts. The number of the city's enterprises that delivered over 1 million yuan of profits and taxes was increased by 50 percent when compared to the previous year. In 1988, the producer of the well-known "Yan Wu" radio-cassette recorder ranked top of the trade in terms of output value, output volume, profits realized, and productivity. The city's gross industrial output value was increased by 22.2 percent when compared to the previous year, which exceeded the average growth rate of the whole province. After entering into the contracts, Funing County put an end to the previously chaotic order of power supply and consumption, and increased its realized profits by 50 percent, being ranked top of the city.

Second, it tapped the potential of the network during the nonpeak period, so that it achieved a sound growth rate in terms of power consumption. Under the circumstances where the quotas of 1987 mandatory and guiding plans on power consumption were lower than those of 1986, the city consumed an additional electric quantity of 167 million kWh by organizing overnight power generation, which accounted for 10.6 percent of its annual power supply or 25 percent over the power supply during the nonpeak period. This was equal to the installation of a set of 30-million worth of 25,000 kilowatt generators without spending a cent. The power supply departments also increased their income by 12 million yuan.

Third, it promoted the conservation of electricity, and improved the efficiency of power consumption. After the contracts were entered into, the order of power consumption became coordinated and stabilized, so that the power consumption per unit product of industrial enterprises was dropped. The 1987 assessment on the power consumption per unit product showed that 41.7 million kWh of electricity was conserved, an increase of 23,285,000 kWh when compared to 1986. The 1987 power consumption per 10,000 yuan of output value was also 311 kWh less when compared to 1986. In the first quarter of 1987 (before the execution of its contract), the city's textile mill, whose annual output value exceeded 100 million yuan, increased the occasions of switching on and off its equipment because of restrictions on irregular occasions of blackout, so that its consumption of electricity per each ton of yarn increased to 1,361 kWh and exceeded its limits. In the second quarter (after the execution of its contract), however, its power consumption per each ton of yarn sharply dropped because of a stable supply of electric current. Its annual power consumption per each ton of yarn was 260 kWh below the assigned level, reaching the advanced level. The power

consumption per unit product of synthetic ammonia made by the city's chemical fertilizer industry was also 26,775,000 kWh below its assigned level.

Besides, through the implementation of contract system on a trial basis, the city has further strengthened its ideology on self-control and its capability of meeting an emergency, perfected the administration of power consumption, and improved the relations between the suppliers and consumers. Their experience will be much more valuable if the city goes further and levies different charges for electricity supplied during the peak period and that during the nonpeak period.

3210/9365

Northeast Suffers From Serious Power Shortage

40130006b Beijing ZHONGGUO XINWEN SHE in Chinese 0244 GMT 20 Sep 88

[Report: "There Is a Serious Shortage of Electric Power in Northeastern China"]

[Text] Shenyang, 20 Sep (ZHONGGUO XINWEN SHE)--Northeastern China, which constitutes an important economic region of the country, is now suffering from a serious shortage of electric power. Therefore power supply has to be rationed in this part of the country.

Reports say that northeastern China is short of 55 million kilowatt hours of electric power per day, which makes up 20 billion kilowatt hours per year. This seriously restricts economic development in northeastern China. During the previous 5-year plan, 20 percent of industrial equipment in this part of the country could not be put into operation due to a power shortage.

Power plants in northeastern China have been in overload operation, with extra generated power of 10 million kilowatt hours per day. During the first 7 months of this year generated power increased by almost 8 percent over the corresponding period of last year, but during the same period northeastern China registered industrial growth rates ranging from 9 to 16 percent. Power supply cannot meet demands. To top it all off, floods and drought have frequently occurred this year, thus prompting a sharp increase in the demand for power supply. Power supply for urban and rural daily life has also increased. Power supply during the first 7 months of this year in Liaoning Province alone increased by almost 30 percent over the corresponding period of last year. Moreover, rural enterprises are using outmoded high energy-consuming equipment that has been discarded from the urban areas. This has aggravated the power shortage in northeastern China.

According to the prediction by a responsible person, the "power shortage" in northeastern China will become more serious this winter and next spring because water levels in five major reservoirs in this part of the country are unprecedentedly low, apart from the fact that coal for thermal power stations has fallen short of supply.

At present, power supply departments in northeastern China are trying every possible means to stabilize the normal generation of electric power networks on the one hand and, on the other, to build 2 million new kilowatt generating units and put them into operation this year so as to alleviate the power shortage.

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Provinces Cooperate on Power Resources

40130002 Beijing ZHONGGUO XINWEN SHE in Chinese 0137 GMT 31 Aug 88

[Report: "Guangdong, Guangxi, Guizhou, and Yunnan Cooperate in Exploiting Power Resources"]

[Text] Nanning, 31 Aug (ZHONGGUO XINWEN SHE)--Led by the Ministry of Energy and the State Energy Investment Corporation, Guangdong Province, Guangxi Zhuang Autonomous Region, Guizhou Province, and Yunnan Province have recently reached agreement and signed a letter of intent on constructing three thermal power plants and two hydropower stations.

The projects agreed upon include: the construction of the Baishui Thermal Power Plant in Qijing County of Yunnan Province with a capacity of 600,000 kW, with its 220 kV transmission project, which is jointly invested in by Guangdong and Yunnan provinces; the stage one construction project of the Anshun Thermal Power Base in Guizhou with a total output of 2.4 million kW jointly invested in by Guangdong and Guizhou provinces and the State Energy Investment Corporation (with an installed capacity of 600,000 kW); the construction of the Panxian Thermal Power Station in Guizhou with an installed capacity of 600,000 kW invested in by Guangxi Autonomous Region and Guizhou Province and the State Energy Investment Corporation; and the Tianshengqiao first cascade hydropower station on the Hongshu He with a total output of 1.64 million kW jointly invested in by Guangdong, Guangxi, and Yunnan provinces (Autonomous Region) and the State Energy Investment Corporation. The Ministry of Energy, the State Energy Investment Corporation and Yunnan, Guangxi, and Guangdong provinces (Autonomous Region) also concluded and signed a letter of intent for their joint investment in the construction of the Longtan Hydropower Station on the Hongshui He.

The total power supply of the above projects will be 5.24 million kW. The power supply of the first stage of construction will include a thermal power supply of 1.8 million kW and a hydropower supply of 1.64 million kW, totaling 3.44 million kW. Of the total investment amount of about renminbi 7 billion, more than half will be carried by Guangdong Province. The proportion of investment by state finance is only 20 percent of the total investment.

In the past, Guangxi, Guizhou, and Yunnan lacked capital for exploiting hydroelectric and coal resources; while Guangdong Province seriously lacked

energy. Now, with their cooperation in the exploitation of electric power resources, each province or autonomous region can contribute its strong points and benefit the other provinces (autonomous region). It is reported that with the exception of the Longtan hydropower station, for which the agreement is to be concluded and signed after its initial design is examined and approved, the construction work of the four other projects will be prepared or begun in the latter half of this year, and they are planned to be completed and put into production successively from 1991 to 1994.

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New Companies Based on Disbanded Energy Ministries

40100005a Beijing XINHUA in English 1611 GMT 19 Sep 88

[Text] Beijing, September 19 (XINHUA)--Three new corporations in charge of China's production and management of coal, oil and gas, and nuclear energy were founded last week with the approval of the State Council.

The new corporations are the China General Coal Corporation, the China Oil and Gas Corporation, and the China National Nuclear Corporation.

Based on the former ministries of coal, oil and nuclear, which have been disbanded, the new corporations were set up in accordance with the principle of separating governmental functions from those of enterprises.

All three corporations have legal status and operate independently under the general management responsibility system.

The companies will adopt independent accounting procedures and assume sole responsibility for their profits and losses.

The China General Coal Corporation will assume all the projects not completed by the former coal ministry for the last three years of China's Seventh Five-Year Plan and build several regional coal combines in the next two or three years.

The China Oil and Gas Corporation is to establish a foundation to develop risk capital for oil and gas exploration at new oil fields and perfect the existing managerial responsibility system to ensure an annual increase of 21 million barrels (bbl) of crude oil in the next five years.

The China National Nuclear Corporation will turn some military product factories into enterprises for commodity production, while concentrating on nuclear research.

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Briefs

More Power Generating Equipment--Beijing (CEI)--More than 1 million technicians and workers from 1,000 machine-building firms are involved in a nationwide effort to turn out more power generating equipment in China. The equipment produced in China between January 1986 and June 1988 had a total power generating capacity of 20.6 million kW, Zhao Mingsheng, vice minister of the machine-building and electronics industry said yesterday at a national meeting. Of it, equipment with a power-generating capacity of 16.87 million kW has joined the power grid, Zhao added. [Text] [40100002a Beijing CEI Database in English 1 Sep 88] /9365

Big Batch of Generators Slated for East China Grid

40130015a Shanghai WEN HUI BAO in Chinese 19 Sep 88 p 1

[Text] For the next 2 years, the East China Grid will install 2.8 million kilowatts of electric power generating equipment a year, creating an all-time record for installed capacity to be made operational by any grid in China in a 1-year period.

In a capital construction conference of the East China Grid convened in Shanghai yesterday, it was revealed that next year it was planned to install 16 generator units in the Wangning, Nantong, Xinhai, and Yangzhou power plants in Jiangsu Province; the Zhenhai hydropower station and the Shitang power plant in Zhejiang Province; the Pingyu and Tongling power plants in Anhui Province; and the Shidongkou power plant in Shanghai. An additional 12 generator units are to be operational in 1990.

According to experts, there are two special features of these generator units to be installed over the next 2 years in the East China Grid: 1) The large capacity: 12 generators of 200,000 kilowatts (or more) installed capacity, including 3 units with a capacity of 600,000 kilowatts; and 2) new technology, examples of which are the 300,000-kilowatt Qinshan nuclear power plant and the 600,000-kilowatt supercritical generators of the Shidongkou No 2 power plant, both of which are using technologies considered to be state-of-the-art by the international electric power industry.

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Decisions on, Inspection, Progress of Three Gorges Project

Sichuan Wants Early Decision

40130006a Chengdu Sichuan Provincial Service in Mandarin 2300 GMT 21 Sep 88

[Text] The CPPCC group inspecting Hubei and Sichuan arrived in the mountain city of Chongqing on 21 September. Gu Jinchi, deputy secretary of the provincial party committee; Li Peigen, vice chairman of the provincial CPPCC; and responsible comrades of the party, government, and army in Chongqing, including Sun Tongchuan, greeted the group at the quay.

In the afternoon, the leading comrades of the province and city reported to the inspection group on the Three Gorges project and other matters. Gu Jinchi said: The Three Gorges project, which affects the overall situation, is by no means an ordinary project. We will resolutely abide by the final decision of the CPC Central Committee and State Council. The fact that no decision has yet been taken on the Three Gorges project has too great an impact on construction on the upper Chang Jiang, especially in those areas scheduled to be inundated. We hope that an explicit final conclusion will be made as soon as possible, on the basis of scientific demonstration and proof. At the same time, when formulating a scheme and adopting measures, it is necessary to take account of the interests of the upper and lower reaches of the river, and to take full consideration for Sichuan's economic development and for the stability and unity of the people in the reservoir area.

Gu Jinchi said that for the lower reaches to benefit and the upper reaches to suffer has been the actual case in China's water conservancy construction for many years. Can we change this situation into one by which both the upper and lower reaches benefit and get rich together? We hold that this is not only possible; it is also the way things ought to be. For this reason, we must first resolve properly and well the population movement problem in accordance with new ideas and guidelines. This is not only an economic but also a social problem, and an issue related to other success or failure of the project and to social stability. Second, Sichuan's extreme shortage of electric power must be fully considered. I propose that we should now get to work to exploit the hydroelectric resources on the upper Chang Jiang and on the Jinsha and Min. In addition, in the design and the future operational management of the Three Gorges project, it is

necessary to simultaneously consider antiflood measures and navigation of the upper reaches, so as to give scope to the transport function of the Chang Jiang as the golden waterway.

Comrade Gu Jinchi also reported to the CPPCC inspection group on Sichuan's economic development and its problems that urgently need resolving.

Zhou Peiyuan, leader of the group, spoke at the meeting. He fully endorsed the achievements of Sichuan Province and Chongqing City in economic construction and reforms, and hoped that they will take further advantage of their strong points in abundance of talent and resources, to exploit the province's hydroelectric resources and do still better in economic construction and reforms.

Local Governments Seek Early Decision

40100006a Beijing XINHUA in English 0740 GMT 27 Sep 88

[Text] Beijing, 27 Sep (XINHUA)--Local governments and people in areas that are expected to be completely covered by water as a result of the construction of the proposed Three Gorges reservoir, have asked for an early decision on whether the project is to be built or not.

The residents' fears were voiced to a XINHUA reporter who accompanied the inspection group of the National Committee of the Chinese People's Political Consultative Conference on a recent trip to Hubei and Sichuan provinces.

If the water behind the dam reaches a level of 175 meters, the total area of the proposed Three Gorges reservoir will cover 1,084 square kilometers, submerging 632 square kilometers of land.

As a result, more than 725,000 people would have to be resettled if the project goes through.

Guo Zhenqian, governor of Hubei Province, explained that "the Three Gorges project is a key project in taming the Yangtze River. It will have extremely great benefits for flood control, power generation and navigation."

However, he pointed out, during recent decades economic development in three counties of west Hubei was considerably affected because the final decision has not yet been made.

"These are the poorest areas in our province," he said. "Because social and economic development cannot be fully carried out, they have become poorer. Therefore, we hope the central government will make the final decision as early as possible."

East Sichuan Province's Wanxian Prefecture is located in the central part of the reservoir. If the project is built, part of Wanxian City and seven counties will be affected.

Leaders of the prefecture told the visiting XINHUA reporter that the local economy has suffered a lot because the project has been suspended for too long. "We cannot build up the old town, neither can we build a new one," they complained, adding, "economic and social development of the whole prefecture has thus been greatly hampered."

The community leaders also mentioned that plans for the resettlement of the local population should be based on a comprehensive census of the population and a thorough investigation of their needs, and said that "results of experiments in the past two years have shown that provided with adequate measures and early preparations, people could be happily resettled."

Officials of Fuling Prefecture in east Sichuan also noted that three decades have past since the Three Gorges project was formally proposed in 1958. During this period, many other projects were cancelled or postponed because no final decision has been made.

"We cannot do what we wish, neither can we help doing nothing. We are cornered," they said.

Fengdu is one of the historical towns in this prefecture. It now has a population of 730,000. But the income of its residents is lower than the national average. What is more, one-third of the population are still struggling to obtain such simple necessities as food and clothing.

Local people have demanded that the top leaders make up their minds as quickly as possible, so that "the state could carry out its construction plan and we could do what we should do to enrich ourselves."

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Small-Scale Hydropower Doubles in 10 Years

40130012a Beijing RENMIN RIBAO in Chinese 31 Aug 88 p 1

[Text] It has been learned from the National Rural Hydroelectric Symposium ending today, that the installed capacity of China's small-scale hydroelectric systems has reached 11.1 million kilowatts, doubling in the 10 years from 1978 to 1987. Generating capacity increased from 10 billion kilowatt-hours to 29 billion kilowatt-hours, an expansion of 190 percent. Over 63,000 hydroelectric generating stations of under 25,000 kilowatts have been built and more than 680,000 kilometers of 10-kilovolt power lines have been erected. Small-scale hydroelectric construction has entered a period of vigorous development.

After the 11th Plenary Session of the Party Central Committee, the central leadership placed great emphasis on small-scale hydropower construction. Premier Li Peng suggested three guiding principles: self-construction, self-management and self-utilization. He also indicated that the central problems in development of small-scale hydropower are the need for independent generating capacity and electrical networks and the need to improve local knowledge about small-scale hydropower development. Over the past few years in an overall environment of reform, deregulation and economic survival, small-scale hydropower construction has followed the policies indicated by the central leadership. Thus gradually instituting an effective management system, stressing economic benefit and greatly promoting small-scale hydropower development. At present the extent of small-scale hydroelectric development is considerable. Its installed generating capacity represents one-ninth of the country's total installed capacity. One-third of the nation's counties and 40 percent of county-run industries as well as rural enterprises, irrigation and drainage, processing of agriculture by-products and the electricity used by farmers all rely heavily on small-scale hydropower. Small-scale hydroelectricity has become the third pillar of the country's electric power system.

China's rural electrification effort has been furthered by the development of small-scale hydropower. In 1983 the State Council decided to designate 100 counties as pilot areas for small-scale hydropower electrification. As of the first half of this year, 24 counties had reached the original, basic electrification standard (200 kilowatts average use per person) issued by the Ministry of Water Resources and Electric Power. By the end of the year 24 more counties will have reached this target. By 1990 the 100 county goal will be achieved.

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Curtain Goes Up on Ambitious Lancang Jiang Project

40130004b Beijing RENMIN RIBAO in Chinese 27 Jul 88 p 1

[Text] After an overall investigation of the Lancang Jiang valley, 40 experts and professors fully confirmed a plan recently put forward by Yunnan Province to make electric power the core of the development plan for this river valley. They also brought up important opinions and suggestions concerning other aspects. Today, the governor of Yunnan Province, Han Zhiqiang, and other government officials are in the capital conferring in depth with specialists and theorists on development plans.

The conference participants without exception consider that the conditions for accelerating the development of hydroelectric power in the middle and lower reaches of the Lancang Jiang, as well as the conditions for establishing a zone of economic development, already exist and that the curtain has already risen. With good execution of the policy to make electric power the core of the development program and with a revolution in management systems, it is entirely possible that within 20 or so years hydroelectric development could be completed, creating a new route for developing the western regions.

After the investigation, the specialists and professors concluded that the potential of the Lancang Jiang valley is excellent in terms of mineral, biological, and particularly, hydroelectric resources. If the 18 million-kilowatt potential of the Lancang Jiang is developed and is combined with the phosphate resources (ranked number one nationally for quality), this will form a solid foundation for the valley's economy.

The investigating group also suggested an independently managed joint stock company be set up as soon as possible to develop the hydroelectric potential of the Lancang Jiang. Yunnan Province would lead the organization of a board of directors and put into effect a general manager responsibility system. The Manwan power station would be incorporated under the company's management. Its operating revenues would provide the company's industry development fund. From many aspects and in many ways funds could be raised. It is hoped that within 20 years the eight cascade power stations of the middle and lower Lancang Jiang will be developed to their full 13.7 million-kilowatt potential. At present, through cooperation, Yunnan has invested 30 million yuan to attract 300 million yuan in funding from outside the province.

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Briefs

Longyangxia Update--After 6 years of construction, most of the main reservoir dam of the Longyangxia hydroelectric station has risen to its design height of 178 meters, with the lowest portion now standing at 161 meters. The Longyangxia hydropower station has been dubbed a "spigot project." Its dam is the highest concrete gravity dam in the country (up to now, more than 2.7 million cubic meters of concrete have been poured). The reservoir at Longyangxia is now the largest in China, with a capacity of 24.7 billion cubic meters of water; the reservoir now holds 6.1 billion cubic meters. Once completed, the reservoir will play a pivotal role in energy regulation, capable of controlling the downstream volume of water and thereby reducing the threat of flooding. [Excerpts] [40130003 Beijing RENMIN RIBAO in Chinese 17 Aug 83 p 1] /9365

Big Dalian Plant Ahead of Schedule

40130004a Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 22 Aug 88 p 1

[Text] Premier of the State Council Li Peng on August 20 in Dalian received Mitsubishi Heavy Industries Chairman Y. Iida and Chairman of the Japan Electric Power Development Corporation I. Fujita who came to participate in the start-up ceremony of the Huaneng Dalian No 1 generating set. Li Peng expressed his gratitude for Japan's cooperation in the establishment of China's electrical power industry.

Li Peng said, "The smooth integration of the Huaneng Dalian Power Plant indicates the success of the economic cooperation between China and Japan. Japan has provided this power plant with a great deal of support in technical areas, equipment, and management. We are satisfied with this."

"It is hoped that H. Suzuki, when he assumes his position as plant manager will be strict in his management, will fully execute his authority, and will manage the plant according to advanced international methods," Li Peng added.

Li Peng said, "In a few days Prime Minister Takeshita will arrive in China for a visit. We hope this visit will produce a positive effect on the development and consolidation of the friendly relations between China and Japan."

Y. Iida and I. Fujita have indicated willingness to continue cooperation with China to make the Huaneng Dalian power plant the most advanced modern plant in the world. Chairman Fujita forwarded Prime Minister Takeshita's best regards to Premier Li Peng.

The Huaneng Dalian power plant is one of the important energy resource projects ratified by the State Council as part of the Seventh 5-Year Plan (1986 to 1990). Work was begun on this project on 1 August 1986. After only 24 months the first 350,000-kilowatt generating set was completed. This was 6 months ahead of schedule.

Li Peng praised both the speed and the approach used in the Huaneng Dalian power plant project. He hopes that all of China's electric power projects will learn from the experience of the Huaneng Dalian project to incorporate speed, high quality and low construction costs in developing the electrical power industry.

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Briefs

Nation's Largest Thermal Power Plant--The Ligang power plant--China's largest thermal power plant (located at Wuxi in Jiangsu Province)--is now under accelerated construction. The agreement to import the complete set of generators was signed recently in Beijing. The first of the generating units will go on stream at the end of 1990; the power plant will have an installed capacity of 2.6 million kilowatts. [Text] [40130015b Shanghai WEN HUI BAO in Chinese 19 Sep 88 p 1] /9365

Tough Problems Foreseen for Chinese Coal Industry

40130007 Beijing MEITAN KEXUE JISHU [COAL SCIENCE AND TECHNOLOGY] in Chinese No 7, Jul 88 pp 2-3

[Article by Tang Dequan [3282 1795 0356]: "Three Major Problems in the Development of the Coal Industry"]

[Text] China's mid- and long-term energy needs springing from its economic development requirements are great: about 1.4 billion tons of standard coal in the year 2000, about 3.4 billion tons in 2030, and about 5.6 billion tons in 2050. If we assume that coal will account for respectively 70, 60, and 50 percent of these amounts, the quantities of raw coal required will be 1.4, 2.9, and 4 billion tons. This large coal requirement involves major difficulties for the mid-term and long-term development of the coal industry. To assure the coal supply it will be necessary to rely on scientific and technical progress to solve three major problems: coal extraction from deep mines, coal transport, and pollution caused by coal.

1. Deep-Mine Coal Extraction

Economic expansion is putting increased pressure on the coal supply, and the depth from which coal is mined will be steadily increasing. The average depth is currently about 350 m, and it will be increasing by about 10 meters a year, with attendant increases in rock pressure, the amounts of escaping gases and water, and ground temperatures, so that the conditions under which coal is mined will deteriorate steadily, and investment per unit output and production costs will rise steadily. Owing to cramped underground working conditions, increased environmental danger and continuously changing production conditions, the coal mining industry continues to be a labor-intensive industry by world standards. Mid-term and long-term increases in the output of the coal industry must be based on scientific and technical progress, using new scientific and technical achievements, and must make the transition from low technology to high technology; otherwise it will be difficult to assure safe, efficient large-scale increases in coal output under complex, highly variable coal mining conditions, with a deteriorating mining environment.

Integrated mechanization of coal mining has been recognized throughout the world as the first revolution in modern coal mining technology and has already been implemented in the advanced coal-mining countries. In China,

integrated mechanization has been only about 25 percent achieved, so that the situation of raising output without increasing personnel has not been thoroughly rectified.

The second technological revolution in the coal industry involves computer-based automation of coal mining, including the use of microelectronics to control coal mining systems and the practical utilization of CAD/CAM systems. The trial utilization of fiber-optic communications and industrial robots will pave the way for computer-controlled automated coal mining. Improved coal winning technology, new technologies for underground coal gasification and liquefaction, and new methods of coal winning such as chemical fracturing and microbial decomposition of coal, are in the experimental or exploratory stages, and it is difficult to predict whether they will come into practical use in the next century.

Coal chemical engineering, centered on underground gasification and liquefaction, will be the third revolution in coal technology. World reserves of coal far exceed those of petroleum and natural gas, and an energy structure with coal as its mainstay will continue. While developing hydroelectric power, nuclear power, and other renewable energy resources, coal conversion technology must make major breakthroughs, allowing it to produce synthetic fuels and chemical engineering feedstocks on a large scale in order to replace petroleum and natural gas. Preliminary estimates indicate that by the year 2030, nearly 60 percent of world coal output will be used to produce synthetic fuels.

2. Coal Transport

Coal will continue to be the mainstay of China's energy structure in the mid term and long term, with coal output reaching respectively 3 and 4 times the present level. The coal supply areas are primarily in Shanxi, western Inner Mongolia, Shaanxi, Ningxia, and western Henan, while the energy-poor areas of the country are in east China, north China, and south China; as a result, the need to transport coal from north to south and from west to east is unalterable.

According to 1984 statistics, the total output of raw coal was 780 million tons, while rail transport could account for only 490 million tons, or about 62 percent of the total. Raw coal transport accounts for about 40 percent of total rail haulage. Many mines have stockpiles of coal that they cannot ship, and the policy of setting production targets with reference to transport capacities is used to prevent spontaneous combustion of the coal. Coal output in the mid term and long term will be respectively 3 billion and 4 billion tons, and if the necessary steps are not taken to solve the coal transport problem, it will be difficult to assure the expansion of the economy.

These are ways of solving this problem:

a. Increasing the percentage of coal that is washed, decreasing the moisture, ash, and gangue content of raw coal, and decreasing the amount of unproductive haulage. Less than 20 percent of all raw coal in China is now

washed, and almost none of the coal used to produce motive power is washed. Hauling high-quality coal will greatly decrease haulage requirements and lower haulage costs.

b. Increased on-site or local coal processing and utilization in order to decrease haulage. Brown coal and low-caloric-value coal are not worth hauling: they should be consumed on site or locally, pithead electric power plants should be built and combined coal and power production operations should be developed. We should make use of our advantages in respect to coal, step up coal conversion and processing in coal-mining areas, and gradually develop integrated chemical-engineering utilization of coal and diversified operations.

c. Expansion of diversified transport methods in order to increase coal haulage capacity. Rail haulage is now the mainstay of coal transport, accounting for about 54 percent of the total. We should vigorously expand the use of specialized through-trains to increase transport capabilities. In addition, we should make thorough use of water transport, step up port construction, and develop combined water and land haulage. Pipeline transport of coal and high-voltage electric power transmission are additional methods of solving the coal transport problem, and they too should be developed where technical and economic conditions are suitable.

3. Pollution Caused by Coal

Direct burning of coal is a major source of air pollution; it produces acid rain and flyash, causes environmental pollution and ecological damage, and constitutes an extremely grave problem in the large-scale expansion of coal production. According to preliminary statistics, the total amount of flyash emissions resulting from coal combustion is fully 13 million tons per year, total sulfur dioxide output is 10 million tons a year, and the output of nitrogen oxides is 3.4 million tons a year; 96 percent of pollutants resulting from the combustion of fuels come from the direct combustion of coal. Total suspended particulate matter in the atmosphere of northern cities has reached 0.93 mg/m^3, several times the world figure, and the total sulfur dioxide concentration has reached 0.12 mg/m^3. In areas where high-sulfur coal is used, sulfur dioxide pollution is so severe that acid rain is already occurring.

In terms of coal quality, we have large amounts of low-sulfur coal, but as coal is mined from increasingly great depths, the amount of high-sulfur coal will increase. The frequency of high-sulfur coal seams will increase in north China and east China, so that the quality of the coal mined there will decline. Failure to take strict measures to control environmental pollution in the course of the large-scale expansion of coal output in the mid and long term will lead to unthinkable consequences.

The United States has drafted a "Clean Coal Technology Plan" to decrease pollution from coal and to increase the efficiency of its use; $6 billion is to be invested under this plan between 1986 and 1992. After a comprehensive evaluation, the U.S. Department of Energy has identified nine priority technologies; coal selection, advanced boilers, fluidized-bed

combustion, flue gas purification, surface coal gasification, coal-gas fuel cells, underground coal gasification, coal liquefaction, and new technologies for direct refining of iron. These technological measures merit our examination.

The following steps should now be taken:

a. Increasing the percentage of coal that is washed; high-sulfur, high-ash coal for motive power should also be washed in order to decrease coal-produced pollution.

b. Increasing the gas purification and sulfur removal capabilities of electric power stations and manufacturing plants and control of flyash and pollutant gases.

c. Vigorous development of coal gas and clean coal for provision to city dwellers.

d. Research and development in advanced coal combustion and conversion (gasification and liquefaction) technologies.

e. Strict standards for controlling pollutant emissions, and the drafting of environmental management regulations.

It will be necessary to rely on scientific and technological progress to resolve the three major problems described above. The coal industry must accelerate its technical progress and carry out modernization. We must begin our efforts now, perceiving the looming energy crisis in mid- and long-term economic development before the coal supply becomes tight. We must use new technologies, new processes and new equipment to implement centralization and integrated mechanization and automation of coal production. We must vigorously develop the processing and utilization of coal, on-site conversion, and diversified operations, make highly efficient use of coal resources, conserve transport, decrease environmental pollution, increase enterprise vitality, and increase economic efficiency.

Because coal prices are currently too low, the industry has long been losing money, has had a shortage of funds, and has lacked the vitality needed for modernization. The experience of the world's main coal-producing countries indicates that not only must the coal industry make a vigorous effort to strengthen itself, but in addition the state must give it aid and support in terms of policy and funding so that it will be able to supply the coal needed for the expansion of all industries in the mid and long term, enabling the economy to achieve sustained, stable, and coordinated development.

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Lu'an Leads Way to Modern Coal Industry

40130001 Beijing GUANGMING RIBAO in Chinese 15 Aug 88 p 1

[Excerpts] In 1985, former coal industry minister Yu Hongen traveled to the Lu'an Bureau of Mining located in the Shangdang Basin of Changzhi in Shanxi. After his inspection, he said emotionally, "In Lu'an we already see a modern coal industry in China." In the 3 years that have passed since then, a revolutionized Lu'an has changed with each year. It has led the modernization of China's coal industry.

While the foundation of China's coal industry is inadequate and the level of technology is low, in the mechanization of extraction, loading, and transportation, as well as in work integration, pit production capacity and fatality rate per million tons mined, Lu'an is comparable to the world standard.

In the world's important coal producing countries, mechanization has reached 100 percent, integration is 70-80 percent, labor productivity has reached 3 to 4 tons per worker and the death rate per million tons mined is 0.5. At Lu'an the level of mechanization is 100 percent, integrated extraction has increased to 97 percent, labor productivity is nearly 4 tons per worker. Among these mines, Wang Zhuang and Zhang Cun have reached a labor productivity rate of 5 tons. The safety situation at Lu'an is excellent, the fatality rate is 0.45 workers per million tons mined. This year, to date there have been no fatal accidents. As of 15 June, Zhang Cun mine has had 3 consecutive accident-free years.

Worldwide, few mines have two teams simultaneously producing a million tons per year. But at the Wang Zhuang mine in Lu'an the two teams have reached this level for 4 consecutive years. One of these teams last year produced 1.7 million tons, breaking the world record of 1.654 million tons set by a team in the Soviet Union in 1986. China now has 19 teams producing at least 1 million tons. Six of these teams are from Lu'an.

In 1984, relying on deep excavation, production was raised to 6.04 million tons. Lu'an concluded a contract with the State under the terms of which, beginning in 1985, production would be increased to 7.3 million tons by 1990. However, through reliance on comprehensive extraction, mechanization of digging and transport automation, by 1986 production had reached 8.02 million tons. The contract's objectives were fulfilled 4 years ahead of

schedule. This represents a 1.4-fold increase over the original capacity. Prior to 1978 the average income of Lu'an residents was less than 900 yuan. Last year, apart from 70 million yuan paid to the State as profit tax, the average income had increased to 2,500 yuan.

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Shenfu-Dongshan Becoming Major Coal Base

40100006b Beijing XINHUA in English 1418 GMT 17 Aug 88

[Text] Xi'an, 17 Aug (XINHUA)--Mobilizing collectives and individuals at the Shenfu coal field has proven effective in making the best use of China's natural resources.

The field, which lies on the border of northwest China's small-scale Shaanxi Province and the Inner Mongolia Autonomous Region, covers 32,000 sq km. The field boasts reserves of 239 billion tons of high quality coal, which has a low ash and phosphorus content.

So far, work is underway on 25 pairs of shafts, each with a designed annual capacity of 60,000 tons of coal. All projects were constructed with funds raised by local farmers without state assistance. Farmers in Shenmu, Fugu, and Hengshan counties have also started up 300 collectively run pit mines.

During first-phase construction, which will be finished in 1992, the field will turn out 12 million tons of coal a year, but output is expected to increase five-fold when the whole project starts up in the year 2000.

Construction at the site is proceeding under the principle "the state supplies the railroads while local farmers open the mines," which was put forward by party General Secretary Zhao Ziyang when he visited the Shenfu field in 1986.

Construction on a railway line linking the field with Baotou, the capital of the Inner Mongolia Autonomous Region, is in full swing and expected to be completed by the end of the year, while work on another railway line which runs from Shenmu to Shouxian County in Shanxi Province has also been started.

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Prospects for Shallow Coal-Formed Gas in Major Coal Fields

40130103 Chengdu TIANRANQI GONGYE [NATURAL GAS INDUSTRY] in Chinese Vol 8, No 2, 28 Jun 88 pp 12-18

[Article by Zhang Wuchai [1728 0063 0322], Li Mingchao [2621 2494 3390], Li Jing [2621 7234], Yu Xin [0151 2946], and Bai Gongzheng [4101 0361 2973] of the Geological Prospecting Branch, Academy of Coal Science: "Prospects for Shallow Coal-Formed Gas Resources in China's Main Coal Fields"]

[Text] **Abstract**

This article comprehensively discusses gas formation conditions, reservoir strata properties, and distributional characteristics of coal-formed gas in the primary coal systems of China's main coal fields in conjunction with projected coal field data. It makes a preliminary evaluation of shallow strata coal-formed gas resources in China and offers some opinions concerning future prospecting and research work on coal-formed gas.

Coal-formed gas (natural gas produced during the coalification process), which is formed mainly by humic organic matter in coal-bearing strata, has drawn increasing attention in many nations over the past 20-plus years. Several large coal-formed gas fields have been found in northern Europe, the Soviet Union, the United States, Australia, and other nations, and their yearly growth rates in gas output and reserves exceed the growth rates of coal and petroleum.

With the sole exception of China, all of the world's large energy-producing nations with rich coal and petroleum resources and high output also are nations with large natural gas resources. This is another indication of the great potential for coal-formed gas resources in China.

The basis for classification of coal-formed gas in this article is evaluation of prospects, categorizing coal-formed gas on the basis of depth of burial into the two main classes of shallow coal-formed gas (depth of burial < 1,500 m) and deep coal-formed gas (depth of burial > 1,500 m). Shallow coal-formed gas can then be classified on the basis of gas reservoir strata properties and gas accumulation characteristics into shallow accumulated coal gas (coal-formed gas which has accumulated in reservoir strata or even formed gas pools) and shallow coal seam gas (coal-formed gas preserved in coal strata, including mine gas, coal mine gas, coal seam

methane, and so on). Deep coal-formed gas can be divided into deep accumulated coal gas and deep coal seam gas. Below, we will discuss the oil formation conditions, reservoir strata properties, distributional characteristics, reserve prospects, and other aspects of shallow coal-formed gas.

I. Indications of Coal-Formed Gas and Distributional Characteristics of Coal Mine Gas

The fact that exploration and resources into shallow coal-formed gas got underway rather late in China and that there has been extremely limited concern for gas in coal field prospecting would lead one to believe that we lack coal-formed gas resources. After adding up and mapping already-discovered coal-formed gas in the coal, petroleum, and geology systems, however, it is apparent that there are widespread indications of coal-formed gas throughout China (Figure 1). They are widely distributed and there are many gas-producing strata, but an estimate of gas-bearing tendencies can only be outlined here because of the very limited extent of exploration in all areas.

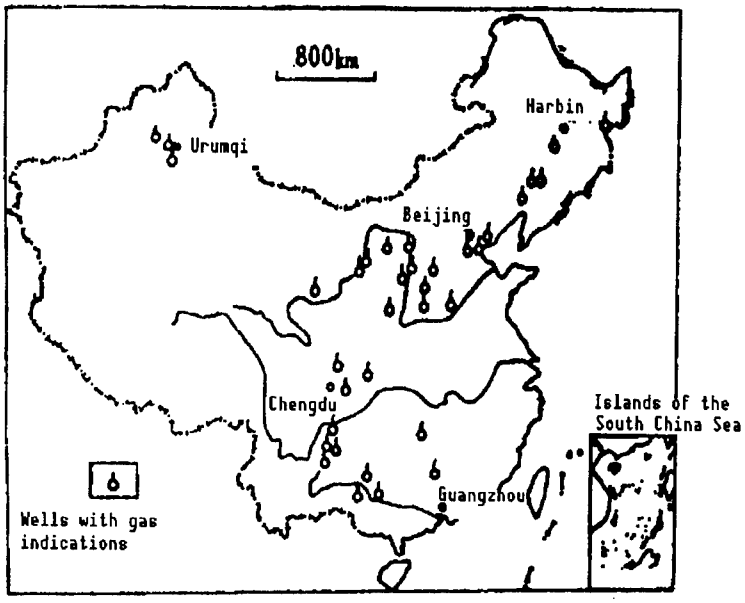

Figure 1. Indications of Coal-Formed Gas in China's Main Coal Fields

Gas eruption during drilling while prospecting coal fields are found in Inner Mongolia, Shaanxi, Ningxia, Xinjiang, Shanxi, Hebei, Liaoning, Sichuan, Guizhou, Hunan, Guangxi, and other regions. Among them, the ares with more concentrated gas indications include the eastern margin of the Ordos Basin and the southern margin of the Junggar Basin, in the Qinshui, Fuxin, Tiefa, Shenbei, Tangshan, and other coal fields, and in Sichuan, western Guizhou, central Hunnan, and other regions. There are even more gas leaks from drilling during prospecting. Most of the coal-formed gas discovered during construction by petroleum and geology departments is located in deeper strata in each of the coal fields, generally at a depth of burial of about 3,000 m.

In summary, the previously discovered gas indications are distributed mainly in regions with rich coal resources in China. The primary gas-producing strata are the Carboniferous and Permian Systems in north China, the Upper Permian System in south China, the Upper Jurassic System (containing the Lower Cretaceous System) in northeast China, and the Lower and Middle Jurassic System in northeast China.

As for the coal mine gas situation in China, Figure 2 shows that high methane and eruptive mines are concentrated in east China. Located in the north are the Hegang, Shuangya Shan, Yingcheng, Fushun, Fuxin, Tangshang, Fengfeng, Jiaozuo, Yuxian, Lianghuai, and other mines, spread out in a more-or-less northeasterly orientation. There also is a rather high gas content in the Daqing Shan--Zhuozi Shan region of Inner Mongolia. Low-methane mines predominate across another vast region in Shandong, Xinjiang, Qinghai, Gansu, and other regions. In terms of their geological age, the eruptive and high methane mines in north China are located primarily in Carboniferous and Permian coal systems, with secondary ones in Late Jurassic era (containing Early Cretaceous Era) coal systems.

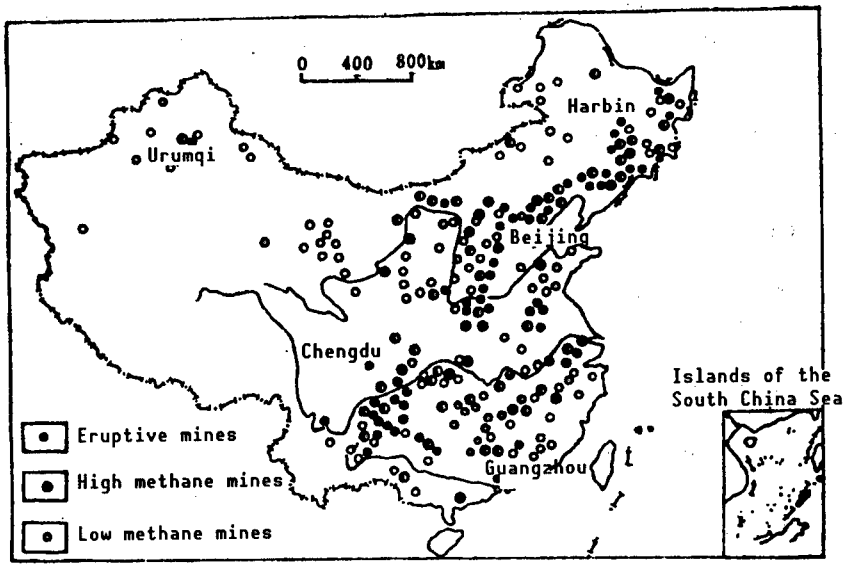

Figure 2. Distribution of Coal Mine Gas Grades in China's Main Coal Fields

The distribution of high methane and eruptive mines in south China is complex, but most occur in Late Permian coal systems. According to resources done by Wang Zhuquan [3769 4554 3123], et al.,[1] the shape of coal field structures in the Upper Permian System Longtan coal system in south China are mainly folded, with secondary fracturing. Along the northwestern and southeastern side of the Jiangnan Uplift, there is an arc-shaped folded zone which is an area of rather concentrated compressive stress. Several high methane and eruptive mines are located exactly along this zone in a band that is roughly identical to the lean coal and anthracite coal band demarcated by Wang Zhuquan, et al., as well as with the zone of unusually concentrated crustal material groups in the coal. All of these things show

that rich accumulation of gas is closely related to the development of geological structures and to metamorphism of the coal, and that it is definitely related to the components of the coal rock, the structure of the coal, the lithology of the surrounding rock, and other things.

At present, the extraction of the gas content of coal seams in mines actually involves the residual amount of coal-formed gas after it has scattered throughout a long geological period. For this reason, the sedimentary history after the coal was formed and structural changes play an important controlling role in the preservation and dispersal of coal-formed gas. This means that the thickness and sealing properties of the capping strata over the coal system, the extent of fault and fissure development, the slope of the rock strata, and other things have a direct effect on the accumulation and dispersion of gas. Fractures in coal seams and the surrounding rock, visible mechanical properties, and distance between faults play different controlling roles toward the gas, in that they can serve as channels for the flow of gas or perform a confining role. As a result, they have a dual role in gas dispersion and preservation. A large number of coal and gas eruption accidents often occur when tunnels are being drilled in faults, which is the best example.

There are many regularities in the vertical distribution of coal seam gas. According to resources by relevant unit in the coal system,[2] the vertical depth of gas weathering zones in China's coal seams is usually 50 to 200 m, below which it lie methane zones. The gas content becomes higher and the pressure greater at increasing depths, and the gas gradient varies from 6 to 27 $m/m^3/t$.

II. Developmental Characteristics of Gas Producing and Reservoir Strata

Coal seams and dark colored mudstone in coal systems are rich in organic matter and they are the primary gas source rock in the formation of coal-formed gas. The organic carbon content of the dark gray mudstone in the main coal-bearing strata throughout China is about 1 percent and may be as high as 5 to 6 percent. The organic carbon content in grayish black carbon mudstone is even higher, usually about 10 percent, and can be as high as 30 percent. It is apparent that there is a rather high organic matter content in the oil-producing rock in China's coal systems.

The categories of organic matter in gas-producing rock in coal systems are listed in Table 1. It is apparent from saturated hydrocarbon/arene, the hydrogen index, and other indices that it is mainly humitic (Type III) and transitional (Type II). The characteristic shape of the casein base and elemental analysis (H/C, O/C) also indicate that it is primarily Type III. The plant organization structure revealed by the microscope and electron microscope scanning as well as the images of algo-fungal categories provided even more direct confirmation that it is mainly humitic organic matter from high-order plants mixed with a smaller amount of lower organisms.

Table 1. Categories of Organic Matter in Gas Producing Rock in China's Main Coal Systems

Location	Era	Type of sample	No of sample	Saturated hydrocarbon / Aromatic hydrocarbon (Minimum-maximum) / Mean	Hydrogen index (I_H) (Minimum-maximum) / Mean	Type of organic matter
Yangquan, Shanxi	CP	Dark gray mudstone	10	0.4~4.5 / 1.25	3.6~10.0 / 6.3	III, II category
		Coal seams	6	0.1~4.91 / 1.87		"
Tangshan, Hebei	CP	Dark gray mudstone	3	0.73~1.0 / 0.91		"
		Coal seams	13	0.07~0.65 / 0.25		III category
Tianfu, Sichuan	P_2	Dark gray mudstone	8	0.29~2.9 / 0.78	76.7~481.2 / 151.7	III, II category
		Carbonitic mudstone	3	0.21~0.51 / 0.33	51.9~82.2 / 69.3	III category
Shuicheng, Guizhou	P_2	Dark gray mudstone	11	0.19~0.69 / 0.53	45.7~328.3 / 183.5	III, II category
		Carbonitic mudstone	4	0.29~1.02 / 0.55	72.5~223.9 / 132.3	"
Daxian, Sichuan	T_3	Dark gray mudstone	9	0.41~0.91 / 0.53	61.8~2135.7 / 584.4	"
		Carbonitic mudstone	2	0.39~0.50 / 0.45	77.5~216.7 / 147.1	"
Huangling, Shaanxi	J_{1-2}	Dark gray mudstone	3	0.45~0.59 / 0.51	64.08~110.04 / 87.9	"
		Coal seams	1	0.51		III category
Tiefa, Liaoning	J_3	Dark gray mudstone	2	0.39~0.70 / 0.55		"
		Carbonitic mudstone	4	0.41~0.83 / 0.64	113.2~186.9 / 175.7	III, II category
		Coal seams	3	0.62~0.96 / 0.77		"

The gas reservoir strata in the coal systems are primarily clastic rock (conglomerate, sandstone, fine sandstone). Carbonate rock also can serve as reservoir strata but since they usually are not very thick, no economically valuable gas reservoir strata have been discovered.

The physical properties of the clastic rock in China's main coal systems is generally poor (Table 2), usually having a porosity of <10 percent and a permeability of < 0.987 x 10^{-3} μm^2, and an expelled pressure of 1.0 x 10^8 to 3.0 x 10^7 Pa. Development is very uneven, however, and the physical properties may improve in some regions. Overall, most of the sandstone in China's coal systems is low porosity, low permeability, and high expelled pressure reservoir strata. For this reason, research on low porosity, low permeability nonconventional gas fields is a topic which should be studied in the future.

Table 2. Material Properties of Clastic Rock Accumulation Strata in China's Main Coal Systems

Region	Lianyuan, Hunan	Yangquan, Shanxi	Tangshan, Hebei	Shuicheng, Guizhou	Daxian, Sichuan	Huangling, Shaanxi	Tiefa, Liaoning
Strata position	C_1	CP	CP	P_2	T_3	J_{1-3}	J_3
Average porosity (%)	0.42~8.15	0.23~10.8	0.79~11.4	2.0~7.42	0.37~3.49	4.46~10.7	2.8~10.0
Average permeability (μm^2)	0.987×10^{-5} ~ 1.06×10^{-3}	0.987×10^{-5} ~ 1.44×10^{-3}	0.987×10^{-5} ~ 1.78×10^{-2}	0.987×10^{-5} ~ 1.97×10^{-5}	0.987×10^{-5} ~ 0.78×10^{-3}	0.987×10^{-5} ~ 8.1×10^{-3}	0.987×10^{-5} ~ 3.26×10^{-4}
Expelled pressure (Pa)		5.20×10^{4} ~ 2.94×10^{7}	1.08×10^{6} ~ 1.0×10^{7}	1.23×10^{7} ~ 2.94×10^{7}	7.26×10^{6} ~ 2.94×10^{7}	2.06×10^{6} ~ 1.32×10^{7}	1.72×10^{6} ~ 2.28×10^{7}

It deserves special mention that coal seams are not only the primary gas-producing strata but also that they are important reservoir strata for shallow coal-formed gas, and are real economy significant. For this reason, research on the microscopic components, chemical properties, gas-producing conditions, physical characteristics, and macroscopic and microscopic structures seems especially necessary. By working, we divided the microscopic fissures in coal on the basis of formational factors into: gas pores, biological organism pores, organisms, mineral foundry pores, pores between the particles of matter forming coal, endogenous fissures, structural fissures, and so on. The pores usually are closed and are able to open up only under special conditions. There are scattered reports of the existence of gas pores within coal in China and foreign countries. Dai Jinxing [2071 6855 2502], et al., discovered gas ores in different brands of coal and we can note further that various types of gas pores have developed in various microscopic components (vitrain groups, inert groups, and crustal groups) but have different probabilities of occurring. They are

distributed mainly in the vitrain groups which, besides the fact that vitrain groups occur with greater frequency in the content of coal, also may be due to their chemical properties, elemental composition, rather strong plasticity, and large amount of gas generated. Obviously, the existence of gas pores, fissures, and biologically organized pores in coal have major effects on the movement and accumulation of gas in coal seams. It has already been discovered that in regions where gas pores developed in coal, most generally are high gas content regions with obvious indications during prospecting or during extraction.

According to scientific research on coal and research by design units,[2] the porosity and gas permeability coefficients of coal are rather low, and its porosity is related to the brand of coal. From long-flame coal to lean coal, the average porosity decreases incrementally from 10.5 percent to 7.2 percent as the degree of metamorphism becomes greater. The degree of porosity does rise slightly moving from lean coal to poor coal, and is about 8.7 percent for anthracite. The gas permeability coefficients of the coal in most of China's mining regions is in the range of 8.27×10^5 to 1.73×10^3 m^2/Pa^2 d, which is equivalent to 2.12×10^{-7} to 4.44×10^{-5} μm^2. It is apparent that the permeability of coal seams throughout China is much poorer than the material properties of clastic rock from the various eras. Thus, the release of gas from coal seams is not an easy thing, and an evaluation can be made of the difficulty of releasing gas from coal seams only after the porosity and permeability of the coal have been studied.

III. Prospects for Shallow-Strata Coal-Formed Gas Resources

1. Estimated shallow coal-formed gas resources

We estimated the shallow accumulated coal gas resources in 75 coal-bearing basins (and coal fields) throughout China. The coal reserves used in the computations were based on Ministry of Coal Industry 1980 national coal field forecast data. The calculated depths were determined according to concrete conditions in each coal field. Generally, they were calculated to 2,000 m in northern coal fields and to 600 to 1,000 m in southern coal fields. The data on dark colored mudstone in coal systems was collected from each of China's provinces and autonomous regions. We calculated the amount of gas produced for coal as well as dark colored mudstone, and the results of the calculations were that the total amount of gas produced by coal in China was three times the total amount of gas produced by dark colored mudstone.

We mainly used a coal gas occurrence rate method for all of the coal and a coal gas occurrence rate for the microscopic components of coal to calculate the amount of gas in China's primary coal fields. In addition, we also used the TTI (time/temperature index) method for a few coal fields and the volatile component production rate to calculate the coal gas occurrence rate for the coal for comparison. The results of the calculations using the various methods were similar.

The coal gas occurrence rate (mudstone gas production rate) is an important parameter for calculating the amount of gas produced. To derive the coal

gas occurrence rate value for organic matter in each stage of coalification, we collected 15 coal samples for low coal grades from different eras, different regions, and different sedimentary environments and four mudstone samples to carry out full coal, single microscopic component, and mudstone thermal simulation hydrocarbon generation experiments and obtained measured coal gas occurrence rate data for all of China's main coal fields.

The amount of coal-formed gas resources is not only determined by the amount of gas produced but also is related directly to gas accumulation coefficients. These coefficients are restricted by many geological factors. we carefully determined the accumulation coefficients for each primary coal field according to the type of coal-bearing basin (and coal field), material properties of reservoir strata, capping conditions, category of enclosure, and other conditions, and compared them with the accumulation coefficients of known coal-formed gas deposits in China. The derived values generally ranged from 0.003 to 0.007.

On the basis of the amount of predicted shallow coal-formed gas resources, we divided China's main coal-bearing basins (and coal fields) into the four grades of accumulated coal gas resource regions of superlarge (resources >500 billion m^3), large (resources 150 to 500 billion m^3), medium (resources 15 to 150 billion m^3), and small (resources < 15 billion m^3) (Figure 3).

2. A look at prospective shallow coal-formed gas regions

Here we will mainly discuss typical regions:

1) The Ordos Basin

This is China's best coal-bearing basin and is one of the world's eight largest coal fields. it contains the three coal systems of Carboniferous and Permian, Late Triassic, and Early to Middle Jurassic periods and it has an enormously thick material foundation for gas production. The predicted shallow coal-formed gas resources are the largest in China. The western margin, northern part, and central parts of the basin are favorable prospecting regions for shallow coal-formed gas and industrial gas flows have been obtained at several sites. The southeastern margin of the basin and the area along the Huang He is a shallow gas preservation region. Near Huangling in northern Shaanxi, for example, an intense gas eruption occurred at a drill which penetrated the Early and Middle Jurassic coal system. Gas indications are extremely common over a 200 km area ranging from Wubao in Shaanxi to Junggar Banner in Inner Mongolia. Besides conventional natural gas pools, this region also may have small aqueous gas and nonconventional natural gas pools, and it is the region with the best prospects for shallow coal-formed gas in China.

2) The Sichuan Basin

The basin primarily has undergone subsidence since the late Paleozoic and has sediments several 1,000 m thick as well as coal-bearing strata. The main gas producing strata are the Late Permian Longtan coal system and the Late Triassic Xujiahe coal system. It is rich in gas producing matter and

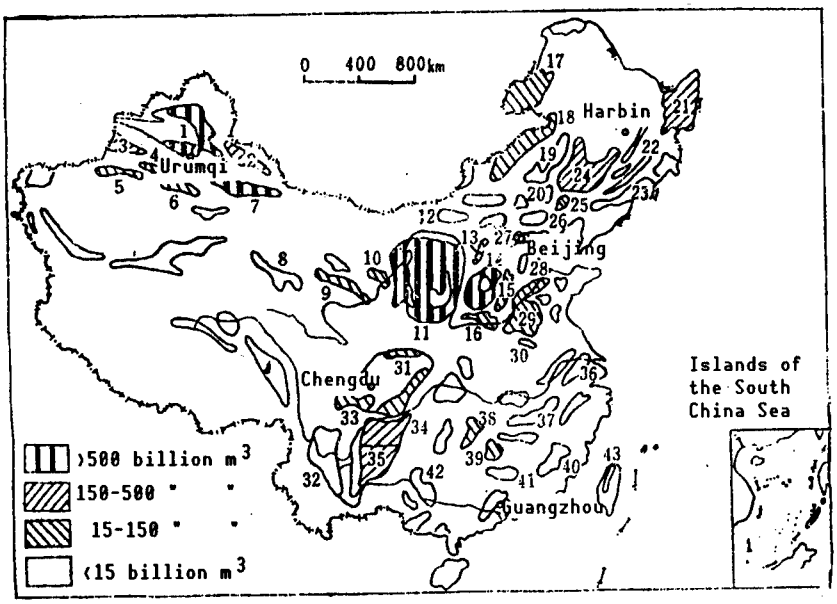

Figure 3. Coal Gas Resources Accumulated in Shallow Strata in China's Main Coal Fields

Key:

1. Junggar Basin
2. Santang Hu Basin
3. Yili Basin
4. Yordos Basin [?]
5. Tabei Basin
6. Yanqi Basin
7. Tuha Basin
8. Northern Qaidam Basin
9. Muli'aganzhen Basin
10. Jingyuan
11. Ordos Basin
12. Baotu Wuchuan
13. Datong Ningwu
14. Qinshui
15. Xingtai Jiaozuo
16. Mianchi Pingshun Shan
17. Dayan Zhalainuor
18. Huolin He Erlian
19. Wanbao Balin
20. Yuanbao Shan Pingzhuang
21. Sanjiang Muling
22. Shenbei Meihe
23. Hunjiang Hongyang
24. Yingcheng Tiefa
25. Zhangwu Fuxin
26. Beipiao Jianchang
27. Beijing Tangshan
28. South Tianjin
29. North Shandong Huaibei
30. Huainan
31. Sichuan Basin
32. Chuxiong Basin
33. East Yunnan
34. Nantong Bijie
35. Liupanshui
36. Jiangying Yicheng
37. Pingxiang Leping
38. Lianyuan Shaoyang
39. Chenzhou Laiyang
40. Yong'an Meixian
41. Aobei
42. Guizhong North
43. Taibei

has a high degree of evolution. Although the material properties of the reservoir strata are somewhat poor, many types of entrapments exist, and it is the region of China with the greatest proven natural gas reserves. Shallow accumulations of coal gas have already been found during drilling in the Qionglai, Dayi, and Pujiang regions on the southwestern part of the Chengdu Plain and in eastern and southern Sichuan, and there are quite a few

industrial gas flows. An analysis of geological conditions indicates that there are very good prospects for finding shallow coal-formed gas in thais basin.

3) Basins of Northeast China

These are primarily a group of basins formed of Late Jurassic (including Early Cretaceous) coal systems. Each basin generally covers only a small area but the coal systems and gas producing rock is quite thick and there are more gas indications. The gas content of mines in the eastern part are higher, and predicted coal-formed gas resources are the most abundant in the region in the Sanjiang Muling coal field and the Yingcheng Tiefa coal field. Gas eruptions occurred at many drilling sites in the Fuxin coal field, and it has a higher hydrocarbon content and better material properties in the reservoir strata. Both anticlinal and lithological traps exist and gas tests in 1987 obtained industrial gas flows. In addition, in the western and northern parts of Shenyang, coal-formed gas eruptions were discovered during coal prospecting and exploratory drilling for oil in the Tertiary, and industrial gas flows have been observed. For this reason, the basis of northwest China should be seen as favorable regions to explore for coal-formed gas.

4) The Junggar Basin

This is a large inland subsidence basin. The Early and Middle Jurassic coal systems are about 2,500 m thick at the southern margin of the basin and generally contain 11 to 33 extractable coal seams with a total thickness of 24 to 148 m, so the gas-producing material is extremely abundant. After this coal system was deposited, since entering a period of thermal evolution since the early Cretaceous, it increased in depth as the subsidence proceeded and the effects of thermal evolution continued in many regions until the Quaternary.

This is especially true of the sedimentation burial center in the southern part of the basin, where the degree of thermal evolution during each stage was higher than in the northern part of the basin. Structures are not very developed in the northern part of the basin, whereas there was intense tectonic activity in the southern part of the basin. Compression formed several rows of folded structures, forming various anticlinal traps which were conducive to the accumulation of coal-formed gas. The Zhuozi Shan anticline on the western side of Urumqi is an example. Gas eruptions were encountered in two wells drilled during coal prospecting. The projected shallow coal-formed gas resources in this basin can reach several 100 billion m^3, so it should be considered an important prospective region to explore for gas, particularly at the southern part of the basin.

5) The Liupanshui and Nantong Bijie Coal Fields

The Permian Longtan coal system is excellently developed in this region. It is widely distributed and rather thick and is a coal-rich region of southern China. Projected shallow coal-formed gas resources are abundant, there are widespread high methane and eruptive mines, and there have been

more instances of gas eruptions and gas bubbles during coal field prospecting. The Anshun-Shuicheng, Qianxi-Bijie region where the Middle and Lower Triassic systems are better developed is a favorable region for small coal-formed gas pools.

In addition, there also are prospects in the area of shallow coal-formed gas development and utilization of Tuha, Qinshui, Lianghuai, central Hunan, and southern Hunan regions.

IV. Some Views

1. Exploration and research work concerning shallow and deep coal-formed gas should proceed concurrently and supplement each other. The relevant leaders and departments must unify their understandings, establish combined exploration for large, medium, and small gas pools, and develop shallow coal-formed gas by using few investments, seeking quick results, and not emphasizing one thing at the expense of another.

2. Development of shallow coal-formed gas can permit full utilization of resources and reduce the danger in mines. Thus, we should organize special teams and provide the suitable financial assistance to actively develop this energy resource. First, we should select the most prospective regions with coal-formed gas indications and near cities or mining regions like Liaoning Fuxin, Shenyang, Sichuan Chengdu, Chongqing, Hebei Tangshan, Shanxi Lishi, Xinjiang Urumqi, and other areas to develop exploration for shallow coal-formed gas to facilitate breakthroughs, summarize experiences, and benefit development.

3. We should continue to intensify research work on shallow coal-formed gas, and we should strengthen research on the physical and chemical characteristics of coal, and thermal simulation experiments on the gas production process. We should develop research on gas preservation conditions and migration pathways. We should improve coal land gas testing measures to increase our understanding of the formational mechanisms and the laws of movement and accumulation of coal-formed gas, and improve resource evaluation and our ability to utilize this resource.

Comrades Hao Qi [6787 3823] and Li Xiaoyan [2621 1420 1750] participated in some of this work.

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12539/9365

Oil, Gas Finds in Central Plains, Tarim Basin

40130012b Beijing RENMIN RIBAO (OVERSEAS EDITION) in Chinese 20 Sep 88 p 3

[Text] XINHUA. In the Central Plains oil fields there have been recent discoveries of large oil-bearing areas north and south of the Huang He. This newly formed oil production could reach 2 to 3 million tons.

In Henan, on the western slopes north of the Huang He, the Central Plains oil fields have been under exploration for several years and more than 200 wells have been drilled. The area confirmed as oil bearing covers over 20 square kilometers. Not only does the area contain rich reserves of high-quality petroleum, the reserves are shallow and have exceptional extracted value. This year, through three-dimensional seismic testing and a series of new exploration techniques and technologies, the known oil-bearing areas have been further enlarged.

According to our understanding, the progressive rate of increase in annual production at the Central Plains oil fields has led the nation for 5 consecutive years. From 1978 to 1987 annual crude oil production capacity increased from 220,000 tons to 6.8 million tons. This year, planned production is 7.4 million tons. Today, these two new oil-bearing regions not only can provide, in the short term, total geological reserve of 200 to 300 million tons and a new annual production capacity of 2 to 3 million tons, but also represent an established foundation for sustained production in the Central Plains oil fields.

In other news, in the northern part of Xinjiang's Tarim Basin oil and gas exploration has recently made major progress. Wells Sha-7 and Sha-14 in separate regions, different geologic structures and different strata, encountered highly productive oil and gas flows. A few days ago both wells exceeded 100 cubic meters [sic] of crude oil production.

In July at well Sha-14 in the basin's northern Shaya region 50 kilometers south of Luntai County, oil and gas bearing Ordovician limestone was discovered below the 5,000-meter level and industrially significant flows have been obtained. This well is still being drilled. In late August, at well Sha-7, 50 kilometers west of Luntai County, Jurassic sandstone and Cambrian limestone were discovered below the 5,000-meter depth. Industrially significant oil and gas flows have been obtained. These two wells are major breakthrough discoveries in new geologic structure and

strata which follow the major discovery in 1984 at Shacan 2, of highly productive oil and gas flows. The natural geographic conditions of this are good. Transportation is comparatively convenient as it is only 200 kilometers form Kuerle on the southern Xinjiang rail line, and there are relatively abundant water resources. There are 18 wells drilled in this area, four of which have obtained industrially significant oil and gas flows. Indications are of different levels of reserves at the other 14 wells.

Tarin is China's largest sedimentary basin, covering 560,000 square kilometers. According to calculations of petroleum geologists, this area contains at least 10 billion tons of oil and gas reserves. Based on initial analysis, both Sha-7 and Shacan 2 produce light crude of very good quality while Sha-14 crude falls between light and heavy grades.

13466/9365

Coal-Associated Gas Reserves Grow

40130012c Beijing GUANGMING RIBAO in Chinese 29 Aug 88 p 1

[Text] China's research into coal associated gas has taken a major step forward with the discovery this year of a number of coal-associated gas fields containing very large reserves. This reporter learned of this at the second session of the International Petroleum Geochemistry Conference of the Asia and Africa Region which opened today.

China's coal reserves are rich and its coal series strata are well developed. Coal-associated gas reserves are also enormous. According to estimates by China's technical workers, China's coal-associated gas reserves total approximately 10 trillion cubic meters. Based on energy value, this is equal to 10 billion tons of oil and accounts for about one-third of China's total natural gas reserves. In the present situation of seriously inadequate oil and gas reserves, the development of coal-associated gas obviously has very great significance.

Following theoretical research into coal-associated gas with practical exploration, China has already discovered a series of coal-associated gas fields. Examples include the Yinggehai 13-1 field, the Shengli field, and the Central Plains field. Plans call for natural gas from the Yinggehai fields to be piped ashore to Hainan island beginning in 1990.

13466/9365

Briefs

Zhongyuan New Oil Deposits--Zhengzhou, 18 Sep (XINHUA)--New oil zones have been found in the north and south of the Yellow River in the Zhongyuan oil field, an official of the oil field announced today. Located on the border areas of Henan and Shandong Provinces and on the north of the Yellow River, the Zhongyuan oil field is one of China's biggest oil producers. After several years of prospecting, 200 wells were drilled and a 20-square-kilometers oil bearing zone was found. And some new oil and gas deposits were also discovered in the south of the Yellow River recently. The newly proved reserves were about 1,400-2,100 million bbl, according to the official. Zhongyuan oil field produced 50 million bbl of crude oil last year while it was only 1.5 million bbl in 1979, and this year it is expected to produce 54 million bbl, the official said. [Text] [40100005b Beijing XINHUA in English 1109 GMT 18 Sep 88] /9365

Nuclear Power Development Symposium Ends 13 Oct

Increased Usage Urged

OW1410040188 Beijing XINHUA in English 1546 GMT 13 Oct 88

[Text] Beijing, October 13 (XINHUA)--China should switch from coal, the predominant source of energy, to using more nuclear power, said Shi Dazhen, vice-minister of China's energy industry, at a nuclear seminar which closed here today.

This is particularly urgent in east China which is short of coal and water resources, he said.

Shi, who is in charge of thermal power production in the ministry, said coal has accounted for about 70 percent of China's energy sources since 1949. It will continue to remain the most important energy source since it is abundant and easy to develop, Shi said.

But, he pointed out, the continuous rapid industrial development in the past few years has aggravated power shortages. Problems such as transport and pollution have "forced us to reconsider our original ideas," he said.

He noted that, if the ministry adheres to existing plans, China will produce 1.4 billion tons of coal by 2000, of which 40-50 percent will be used for power and one-third of it will be transported to southeast and northeast China.

"The severe pollution which would be caused is unimaginable, let alone the transport problems," he said. "We have to develop nuclear power."

Existing conditions make this possible. Eastern European countries have offered to provide China with nuclear power equipment as part of barter deals and loans on favourable terms. The United States has expressed willingness to sell existing nuclear power plant equipment at reasonable prices. And France and the Federal Republic of Germany have both expressed readiness to transfer nuclear technology.

Relying mainly on China's own efforts and cooperating with foreign countries is the best and quickest way for the country to develop its own nuclear industry, he said. The right technology and equipment should be imported this century to lay the basis for the industry in the next century.

Number of Plants Reevaluated

HK1410102188 Beijing CHINA DAILY in English 14 Oct 88 p 1

[By staff reporter Xu Yuanchao]

[Text] Chinese nuclear energy experts say the country will have the means to build nuclear plants with the capacity to produce at least 4,500 megawatts of power by the year 2000.

Ninety-two experts attended a national symposium on the development of nuclear power in the 1990s, which ended in Beijing yesterday.

The total capacity will include the 1,800-megawatt nuclear power plant at Daya Bay in Guangdong Province and the 300-megawatt plant at Qinshan, Zhejiang Province. There are plans to expand the Qinshan project by adding four 600-megawatt nuclear reactors so that it will eventually have a total capacity of 2,700 megawatts.

The latest target is lower than a previous one to try to build and install nuclear plants with a total capacity of 10,000 megawatts by the turn of the century.

After detailed research, experts agreed that it would be more practical to lower their sights.

Delegates from coastal provinces--where there is an acute shortage of electricity--urged that more nuclear plants be built and total capacity increased to 6,500 megawatts by the year 2000. They also wanted another 6,000 megawatts of power within the first few years of the 21st century, which would have meant work starting immediately on a third 2,000-megawatt power plant in northeast China's Liaoning Province.

Other delegates called on the central government to set up a special fund to finance the building of nuclear power plants.

The proposals will be submitted to the Ministry of Energy for reconsideration.

The symposium was organized by the Ministry of Energy--the leading group in the nuclear power industry and the highest decision-making body under the State Council--and the China Nuclear Industry Corporation.

/9365

Nation's First 5-Megawatt Nuclear Heating Facility Passes Initial Tests

40130008 Shanghai JIEFANG RIBAO in Chinese 27 Jul 88 p 1

[Text] Based on a release by the Shanghai Institute of Atomic and Nuclear Research of the Chinese Academy of Sciences, China's first 5-megawatt low-temperature nuclear heating reactor completed its physical testing in Shanghai yesterday and experts estimate that this state-of-the-art nuclear energy heating facility will officially become operational either this winter or next spring.

Today, advanced nations of the world are devoting much attention to low-temperature nuclear heating reactor technology development--this high technology is a major item on the agenda for China's Seventh 5-Year Plan. These nuclear heating facilities have a higher safety margin, a shorter construction time, and a lower cost than conventional energy sources. They do not pollute the urban environment, providing instead an ideal source of heat for the world's burgeoning population centers and industrial bases. China made the decision to first construct a model low-temperature heat supply reactor.

Experts expressed satisfaction with the results of the experiments, thus proving that the design of China's first low-temperature nuclear heating reactor was rational and all computations precise. It has been reported that before the end of August [1988], this nuclear energy facility will be put through additional tests.

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Briefs

China Exporting Wind-Powered Generators--In the late 1980's, China, the first country to make use of wind power, has developed high-quality wind-powered generators and water-lifting windmills, some of which are now being exported. This was made known at the Yatai District conference on wind power yesterday. In the Sixth 5-Year Plan, the utilization of wind energy was an important item on the State's list of major technological breakthroughs. A number of relatively high-quality wind-powered generators and water-lifting windmills were developed and many small generators now supply electricity to farmers and herdsmen in Xizang, Qinghai, Gansu, and Inner Mongolia, satisfying their needs for lighting and television viewing. Wind power equipment manufactured in China relies on critical parts supplied by a number of research institutes and factories in Shanghai. The 150-watt wind-powered generators made in China are now being exported to Japan, Australia, and other countries; 10 or so countries, including the United States, Great Britain, and Japan, have established technical exchange links with China. [Text] [40130020 Shanghai JIEFANG RIBAO in Chinese 2 Aug 88 p 2] /9365

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