185013

JPRS-CEA-84-032 (CORRECTED)

30 April 1984

19981112 138

ERRATUM: Please destroy previously issued JPRS-CEA-84-032 CHINA REPORT ECONOMIC AFFAIRS, sub-titled ENERGY: STATUS AND DEVELOPMENT -- XXVII of 30 April 1984, as the cover was inadvertently published on material assigned to JPRS-SEA-84-063 SOUTHEAST ASIA of 30 April 1984.

China Report

ECONOMIC AFFAIRS

ENERGY: STATUS AND DEVELOPMENT -- XXVII

FBIS FOREIGN BROADCAST INFORMATION SERVICE

5
95
AØ5

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information Service, Springfield, Virginia 22161. In ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

Current JPRS publications are announced in Government Reports Announcements issued semi-monthly by the National Technical Information Service, and are listed in the Monthly Catalog of U.S. Government Publications issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Correspondence pertaining to matters other than procurement may be addressed to Joint Publications Research Service, 1000 North Glebe Road, Arlington, Virginia 22201.

185013

JPRS-CEA-84-032 (CORRECTED)

30 April 1984

ERRATUM: Please destroy previously issued JPRS-CEA-84-032 CHINA REPORT ECONOMIC AFFAIRS, sub-titled ENERGY: STATUS AND DEVELOPMENT -- XXVII of 30 April 1984, as the cover was inadvertently published on material assigned to JPRS-SEA-84-063 SOUTHEAST ASIA of 30 April 1984.

China Report

ECONOMIC AFFAIRS

ENERGY: STATUS AND DEVELOPMENT -- XXVII

FBIS FOREIGN BROADCAST INFORMATION SERVICE

5
95
A05

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information Service, Springfield, Virginia 22161. In ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

Current JPRS publications are announced in Government Reports Announcements issued semi-monthly by the National Technical Information Service, and are listed in the Monthly Catalog of U.S. Government Publications issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Correspondence pertaining to matters other than procurement may be addressed to Joint Publications Research Service, 1000 North Glebe Road, Arlington, Virginia 22201.

JPRS-CEA-84-032

30 April 1984

CHINA REPORT

ECONOMIC AFFAIRS

ENERGY: STATUS AND DEVELOPMENT -- XXVII

THERMAL POWER

COAL

OIL AND GAS

NATIONAL POLICY

BOOSTING POWER GENERATION TO KEEP PACE WITH ECONOMIC GROWTH

Beijing GUANGMING RIBAO in Chinese 3 Feb 84 p 3

/Article by Wu Qian /0702 6692/: "The Speed of Electric Power Generation Must Exceed That of Economic Development"/

/Text/ The central leadership has proposed that the nation's total industrial and economic output value quadruple by the year 2000. Should the electric power industry maintain an even faster rate of development if it is to meet the demand? I feel that the rate of electric power generation must exceed that of economic development.

Energy is the motive power behind the whole of "the machinery of economics"; and foremost is electric power. There have been great achievements in energy exploitation and utilization since the founding. However, owing to the fact that knowledge concerning the important position and utilization of energy--and particularly electric power--in the national economy has been inadequate, there have been serious maladjustments in the proportion between electric power generated and that required. The electric power industry sets sales according to production, and industrial production sets its volume according to (availability of) electricity. Assurances of power for urban life and rural usage cannot be given. As a result of inadequate supplies of electric energy, approximately 30 percent of the nation's industrial production potential cannot be mobilized in a regular fashion. Not only does this retard economic growth and idle or waste national construction funds, it also brings great inconveniences to the people's livelihood.

In macroeconomics, the electric power flexibility coefficient is the comparable value between the average annual rate of increase of electric energy and of the economy over a fixed period. It is used to demonstrate the close relationship between electric power consumption and economic development. According to long-term worldwide statistics, this coefficient is almost invariably greater than 1--that is, the rate of electric power development is greater than that of economic development.

In real terms, when the coefficient is greater than 1, representative energy usage per unit of production value such as gross national output value and gross industrial and agricultural output value tend to rise. As soon as some people hear of a rise in electric power consumption, they criticize it as waste without thinking. Actually, there are two essentially different types of increase in electricity consumption. One is waste brought about by poor management and added consumption which occurs when planning directives are not attained. The other is that logical increase in electricity usage which raises the labor production rate, improves labor conditions and environmental protection, increases production quantity and quality, conserves energy, and seeks greater economic results, which should be accommodated. That is to say, questions concerning rational electricity usage and restricting electricity usage should be examined from the standpoint of the total effect on social and economic results.

The basic reason for the electric power flexibility coefficient being greater than 1, over and above construction of usage, is interwoven with the process whereby electrical power replaces other nonelectric energy sources and elements of production and whereby the scope of electricity usage is expanded. This process is a key indicator of social development and technical advances, and is a necessary tendency. For example, upgrading the livelihood of the people and establishing spiritual and material civilization requires an increase in electrical consumption. Modern mechanization and automation of production are developments which come about through electrification. Since economic results achieved through the use of electricity are greater than through the use of other forms of energy and electric power is gradually replacing these other forms, an increase in the use of electricity is necessary. The majority of technical measures for conserving energy resources come about through the use of electricity, e.g., electrical metallurgy, electrified railways, and all forms of electrical manufacturing, processing, electrical heat and electrolysis used in industry. At the same time, such nonconventional sources as nuclear, geothermal, marsh gas, solar, and wind energy must be turned into electricity before transmission, distribution, and use. The manifest form and actual result of the exploitation and utilization of new energy sources is an increase in electrical usage. This is to say that so long as this process of replacement and expansion of electrical usage develops, so long as this replacement and expansion has economic results, and so long as the amount of this replacement and expansion exceeds the amount of electricity conserved, the electric power flexibility coefficient will be greater than 1 and the aggregate electrical consumption amount per unit of production value will increase correspondingly. The simplistic and unanalytical view that any rise in the aggregate amount of electricity consumption as represented by the gross industrial and agricultural output value is attributable to waste is a mistaken one.

Economists around the world pay strict regard to the development of policymaking, and the basis of policymaking lies in objectively predicting the future. In building up the electric power industry, if development projections are inadequate, the most glaring harm is that which influences the initial stage of work--in many cases, factory sites which should have been selected beforehand are put off and written specifications which should have been submitted beforehand are delayed. As a result, when the go-ahead is given, nothing is prepared, like digging a well when one is thirsty, and there is a huge waste of manpower, material, and money. More importantly, if projections are inadequate there will continue to be electrical shortages and more serious shortages; and electrical shortage itself is an enormous form of waste. In the United States 1 kWh costs

8 cents, but a shortage of 1 kWh costs 3.50 dollars. Annual losses at home due to electrical shortages amount to several billion yuan of production value. In the overall picture, with the present inadequacy of investment capital, it should be better to build one less business which uses electricity and one more electrical source which can provide for the production usage of several or several tens of such users, so that the economic results for these users can be brought fully into play. In policymaking where investment capital is inadequate, the focus should be upon generating capital. Plans should be geared toward capital accumulation. Settling for balances on paper, like cutting the foot to fit the shoe, would be strictly avoided, lest we sow the seeds of future problems in the very steps we carry out.

12303
CSO: 4013/105

NEW TECHNOLOGY

CENTER FOR MICRO-COMPUTER REAL-TIME CONTROL OF HYDROPOWER STATIONS ESTABLISHED

Wuhan HUBEI RIBAO in Chinese 24 Mar 84 p 1

[Text] China's first experimental center for hydroelectric power station economic operation with microcomputer real-time control was given the go-ahead yesterday and will be set up at the Huazhong Industrial College. Both Chinese and foreign experts are of the opinion that establishing this experimental center will create a positive and sure way for the nation's electric power industry to use new technology.

This experimental center is a major state research project, with the research being handled by the Hydropower Resources Institute of Huazhong Industrial College and the Hunan Provincial Computer Technology Institute. The research personnel of these two units have been conducting research since 1980 and the building of the experimental center was completed in October 1983. At the same time, they succeeded in developing a hydroelectric power station economic operations microcomputer real-time control system and undertook experimental operations. The appraisal certifies that this control system is capable of some 18 functions, including start-up, shutdown, frequency modulation, voltage regulation, and danger alerts. The system operates with great speed, and can process within a tenth of a second multiple feedback signals that reflect changes in the station's operations the instant they happen. It can also make decisions and issue instructions within one-tenth of a second, so that the station's generators can operate at optimal conditions at all times. This assures that operations at the station will be safe and reliable, the economic return high, and the power quality good; the amount of electricity generated can be increased by 2 to 3 percent. The mathematical models, simulation technology, hardware, and software for this system, when tailored to the general requirements of various power stations, can provide the experimental means and the theoretical basis for modernization of the nation's large- and medium-scale hydroelectric power stations through the realization of microcomputer real-time control.

In industrially developed nations, it is common practice to use medium- and small-scale computers to provide real-time control of hydroelectric power stations. The S&T personnel of this experimental center, from the standpoint of conditions in China, and displaying bold innovation, are using real-time microcomputer control of hydroelectric power stations to achieve greater economic return for a smaller investment.

CSO: 4013/142

DEVELOPING EHV NETWORKS, PROMOTING HV ENGINEERING

Beijing DIANLI JISHU [ELECTRIC POWER] in Chinese No 1, 5 Jan 84 pp 69-71

[Commentary by the Special Committee on Overvoltage and Insulation Coordination]

[Excerpt] In order to create a new situation in the electric power industry and achieve the plan envisioned for the year 2000, the Overvoltage and Insulation Coordination Committee of the High Voltage Committee of the Chinese Electrical Engineering Society has made the following proposals for developing extra-high voltage power networks and promoting high-voltage technical work. They also proposed key research topics for the near future.

I. Some Proposals for Developing Extra-High Voltage Power Networks

1. The total installed capacity of China's power networks at the end of 1980 was about 60 million kW, with an annual generating capacity of 310 billion kWh. At the end of 1981, the highest power transmission voltage in China jumped from 330 kV to 500 kV, and it became the 8th nation in the world to have a 500 kV power network. This is the starting point for progress toward the year 2000 in the electric power industry. For China to quadruple its national economy by the year 2000, the total installed capacity of the power network must reach 240 million kW. The largest generating sets will increase from 200 MW or 300 MW to 600 MW or more. Because of fuel limitations, we must strive to develop hydroelectric power and transform the electric energy structure. Therefore, there must be changes in the structure of power networks and a greater role for extra-high voltage and long-distance power transmission. Thus, the 500 kV power network must spread throughout the country before the year 2000 so that 500 kV lines become the backbone of power transmission. An important task for the present is to perfect the 500 kV power network by increasing reliability and reducing costs. High-voltage workers should strive to perfect voltage-limiting measures and insulation coordination techniques, reduce overvoltage and insulation levels in power networks, and greatly reduce the construction costs of second-generation 500 kV lines. Manufacturing in the electrical industry should improve 500 kV equipment and greatly increase the reliability of the equipment. We should strive to attain present levels of advanced industrial countries (the U.S., Canada, etc.) in 500 kV power transmission techniques around 1990.

2. To resolve problems in transmitting high-capacity hydroelectric and pit-mouth thermoelectric power to remote regions (800 to 1,400 kilometers and farther), we must undertake research on extra-high voltage DC transmission and do comprehensive engineering to solve problems in manufacturing ± 500 kV to ± 600 kV power transmission equipment, problems in power network transmission and control, and problems of overvoltage protection and insulation coordination in DC transmission. Research on special problems of insulation coordination in DC power transmission systems is now an urgent priority. We should, for example, rapidly develop an understanding of the special characteristics of overvoltage in combined AC/DC systems, protection of transverter stations, experiments on the special characteristics of outer insulation, development of insulators, experiments on coronas in direct current lines, and so on.

3. We should study transmission patterns in EHV power networks and voltage grades in China. Research on transmission at one higher voltage grade in China and abroad requires about 10 years (this was the case in China in the increase from 220 kV to 330 kV and from 330 kV to 500 kV). This makes it even more important that research on voltage grades be in the forefront. Based on the power network structure, energy distribution and structural characteristics in China, we feel that adopting 500 kV alternating current transmission and ± 500 kV or ± 600 kV direct current transmission by the year 2000 can satisfy the needs of the nation's unified network, as well as distant transmission of hydroelectric power and pit-mouth thermal electricity generation. The most appropriate next higher grade over 500 kV is 1,000 kV to 1,200 kV, but this will not be needed until about 2000. The adoption of a 750 kV grade voltage is not suited to China because there is too little difference from 500 kV. At most, it should be considered when developing a one-grade higher voltage network in the 330 kV power network in the northwest.

4. High-voltage work can no longer be limited chiefly to long gap discharge, electrostatic induction, overvoltage and restrictions, insulation coordination and other subjects. Instead, give substantial attention to power transmission networks and equipment. This is especially true for high-voltage work in electric power departments. Many problems in power transmission technologies cannot be solved by one specialization, but must instead be solved jointly by several, such as high voltage, systems, power cutoff protection, automation, and so on. High-voltage power transmission is also a product of several disciplines, including electricity, magnetics, machinery, mechanics, thermodynamics, high-voltage technology, and so on. It will be hard to resolve problems related to AC/DC power transmission patterns and EHV voltage grades if we merely rely on electric power systems specializations and if power transmission equipment only depends on machine manufacturing specializations and high-voltage workers do not participate in this work. If high-voltage technologies are mutually overlapped with and permeated by electric power systems technologies, power transmission technologies and electric power equipment manufacturing technologies, there can be much greater development of these technologies. High-voltage technologies must be very closely linked with power transmission and transformation engineering before the high-voltage specializations can play an even

greater role in electric power construction and manufacturing. To develop HV and EHV power networks in China, we must achieve the organic integration of the high-voltage, systems, transmission, and manufacturing specializations.

5. As electric power systems develop, the problem of dangerous influences by power lines on communications lines increases. In the past, single-phase short-circuit current was under 10 kA. Now, most exceed 10 kA, and some have reached 17 to 30 kA or higher. In past construction of new circuits (110 to 220 kV), the investments made to solve the problem of dangerous effects on communications lines have been several hundred thousand yuan, and some now involve 1 million yuan or even 10 million yuan. For the No. 9 line in southern Sichuan, for example, posts and telecommunications departments began requesting the replacement of a repeater section with cable, which required an investment of 14 million yuan. The Ministry of Water Resources and Electric Power later upheld its opinion, the result being a changeover to laying 4 shielded lines, with an investment of just over 600,000 yuan. It was planned to use 500 kV to transmit power to Dalian, and the design estimate for eliminating dangerous effects on communications lines was an investment of 60 million yuan. The root of the problem is that the posts and telecommunications departments insist on using the "Regulations on Dangerous and Interfering Influences of Power Lines on Communications Lines (orginally called the 4th Ministry, 1st Bureau Agreement)" which were formulated in the Soviet Union in 1943. The regulations stipulate that the ground induction voltage of the wire cannot exceed 500 volts. At that time, the short-circuit cutoff time was about 0.5 seconds. Some are now under 0.2 second (on the Shanxi-Beijing line, for example, main protection and equipment protection cutoff is 0.1 second). After 40 years of technological progress, there is now a deeper and clearer understanding of the effects of contact voltage on humans. Therefore, the Soviet Union, East Germany, Australia, Finland and other countries now permit the voltage to be raised to 650 volts at less than 0.5 second, 900 volts (at less than 0.35 second), or 1,200 volts (at less than 0.2 second). Although the Shanxi-Beijing line has a short-circuit cutoff time of 0.1 second, the posts and telecommunications departments still insist on using the 500 volt Soviet standard from 40 years ago. Moreover, they oppose an effective protection measure which is widely used in the Soviet Union, Europe, and America: dischargers. In the past, electric power departments as well as post and telecommunications departments have done research on this problem in electric power and communications specializations. In essence, however, this was a high-voltage problem. Acceptable contact voltages should be coordinated between national standards and regulations of the Ministry of Water Resources and Electric Power using the acceptable voltage law: $u = u_0 / \sqrt{t}$ (because of differences in physical condition and physical resistance values, difference in environmental conditions of human contact, different probabilities of occurrence and other factors, the two values will be different). On high-reliability 220 kV, 330 kV and 500 kV lines, we propose using at least the 650-volt figure in the 1963 decision of the Consultative Committee on International Telegraphs and Telephones (CCITT) (with 20 years of worldwide applied experience). This can solve a major problem. We propose that HV

workers make the study and resolution of existing dangerous influences of electric power lines on communications lines the order of the day. The German electrical industry standards VDE divided the dangerous influences of electric power lines on communications lines into external overvoltage and lightning overvoltage. The famous Soviet high-voltage workers M. V. Kostenko and V. V. Burgsdorf have studied the subject of the dangerous influences of power lines on communications lines. High-voltage workers in China have done very little research on this question. This situation should be reversed as soon as possible.

II. Directions in High-Voltage Technology

1. Be concerned with production and work quickly to solve the large number of HV technical problems in power networks of 220 kV, 330 kV, and below. For example, lightning damage and surge are the primary forms of breakdown not only at 110 kV and below, but also at 220 kV and 330 kV. This is the situation for 330 kV to 500 kV abroad. It is urgent that research be done on lightning current curves, density of lightning strikes and other parameters in those regions with particularly intense electrical storm activities in Guangdong, Guangxi, Fujian, and to the south that have over 70 days of thunderstorms, as well as research on effective protection measures. The number of thunderstorm days in Europe, America, the Soviet Union, Canada, Japan and other countries is usually less than 40, and there is no experience in this area which can be borrowed. We can only solve this problem through on-the-spot investigations, observation and experiments. Other questions which must be solved include corrected lightning current curves, determination of stroke branching and return, and exploration of stroke distance laws. When 110 kV and 220 kV power networks enter an urban area, the study and utilization of compact circuits, cross-linked polyethylene cables, miniaturized substations, complete substations, SF6 fully enclosed integrated electrical equipment and fully enclosed substations all involve new questions of overvoltage and insulation coordination. Resonance overvoltage cutoff occurs not only in 10 kV to 63 kV neutral non-direct ground power networks, but is often seen in neutral direct ground 110 kV and 220 kV power networks as well. Prevention measures should be taken as soon as possible. There are still no unified rules for neutral grounding of 200 MW and 300 MW generators. Along with development of power networks, the short-circuit to ground current of many generating stations and substations will increase to 10 or 20 kA or more. Many problems will become quite prominent, such as the higher potential of large ground nets, high potential transfer, contact and stepping voltage, questions of the distribution of potential and counterbuff during lightning strikes, as well as experimental standards for control and signal lines and for solid relay pulse protection. Furthermore, increased automation levels require urgent solutions for problems of lightning protection and electromagnetic pulse protection in electrical systems, information systems and modern electronic computers.

2. Being concerned with equipment manufacture, strengthening information feedback, coordinating manufacturing departments, and improving equipment quality are tasks that cannot be ignored. High-voltage technology workers must study and understand electrical equipment. Without reliable advanced

equipment, there can be no reliable and advanced power networks. In recent years, electrical industry departments have developed complete sets of power generation and transmission substation equipment, and they have obtained gratifying results in comprehensive supply of domestically-produced equipment. It cannot be denied, however, that breakdown rates are currently high in transformers, coupling capacitors and other equipment, and that there are unresolved long-term problems in circuit breakers and mechanical breakdowns. The partial discharge of some epoxy resin inductors is as high as hundreds or even a thousand or more picoCoulombs, and many accidental explosions have occurred. Because there are no rational partial discharge power standards or methods for determining the location of the discharge, the poor sealing of electrical equipment often leads to insulation puncturing. Fracturing and breakage of electroceramic components in power stations and substation frameworks have caused the destruction of equipment at voltages as high as 220 kV (circuit breakers) and 500 kV (isolating switches). These have directly influenced safe power transmission in the networks. Zinc-oxide lightning arrestors are manufactured in factories throughout the country. A unified appraisal is urgently needed to improve quality in each factory. High-voltage workers should also do research occasionally on developmental trends in electrical equipment.

3. High-voltage workers should pay attention to doing research and extending new technologies in electric power departments, in manufacturing departments and in vocational schools and colleges. Examples include the question of equivalence of internal equipment and computers in overvoltage calculations and on the degree of their conformance with the results of on-site testing; on questions of equivalence between lightning protection analyzers and computers in calculating lightning overvoltage and on the degree of their conformance with on-site measurement of low-voltage puncture and high-current puncture, and on questions related to the widespread application of computers in high-voltage technologies. Research on all these topics should be organized through integrated projects to link up and coordinate forces in all areas, to give play to the advantages, and to avoid repetition of work in each area. Calculation and forecasting of overvoltage in 500 kV power networks should also be directed toward a group of projects and unified research conducted on different installed capacities, different power network structures, and different powerline lengths to reach conclusions. Expanded use statistical methods in insulation coordination, research and utilization of reliable technologies, and other questions should be dealt with in an organized manner.

12539
CSO: 4013/88

EXPANSION OF ELECTRIC POWER OUTPUT IN YUNNAN DISCUSSED

Kunming YUNNAN SHEHUI KEXUE [SOCIAL SCIENCES IN YUNNAN] in Chinese No 3, May 83 pp 39-44

[Article by Liu Yuanqu [0491 0337 2978] and Yang Jiuan [7122 0036 1344]: "Accelerating Electric Power Industry Construction Is the Key to Quadrupling Yunnan's Gross Output Value"]

[Text] Energy is the motive power for developing the national economy and directly affects the speed of socialist modernization. China has abundant energy resources which are fully adequate for quadrupling gross industrial and agricultural output value in the next 20 years. But the amount of power industry construction is not commensurate with the development of industrial and agricultural production; energy supplies are currently tight and have already become a constraint on national economic development. Since energy output will only be able to double in the 20 years, we will rely primarily on scientific and technical progress to quadruple gross industrial and agricultural output value; but estimates by the relevant departments indicate that national power generating capacity and installed generator capacity will need to quadruple to meet the economy's needs. This requirement makes the task of power industry construction an extremely arduous one.

Yunnan is relatively rich in energy resources. In electrical power in particular, it is a leading province in both potential capacity and conditions for development. But there have been power shortages for several years running, constituting a weak link in the province's economy. To quadruple output value by the year 2000, a power generating capacity of more than 20 billion kilowatt-hours will be needed, 3 and 1/2 times the actual 1980 generating capacity and thus involving nearly a quadrupling in size. Taking account of the need to transmit electricity out-of-province for national needs, the power industry construction tasks for Yunnan Province become even more arduous. Between the late Sixth 5-Year Plan and early Seventh 5-Year Plan, electric power will become scarcer in the province, which will considerably constrain the development of industrial and agricultural production. Current exploration of energy reserves, engineering design, raising of funds, personnel availability and key research efforts related to Yunnan's electric power generation potential (including hydropower and coal-fired power) fall far short of the power industry's unprecedented development requirements. Accordingly, making a timely resolve and collecting the necessary funds, resources and manpower to accelerate Yunnan's power industry construction are a strategic matter affectig the overall national economy and are the key to quadrupling gross output value. The question of what to do about electric power so as to quadruple the province's GNP is an extremely demanding one. We believe that it can be answered clearly so as to assure quadrupling of the GNP. Below we present, for discussion, some views on how to speed up power industry construction in Yunnan.

I. We Need a Correct Energy Policy and Power Industry Construction Principles

The electric power industry is highly socialized large-scale production, and its construction is typically of large scale, requires long periods, is technically complex and involves a multiplicity of factors, so that objectively it requires a strategic policy that is stable over a long period. The province's power construction achievements over the past 30 years are considerable, but we have also learned profound lessons from errors in strategic decisionmaking. Specifically, there was a lack of consistency in energy policy, resulting in a continuing resort to "emergency use of fossil-fired power production," while the advantages of hydropower resources could not be fully utilized; and power industry construction policies wavered between left and right, wasting resources and time and keeping power production long in a passive state. In 1958, when work began simultaneously on a dozen or so hydroelectric and fossil-fired power stations, including Yili He, Xi'er He, Xuanwei, and Pupingcum, the front was overextended in manpower, funds, materials and technical conditions, so that we ended up blindly transferring survey and design personnel in order to prepare for the 10.8 million kWh Baihetan hydroelectric station. Later, when the Yili He cascade stations were nearing completion, the power grid was gradually expanded and thought was given to continuing with other large projects, but at this time overcaution prevailed and the policy of "getting support before work started and linking the performance of work to support" was announced, with the result that survey and design were not undertaken for the excellent resources of the middle Lancang Jiang. Efforts on the Lubuge and Xi'er He stations were also sporadic and a good deal of fruitless labor was expended. The situation was the same in fossil-fired power production: the Xiaolongtan pit-head power station project had been proposed very early, and the agreement of the Ministry of Water Resources and Electric Power had been secured, but because of the refusal of certain individuals to agree, it was put off.

To date, the Manwan hydroelectric station on the Lancang Jiang has not been put on the development agenda in timely fashion, and progress is slow on certain stations that are under construction or planned, resulting in the current energy shortage in Yunnan; this must be ascribed to errors in energy policy and power construction guidelines.

What kind of energy policy and power industry construction principles should Yunnan implment? We believe that this is a strategic question affecting the entire province's economic development and must not be approached in terms of partial or temporary gain or loss; continually getting by over a long period with emergency measures. Instead, we should take full account of Yunnan's energy characteristics, particularly its advantage in hydropower resources and its strategic position in the country, of the overall needs of the province's economic development, and of the contribution which developing others of Yunnan's natural resources will make to the entire country. Only such an approach, based on Yunnan's actual situation, will enable the energy policy and power industry construction principles to remain relatively consistent and will help motivate all parties, make favorable use of all advantages and speed up construction.

Overall, Yunnan has abundant energy resources, but the abundance of individual types varies and the structure is not uniform. No reserves of petroleum or natural gas have yet been found. Although 15.7 billion tons of coal reserves have been identified, 70 percent is low-caloric-value brown coal, in an amount equivalent to 73.6 tons of standard coal per capita, or only 63 percent of the national-average per capita coal reserves. Hydropower resources are particularly abundant, with a developable capacity of about 71 million kilowatt-hours and a potential multiyear average output of 394.5 billion kWh, second in the entire country, giving a per-capita figure 7.3 times the national average. Although we are well supplied with other new energy resources such as geothermal and solar energy, we are not currently in a position to develop and use them on a large scale. With this energy resource situation it is relatively clear what energy policy should be set for Yunnan.

Hydroelectric power generation is one of Yunnan's major advantages. Early development and use of hydropower resources is not subject to the problem of resource exhaustion, while coal resources are not very large, and each ton used decreases resources by a ton. In particular, Yunnan's 10-odd billion tons of tertiary brown coal has good chemical activity and is easily converted, so that gasification and liquification can be used to make up for the province's shortages of oil and gas; refining can produce dozens of organic chemicals, thus upvaluing the coal by as much as several dozenfold. If other countries are willing to buy China's brown coal at 3 times the price of good-quality coal, we ourselves certainly should not think only in terms of burning it directly for power production, while letting our rich hydropower resources go unused.

Hydropower is a clean, safe, cheap energy source, and developing hydropower will help to develop such high energy consumption industries as nonferrous metals and phosphates in the province given the province's natural resource situation and the entire country's needs, Yunnan's nonferrous metals, phosphate, chemicals and coal chemicals industry should be able to develop to a considerable degree, relying primarily on hydropower for the large amounts of electricity that they need. Most prominent among these industries at present is the phosphate industry, which directly affects the development of the country's agriculture. Yellow phosphorus enterprises with a capacity of 300,000 tons a year would consume electric power equivalent to the entire present generation capacity of Yunnan's power grid. Based on current rates, not only would construction funds not be recoverable, but even production costs could not be made up. Such an enterprise could become viable only by using cheap hydropower. Therefore, we need hydropower to get into yellow phosphorus production; we need large hydropower stations with capacities of more than a million kilowatts. Development of such other industries as nonferrous metals and soda is similarly dependent on hydropower. Hydropower is a necessary, and favorable condition for developing Yunnan's natural resources and making a contribution to the entire country.

Yunnan not only has large potential hydropower resources, but their development is largely for the single purpose of generating electric power, the hidden costs are low, the amount of construction required is fairly small, and investment requirements are fairly low. Over the long term, developing Yunnan's hydropower is of strategic importance, since it can be transmitted eastward to meet the needs of South China. Most developed and developing countries are giving priority to the development of hydroelectric power; their hydropower resources are generally 40 to 50 percent developed, with a maximum level of over 80 percent while only 1.5 percent of Yunnan's hydroelectric power resources are developed. Thus, hydropower development is highly necessary and extremely beneficial.

Hydropower development naturally must be accompanied by some fossil-fired power development to deal with the differences in output between the high-water and low-water seasons. Yunnan has some coal reserves, providing the material basis for a complementary arrangement in which hydropower is of primary importance and fossil-fired power of secondary importance. But we must not reverse this relationship or fail to distinguish between primary and secondary.

A Yunnan power industry based primarily on hydropower would have to combine large, medium and small stations, using the large stations as the mainstay. The reasons are as follows.

1. Yunnan has both large-scale power stations and medium- and small-sized stations, and objective conditions require a combination of all three sizes. In the case of hydropower resources, for example, of a developable capacity of 71 million kW, large stations with a capacity of 250,000 kW or more account for a total capacity of 61.9 kW, medium-sized stations (25,000-250,000 kW) for 7.14 million kW, and small stations (10,000-25,000 kW) for 1.35 million kW; since each type has its advantages and disadvantages, a combination of all sizes promotes the thorough utilizaiton of hydropower resources. The same is true of fossil-fired resources: fossil-fired stations should be built close to electricity use centers or at large mines, but it is also rational to establish medium and small fossil-fired stations at locations off the large power grid which have coal but no water power and in certain coal bases using poor-quality coal as a fuel.

2. A combination of large, medium and small stations is also advisable from the viewpoint of electric power consumption. Yunnan is located on China's border, with difficult communications and uneven economic development. Only a few central cities and industrial districts and 54 counties get their power from large grids, while the large area of the remaining 74 counties relies entirely on small-scale hydroelectric and fossil-fired power.

Developing medium and small-sized power stations can help further extend electrification, will promote industrial development in border minority areas, will help in providing energy to the countryside, protecting forests and preserving the ecological balance, and will help develop material and spiritual culture in the countryside.

3. Combining large, medium and small generating stations helps motivate all parties to become involved in electric power. Currently, large-scale power stations are built mostly by the central government, while medium and small power stations may also be built by the localities; thus, all levels from the center to the province, prefecture (or autonomous prefecture) and county, and even communes, brigades and individuals, can become involved in electric power generation, which will greatly speed up construction.

4. The emergence of industries with heavy power consumption and the development of large power grids must be based on large power stations. This is because only large stations can provide large, stable amounts of power--only large stations, particularly hydroelectric stations, can produce cheap power and promote the development of natural resources in the province --and in the long run only construction of large power stations will be able to break down province barriers and allow large-scale interconnection of power grids and exportation of power from Yunnan Province. Therefore, an effort to complete the Manwan hydroelectric power station is the key to Yunnan's power industry construction in the near term.

To summarize, in order to speed up Yunnan's power industry construction we must first draft a correct energy policy and power industry construction principles. We believe that the most suitable policy is for hydropower to be primary and coal-fired power secondary, and for large, medium and small-sized stations to be combined, with large stations as the mainstay.

II. Several Problems of Understanding Must Be Solved

Here we are referring to problems of understanding with regard to the priority development of hydropower. Some say that while developing hydropower is good, it requires large investments, involves long construction times, cannot meet immediate needs, that assured output is low and large seasonal power outputs cannot be balanced, and so on. In short, these people maintain that at present Yunnan should not accord priority to hydroelectic power development. We believe that this question should be scientifically analyzed and an overall, realistic evaluation made. Like everything else, hydroelectric power generation is not perfect, but has its shortcomings. But we must realize that many of these shortcomings can be overcome. Below we give brief anlyses of three points.

A. Large Investment Requirements

Electric power construction, either of hydroelectric or fossil-fired stations, requires larger investments than construction in other industries. But national economic development requires that electric power lead the way, and thus the country must put considerable funds into power industry construction. The key to the problem is the question as to which of the types of power requires the greater investment in Yunnan. Comparison of electric power investments in the past took account only of the cost of hydroelectric and fossil-fired stations, which resulted in higher investment figures for hydroelectric power; but this was not reasonable. It is a characteristic of hydropower stations that primary energy source (water power) development and secondary energy (electricity) conversion are carried out at the same time, while in fossil-fired power generation it is done in two stages, i.e., the extraction of the primary energy resource (coal) followed by its conversion to electricity in the power station. Thus, calculation of fossil-fired power investments should include the investments in the power station, the coal mines, and railways. With this broad comparison, as of 1980 average electric power station construction cost of the Yunnan Electric Power Office system was 1,126 yuan per kilowatt of hydroelectric power, and 1,356 yuan, or 20 percent higher, per kilowatt of fossil-fired power (including coal mine investment). Again, in terms of investment results, the production cost for fossil-fired power is 3.4 times as high as for hydroelectric power, and the profit per kilowatt-hour is 3 times as high for hydroelectric as for fossil-fired electric power. Because unit investment for hydroelectric power is lower and the generating cost is lower and the profit higher, the investment payback period is much shorter than for fossil-fired power generation. In the case of the Yili He cascade, the investment was fully recovered in less than 8 years after commissioning, while in the case of the Liulangdong station the recovery period was only 4.2 years; the range for all power stations under the office is generally between 4 and 7 years. The recovery period for fossil-fired power stations, on the other hand, generally is about 15 years, and if coal is included it is about 18 years (because coal losses cannot be recouped). In the case of the Xuanwei power station the period is estimated to be about 25 years. Let us consider two other projects, one under construction and one planned. The first stage of the Xiaolongtan pithead power station has an installed capacity of 200,000 kW and involves an investment of about 275 million yuan, so that the average construction cost per kilowatt is 1,375 yuan; in the case of the planned Manwan hydroelectric power station, the first stage has a generating capacity of a million kilowatts and the investment is about 1.23 billion yuan, so that the average construction cost per kilowatt is 1,230 yuan. Clearly the investment is smaller for hydroelectric power, and investment is no reason to undervalue hydroelectric power stations.

B. Long Construction Cycle

Many of Yunnan's rivers pass through remote mountain gorges. Every kilowatt of installed generating capacity requires 2 to 2.5 cubic meters of concrete installations, so that the amount of construction work is less than that for other domestic projects of the same type and the construction time is potentially shorter. The main reason that construction times have been long for some hydroelectric stations in Yunnan has been the effect of human factors such as the superstructure and production relations, for example repeated changes in policy, or an irrational management system, overextending the front; some projects have proceeded by fits and starts, with excessive interruptions during the course of production. If these factors are removed, the actual construction time is not long, generally ranging from 2 to 5 years. The Liulangdong power station was producing power somewhat more than 2 years after construction began. The actual construction time for the Yili He 3d and 4th cascades (each with an installed capacity of 144,000 kW) was only 4-5 years to startup. None of these figures is much greater than the time required for fossil-fired stations of the same capacity. Provided that the advance preparations are done effectively, as management quality, the extent of mechanization, and construction technology are improved, it is possible to have hydroelectric projects of the size of the Manwan power station producing power within 8 years and to complete them within 10 years. In addition, medium and small-sized hydroelectric stations require smaller investments and produce a rapid return, so that more such stations could be built in order to solve the short-term power shortage. Practical experience tells us that other than objective factors, the crucial factor determining whether construction times are short and the projects can meet the need in time is the extremely important human factor of subjective initiative.

Because of past vacillation in policy, power industry construction lacked a long-term program and power industry development was not matched to economic development; when industrial and agricultural production urgently required electric power the problem was generally solved by a resort to fossil-fired power as an emergency measure, with the result that some persons received the incorrect impression that fossil-fired plants were what were needed to generate electricity, that they could be made ready faster than hydroelectric plants, and that they constituted a better policy for dealing with an acute situation which is still usable in the future. Actually this is not the case. Most of the past emergency fossil-fired projects created as many problems as they solved, because the focus was exclusively on completing the stations themselves without any consideration of whether enough coal mines could be built, so that other coal uses were squeezed out by power generation; this was regarded as a solution of the problem. It was possible to get by with this approach in the past when power consumption was low and there was not an extreme scarcity of coal; but in the next 20 years, electric power production is scheduled to quadruple and new generating capacities of more than 14 billion kWh will have to be added at an average rate of more than 700 million kWh a year, requiring combustion of more than 450,000 additional tons of brown coal, which is impossible without squeezing out other uses of coal. When future new fossil-fired plants are built we must build coal mines and railroads at the same time; if coal gas is used, coal gasification facilities must also be built, so that the construction period will be lengthened and use of coal-fired power to meet emergency needs will become increasingly ineffective.

C. Low Assured Output

The "assured (or reliable) output capacity" of hydroelectric stations usually refers to the generating capacity at the lowest-water period of the year. The size of the assured capacity depends on the water flow difference in the high-water and low-water seasons and the regulating capacity reservoir capacity. If the stations of the Yili He and Xi'er He cascades, which have multiyear regulating reservoirs upstream, were compensated by coal-fired power stations during operation, the dry season capacity could be raised higher, so that not only could the coal-fired generating units be kept in high-efficiency stable operation, but it also would become possible to couple them with fossil-fired power stations with low guaranteed output units. In Yunnan, even hydroelectric stations with relatively poor regulating capabilities usually have seasonal or daily regulation reservoirs. Hydroelectric power has the advantages of rapid startup and stable operation, while the Yunnan electric power system's load peaks and valleys tend to differ greatly; this situation is quite favorable for thorough utilization of seasonal and daily regulation. For example, the guaranteed output of the Lubuge station, with an installed capacity of 600,000 kW, is low only in isolated operation (86,000 kW); but in actual operation it will be paired with other power stations and will make full use of seasonal regulating resevoirs. When the load on the power grid is at its low point, the station shuts down a large amount of its equipment to conserve energy and assures that more equipment will go into operation during the peak period. Thus, this station acually does not operate as low as the guaranteed output level: its operating output is above 300,000 kW. The stations of the future Lancang Jiang main-channel cascade, namely the upstream Tuoba station, the middle-stage Xiaowan station and the downstream Nuozhadu station, can be equipped with multiyear regulating reservoirs having planned total capacities of 5.15, 15.65, and 7.3 billion cubic meters respectively, not only assuring continuous operation on the cascade, but also helping compensate other power stations.

Because of the difference in output of hydroelectric stations during the high water and low water periods, a seasonal variation in electric power output is unavoidable. But this problem can be solved by taking a few steps. For example, Yunnan has respectable coal reserves, and building a certain proportion of coal-fired stations for mutual regulation is an extremely beneficial approach. Another important point is that encouraging seasonal use of electricity by the production sectors, and particularly offering preferential seasonal electricity prices to Yunnan's high-power-consumption nonferrous metals, phosphate and salt-based chemical industries so as to encourage more electricity use during the high water season is an effective way to balance seasonal electric power output.

To summarize, the problem of guaranteed output is no reason to slight hydroelectric power.

III. Some Suggestions for Speeding Up Construction

A. Effective Long-Term Programs and Advance Work for Construction

An economic development strategy must be provided with implementation measures, and drafting long-term programs is a concrete realization of strategic measures. One of the important reasons that Yunnan's electric power industry is in its current passive situation, other than past problems with energy policy and power on industry construction guidelines, is that it has lacked a long-term program combining a river development program and an electric power program. For example, in regard to the problem of long construction times for hydroelectric power stations, whose benefits are thus supposedly too far off to meet immediate needs, if a program had been worked out earlier, design preparations had been made and effective specific steps had been taken regarding the development and utilization of hydropower resources, we would not have the current problem of "digging the well when one has begun to be thirsty" or the worry of results coming too late to meet immediate needs.

Good advance work is the foundation for accelerated power industry construction. We must start by strengthening advance surveying and planning work for hydroelectric station construction, consistently pursue unified geographical distribution of facilities, integrate river valley development with electric power programs, see to it that both long-term and short-term objectives are taken into account and that resources are comprehensively utilized, and appropriately handle the relationships of upstream, midstream and downstream areas, main and branch channels and both banks. In planning for coal-fired power production, advance preparation for coal mines and railways must be allowed for. We must carry out vigorous and effective feasibility studies and preliminary design of construction projects, as well as technical design and planning of construction organization for projects in progress; and we must see to it so that we have a design reserve, so that construction projects can be arranged immediately if a need arises.

B. According Strategic Status to Reliance on Science

Electric power construction, particularly the construction of large hydroelectric stations, requires large expenditures, has high technical requirements, and takes a long time, so that objectively it requires the use of advanced technical means and management methods. Hydroelectric power construction in Yunnan currently involves many technical problems, such as: high-head, high-discharge spillway energy dissipation; rapid construction of large-volume high earth-and-stone dams, high concrete dams, and underground installations; the ecological effects of hydroelectric power development; and operation and management of large power grids. These topics directly affect the large-scale mainstay projects which are about to be begun, and thus in the future we must vigorously organize key-problem scientific research efforts. Otherwise construction time will stretch out, which will make the situation even more passive.

There is also the problem of scientific management. The key to management is policymaking. In the past, some major policymaking errors in electric power construction caused major losses. Future construction tasks require that the leadership at all levels have a certain level of understanding of Marxism and some modern specialized knowledge, that they have mastered the laws of electric power production and power industry construction, that they overcome the long-standing past undervaluation of science and technology and prejudice against intellectuals, that they boldly utilize and train the intellectuals and motivate them fully, and that they inculcate in all employees a strategic spirit of reliance on science and technology.

In addition there is the matter of intensifying the technical training of employees, adding more technical facilities, and increasing the level of mechanization of construction work. These are important measures for dealing with the Yunnan power industry construction's current problem of low efficiency, high costs and long construction times in power industry construction, and it should be accorded its full importance.

C. Motivating All Levels To Involve Themselves in Electric Power Generation

The development of the electric power industry is directly related to the entire national economy, and its construction must be coordinated with all other areas; it is especially important that party and government organizations at all levels intensify their leadership. Under the current management system, large mainstay projects are mostly conducted by the central government, while medium and small-sized projects are mainly done by the localities; large power grids are generally associated with industry, while small power grids and small power stations are associated with agriculture or water conservancy. This leads to contradictions between the central government and the localities and between industry and agriculture. We believe that to solve these problems requires not only improving the existing management system and relevant policies and effectively handling the relationships between the various interests, but also improving people's understanding at all levels in electric power production.

Developing Yunnan's electric power industry is primarily a necessity for developing Yunnan's economy; it is an important link in achieving the objective of quadrupling the province's output, and motivating all levels in Yunnan to involve themselves in power production is a leading factor in speeding up Yunnan's power industry construction. For example, large mainstay projects are generally handled by the central government, but the localities must also make an active effort in them and solve construction difficulties that arise in timely fashion; it is particularly necessary to accelerate local economic development, to make effective advance preparations for power industry construction and to create the conditions for central government decisions on projects. Naturally the central government must pay attention to motivating the localities. For example, Yunnan has the potential for joint central and local operation of large-scale power facilities and for multiprovince management, compensatory trade and the like, and the central government should support these and appropriately ease the relevant policies. Again, a changeover to payment of taxes to power generating regions by the power industry and the offering of preferential electric power prices by hydropower bases are positive measures which would help motivate the localities to involve themselves in power construction and which should be implemented soon. It is even more important to develop and draft correct policies with respect to the construction of medium and small power stations, to motivate the localities, and to speed up development by means of comprehensive programs, unified geographical distribution and improved economic results.

D. Accelerated Base Construction, Solution of Employee Family Concerns

Currently, priority development of hydroelectric power particularly requires an acceleration of under-construction hydroelectric projects. But hydroelectric power construction is extremely arduous, and motivating a project contingent on several tens of thousands of people is an extremely important link in them. In the past, because of the emphasis on "production first, living amenities after," construction of facilities was slackened and many real problems went unsolved, such as housing for family members, employment problems, residence registration problems, education for workers' children, worker benefits and the like, with the result that the workers became burdened, which directly affected morale. If these problems are not solved, it will be difficult to maintain a stable body of personnel and knit it together, or to rapidly correct low labor productivity and slow progress. Therefore, the gradual solution of these problems should be conscientiously investigated.

8480
CSO: 4103/311

POWER NETWORK

BRIEFS

GEZHOUBA-SHANGHAI TRANSMISSION LINE--With the concurrence of the State Council, the State Planning Commission has recently approved the construction of a 1,080-km-long 500,000-volt DC power transmission line between Gezhouba in Hubei and the city of Shanghai. When the project is completed, the transmission line will be able to transfer 1.2 million kW of electric power to east China and the Shanghai Economic Zone. With an investment of 700 million yuan, the first stage of the project is expected to be completed by the end of 1987. When the first stage is completed, it will be able to transfer 600,000 kW of electric power from Gezhouba to Shanghai. [Summary] Shanghai City Service in Mandarin 2300 GMT 8 Mar 84 OW]

CSO: 4013/127

MINISTRY PLANS MORE POWER STATIONS, LESS INVESTMENT

HK300825 Beijing RENMIN RIBAO in Chinese 27 Mar 84 p 1

[Report by Xin Fengbing: "Ministry of Water Resources and Electric Power Studies Ways To Build More Power Stations With Less Investment"]

[Text] Editor's note: In the course of party rectification, the Ministry of Water Resources and Electric Power has made a careful comparison between the actual situation in our country's electric power industry and the advanced level reached by its foreign counterparts. Adhering to the principle of seeking truth from facts, the ministry has courageously recognized its weaknesses, discovered the gap, and proposed some preliminary measures to improve the work. What the ministry has done shows its sense of responsibility to the party and the people and will have a good influence on the staff of the ministry, pushing them to emancipate their minds, and encouraging them to work energetically.

In the course of party rectification, each department should not just pay lip service but should carry out rectification and correction of defects in a down-to-earth manner, centering around the major problems existing in their vocational work. We are looking forward to more departments emulating the Ministry of Water Resources and Electric Power. [end editor's note]

In the party rectification, in accordance with the opinions of a central leading comrade, the party group of the Ministry of Water Resources and Electric Power has devoted great effort to dealing with the present major problem of high costs and long construction periods of electric power projects, has conscientiously summed up experiences, discovered the gap, and discussed and studied ways to build more electric power stations with less investment, in order to speed up the development of the electric power industry.

Last year, the central leading comrade made a remark on a report written by the party group of the Ministry of Water Resources and Electric Power. The remark reads: To develop the electric power industry, "it is necessary to lower construction costs, to select optimal schemes, and to shorten project construction periods. Just think, if we had built three stations for the cost of two, or had built four for the cost of three in the past few years, then it would have meant an increase by one-third or one-fourth in total investment." This year, the central leading comrade pointed out again: "In order to fulfill the sacred task of quadrupling the output value of our national economy by the turn of the century, our comrades of the Ministry of Water Resources and Electric Power must think about their duties more seriously. One of the key questions is how to build more power stations with less investment, and how to substantially shorten project construction periods." In accordance with the opinions of the central leading comrade, the party group of the Ministry of Water Resources and Electric Power has taken this question as a major part of the content of party rectification and correction of defects. Through study and discussion, they were profoundly impressed with the fact that for many years they had had a poor understanding of the principle of developing the national economy centering around the enhancement of economic results in their work in the field of water resources and electric power. For this reason, they had done a poor job regarding economic accounting, prevention of waste, improvement of efficiency, and the saving of energy, funds, and materials. The main problems are: lack of overall planning, which makes it difficult to work out a unified long-term design and construction plan and has thus delayed some projects for a long time; ever increasing construction costs, which have risen from 743 yuan per kilowatt in the period of the "Second Five-Year Plan" to 1,500 yuan at present; ever lengthening periods for the completion of projects.

It usually took 3 to 4 years to build a large or medium-sized hydroelectric power plant in the 1950's and the early 1960's but, according to the schedule, it will take 10 years to complete the Longyangxia power plant, which is now under construction, 12 years to complete the Baishan power plant, and 9 years to complete the Tianshengqiao power plant. The party group also compared the country's attainments with the advanced level reached abroad in the power industry field. The comparison indicates that there are gaps of different degrees between us and foreign countries with respect to project planning, survey and design, project construction, and development of equipment. To be sure, we have attained high standards in certain individual technical fields. However, some conspicuous shortcomings and problems are exposed as soon as we attempt to tackle a whole large-scale project. In order to quicken our pace, it is necessary to import advanced technology and developed management methods from foreign countries.

Since last year, the party group of the Ministry of Water Resources and Electric Power has convened many forums to solicit opinions from among leading comrades, specialists, engineers, and technicians from various electric power administration bureaus, relevant organizations stationed in river valleys, engineering bureaus, and project design bureaus, and to discuss the question of "reducing project costs and shortening construction periods." They realized that the central leading comrade had struck home in his criticism of the power industry. Increases in investment are necessary in order to quadruple the country's electric power by the turn of the century. However, if we fail to solve the key problem of reducing project costs, selecting optimal schemes, and shortening construction periods, we will hardly be able to boost the power industry, despite increases in investment. At present, the party rectification and correction of defects are being carried out in a deep-going way. From the higher levels to the grassroots, people are studying, discussing, examining their work, and working out measures. The following are some preliminary proposals for the improvement of the water resources and electric power industry: 1) In order to prevent waste of manpower and material and financial resources, hydroelectric power stations are to be built one by one along successive river sections and not arbitrarily at separate spots, without overall planning. 2) The economic responsibility system must be enforced in running hydroelectric power projects, and a thorough reform must be carried out in the construction administration system. Shitang hydroelectric power station in Zhejiang Province has been selected as a pilot project to be built by selected builders. 3) Some unreasonable procedures of design work are to be revised so that project costs and raw materials consumption can be reduced. 4) Great effort will be devoted to development of building technology. Yantan hydroelectric power station in Guangxi Region has been selected to carry out an experiment with the dam-building technique of crushed concrete [nian ya hun ning tu 4317 1090 3236 0413 0960]. The comrades of the Ministry of Water Resources and Electric Power are determined to strive for great progress in the electric power industry through party rectification.

CSO: 4013/127

HYDROPOWER

WORK PROGRESSING ON SHAXIKOU, SHUIKOU PROJECTS

Fuzhou FUJIAN RIBAO in Chinese 11 Jan 84 p 1

[Text] First-Stage Cofferdam of Shaxikou Finished Ahead of Schedule

The groundwork has now been laid to begin construction on the 300,000-kilowatt Shaxikou Hydroelectric Power Station project. The 900-meter first-stage low cofferdam was completed late last year, setting the stage for excavation to begin on the power station's main dam foundations.

After October 1983, the water level of the Sha Xi dropped, leaving exposed a large portion of the riverbed. The Min Jiang Hydroelectric Engineering Bureau, the unit in charge of construction, took advantage of this opportunity to complete the work on the small cofferdam--originally scheduled for 1984--ahead of time. Given the seasonal nature of work on the hydropower station, by completing the small cofferdam early, a low-water period could be created in which to work on the entire project.

Other construction preparation work is progressing smoothly, with power and water for production and living now in place and a road and communications system taking shape. Work on over 35,000 square meters of buildings to be used in the construction has been finished. According to capital construction procedures, work may formally get under way on this project pending official approval of the higher authorities in charge [of this project].

Curtain Raised on Shuikou Hydroelectric Project

Work has recently begun on the railroad projects that will support the construction of the Shuikou hydroelectric power station. Overall work on the two stations of Liangsan and Yingkou has begun and they will be made available for operations by the end of the year. Plans for the expansion of the Minqing Railroad Station were appraised on 6 January and work will begin soon. Survey and design work on the expansion of the Nanping station, the new Xiaojiu station, and the stations at Eyang, Anji and Shuikou is now in progress, with construction scheduled for later in the year. The renovation and construction of these stations and the work on the stretches of the 115-kilometer line between Nanping and Minqing that will be flooded by the Shuikou hydroelectric station will guarantee the unimpeded supply of the large amounts of materials and equipment needed by the hydropower station.

CSO: 4013/130

THE FEASIBILITY OF HYDROPOWER AS SICHUAN'S MAIN ENERGY SOURCE

Beijing SHUILI FADIAN [WATER POWER] in Chinese No 12, 12 Dec 83 pp 9-13

[Article by Zheng Ping [6774 1627], Chengdu Surveying and Planning Institute, Department of Hydroelectric Power]

[Excerpts] 1. The Problem

Since Sichuan Province has limited coal, oil, and gas reserves but is very rich in water power, hydropower is fundamental to its plans for energy development. However, Sichuan is densely populated and land is scarce (an average of 0.9 mu per person is under cultivation), so it is necessary to minimize the area of land flooded by reservoirs.

If hydropower is to be the main energy source, effective regulation will be required so that available power can meet demand and ensure a reliable supply of electricity. Effective power regulation generally requires large reservoirs which cause serious flooding losses, and for this reason it is not feasible to construct numerous power stations. Thus we have two conflicting requirements which, although critical, cannot both be satisfied: the need to improve the distribution of hydropower while reducing the amount of land taken up by reservoirs. Sichuan, therefore, has many direct-flow power stations which have a low capacity during the dry season and must be supplemented by thermal power. For this reason it is sometimes claimed that hydropower unsupplemented by thermal power is not feasible, and is, therefore, not capable of becoming Sichuan's main power source. It has even been asserted that hydropower is incapable of supplying more than 50 percent of the total energy needs.

Most of Sichuan's rivers flow from high plains to basins and have natural water heads ranging from several hundred meters to 1,000 or 2,000 meters. The eastern portion of the Sichuan basin is heavily cultivated, so large dams and reservoirs cannot be constructed there. Western Sichuan is mountainous and the rivers flow through narrow valleys, making it difficult even to achieve a large reservoir capacity by constructing big dams. The development of Sichuan's hydropower resources is thus marked by two special features: 1) the rivers have large natural heads; and 2) a regulatory storage capacity is difficult to obtain. In this article we explore whether the favorable water head of Sichuan's rivers can be exploited to provide more effective hydropower regulation while reducing reservoir land losses.

2. Supplementary Regulation by Tapping Tributaries

(1) Example of good results on the Longxi He

In 1982 Sichuan Province possessed an installed capacity of 2.882 million kilowatts, of which hydropower and thermal power comprised 1.191 and 1.691 million kW, respectively. The power grid must satisfy a demand of 2.0-2.1 million kW, but the peak output during the dry season is only 1.5-1.6, leaving a shortfall of 500,000 to 600,000 kilowatts. Direct-flow power stations provide 87 percent of the 1.191 million kW hydropower output. Although these stations produce 1.085 million kW during the rainy season their output drops to only 500,000 kW during the dry season, and under these conditions power shortages result from the poor hydropower regulation. This problem will be aggravated in the future when such flow-through stations as the Nanya He third cascade, the Yuzi Xi second cascade, and the Tongjiezi become operational.

Sichuan currently has two types of hydropower--power generated from large rivers by big direct-flow hydropower stations, of which the Gongzui station is representative, and power generated from small and medium-sized rivers by cascade power stations, of which the Longxi He stations are typical. These two types of hydropower stations affect the power grid in different ways.

Gongzui, with an installed capacity of 700 MW, is the largest station in Sichuan's power grid. The guaranteed minimum capacity is 180 MW and the annual energy output is 3.42 billion kWh, or one-fourth the yearly output of the entire grid. During the rainy season the Gongzui station accounts for one-third of the total electricity generated and for more than one-half of the hydroelectric power. From September through November Gongzui accounts for 35 percent of the total capacity; this percentage decreases to 25-30 percent during December and from April through August. However, during the dry months January-March the output drops to 15-18 percent of the total grid power, and during the driest month (February) the station's average capacity is only 250 MW.

The Longxi He cascade stations have a capacity of 104.5 MW, a guaranteed minimum of 38,000 kW, and an annual output of 5.5 million kilowatt-hours. Their relative contribution to the Sichuan grid is very small, just 4 percent of the total installed capacity and 3.7 percent of the electricity generated. However, it has a permanent control reservoir and is the only example in Sichuan of a well-regulated hydropower source. The reservoir regulates water flow during the course of the year by storing water during rainy periods and releasing it during dry spells in order to supplement the discharge through the station. In this way the small Longxi He stations are able to generate an average of roughly 100 MW during the January-March dry season, even though their installed capacity is only 100 MW. So although the available grid power is lowest during February and serious shortages result from the reduced capacity of the large Gongzui hydropower station, the output of the small Longxi He stations may be as much as 112 to 129 MW and its contribution to the power station is maximum during the critical period.

(2) Benefits derived from the Nanya He stations

The Nanya He is a minor tributary of the Dadu He. The portion of the river to be developed has a head of 1,800 meters; 6-8 cascades are planned, of which the second and third have already been constructed. The Yele Reservoir, now in the planning stage, will have a capacity of 340 million cubic meters and will be capable of regulating the discharge on a multi-year basis. The six cascades (see Fig. 1) will span a total head of 1,737 meters and will have a total installed capacity of 530.5 MW. During the 6 months when the Yele Reservoir will add to the system, the guaranteed minimum will be 413 MW. The annual output of electricity will be 2.857 billion kilowatt-hours (see Table 1), which is equivalent to five times the output of the Lonxi He stations. If the period during which the reservoir adds water to the system is reduced to less than 6 months, the installed capacity can be increased to 700-800 MW. When completed, the Nanya He project will supplement the Gongzui hydropower station during the dry season by increasing its output to a maximum of 500-550 MW, or three times the rated minimum of the Gongzui station. This will completely offset the decline in the capacity of the Gongzui station during the dry season and will add another 200 MW or so of reliable power to the overall system and substantially improve the supply of electric power in Sichuan (Fig. 1, part C). In addition, the capacity of the Nanya He stations can be augmented during the dry season by constructing multi-stage direct-flow stations farther down the mainstream of the Dadu He so as to raise the guaranteed minimum output by 80-100 megawatts.

Since the Nanya He has a large drop, Yele Reservoir (with a volume of 340 million cubic meters) can store water with an energy equivalent of 1.315 billion kilowatt-hours, or 386.7 million kWh per 100 million m^3 of reservoir capacity. By contrast, the large dam planned for the Gongzui station on the Dadu He will create a regulatory reservoir with a storage capacity of only 23.6 million kWh per 100 million m^3 of reservoir volume, or 16 times less than the specific energy storage capacity of Yele Reservoir. In other words, the 340 million m^3 Yele Reservoir would be just as effective in regulating the energy supply as a 5.5 billion m^3 reservoir on the Dadu He. Rather than building large reservoirs on major rivers, we can thus construct reservoirs on small and medium-sized rivers exploiting their large heads, thus avoiding serious flooding losses.

3. Supplementary Regulation by Pumped Storage

(1) Xiagu project plans

Five cascade hydropower stations with a capacity of 10.8 million kilowatts are planned for the lower reaches of the Yalong Jiang. The Jinping first cascade (abbreviated "Jin-I") serves as the control reservoir for this section but is not capable of year-round regulation. Its installed capacity will be 3 million kilowatts with a guaranteed minimum of 1.49 million kilowatts and an annual output of 18.2 billion kWh. During the 7 dry months of the year (January through May, and November through December) the average long-term output will be

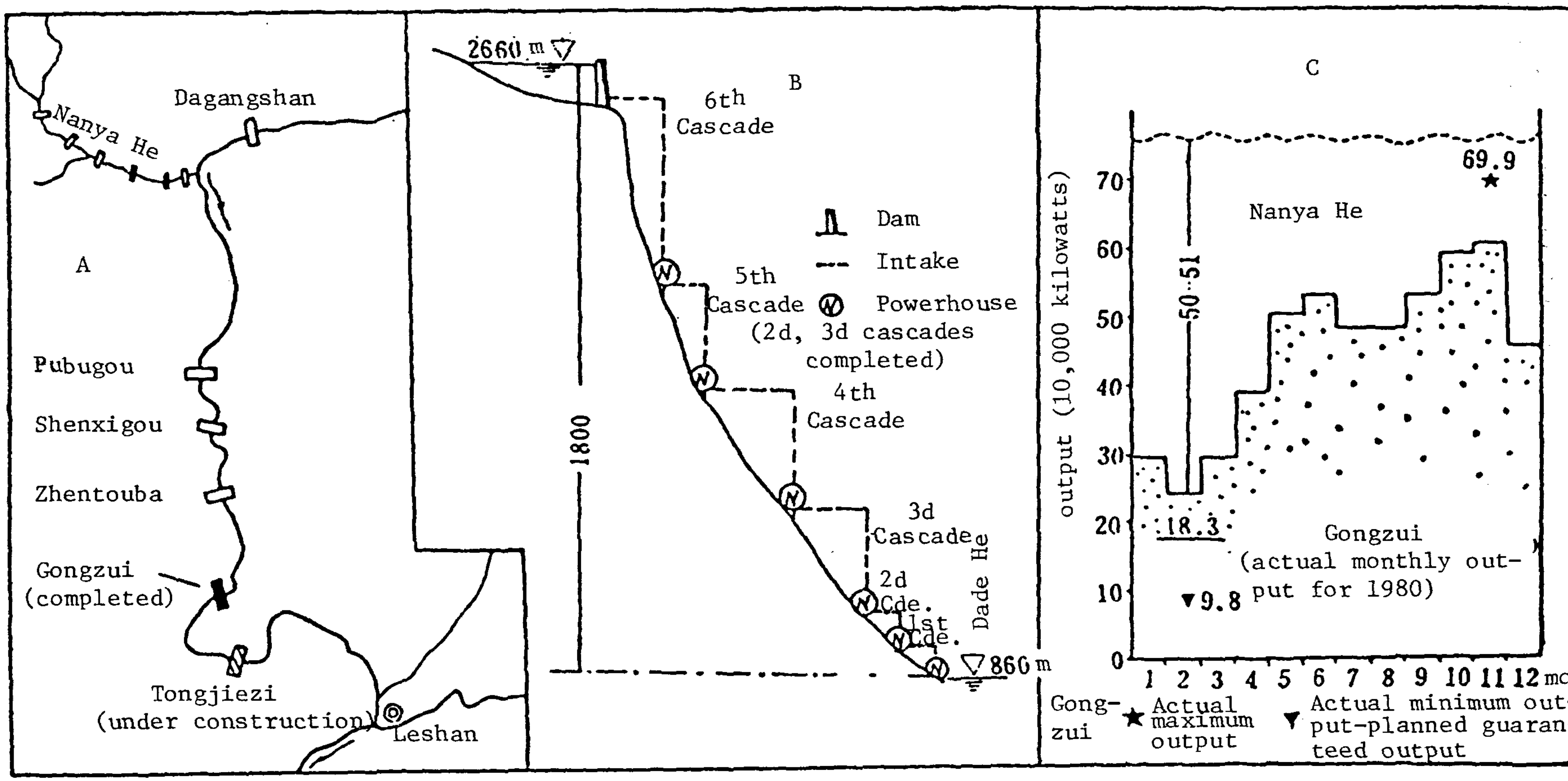

Figure 1. A - The Nanya He; B - Nanya He cascade development; C - Nanya He - Gongzui compensation

Table 1. Targets for the Nanya He Cascade Power Stations

No of cascade	6	5	4	3	2	1	Total
Available head (m)	630	300	320	295	92	100	1,737
Installed capacity (10,000 kilowatts)	16	7.4	12	1.45	1.45	4.2	53.05
Guaranteed output (10,000 kilowatts)	14.8	7	8	8	1	2.5	41.3
Yearly output (100 million kWh)	6.52	3.3	7.5	7.5	1.2	2.55	28.57
Remarks	planned	planned	planned	completed	completed	planned	

1.24-1.80 million kilowatts. This will increase to 3 million kilowatts during the 5 wet months (June through October). The output is thus roughly halved during the dry season. An output of greater than 1.8 million kilowatts will generate 4 billion kWh of electricity; provision is also made for a flood discharge of 6.2 billion m^3. The Jin-I reservoir is located on the lower reaches of the Litang Qu near the source of the small Yongning He tributary. The upper reaches of the Yongning He flow over a distance of 15-16 km across a high basin 1 to 5 kilometers wide located close to the Xiagu project on the Litang Qu, and the river drops sharply. Hypothetically, a power station between the Xiagu and the Yongning He (Fig. 2) could draw off the seasonal excess discharge through Jin-I by storing the flood discharge from the reservoir and then returning it during the dry season to augment power generation by supplementing the flow through the Jin-I direct-flow station.

Jin-I will normally store water at an altitude of 1,900 meters and will be able to fill Xiagu to a depth of $\gtrsim$30 m; Jin-I can therefore serve as the lower reservoir. The Huangjiagou dam will store water 101 meters deep at an altitude of 2,666 meters. This water makes up the upper reservoir on the Yongning He and will have a total volume of 3.1 billion m^3. A regulatory reservoir capacity of 2.3 billion m^3 can be achieved by driving a tunnel 14 km long from the upper reservoir of Xiagu if the discharge outlet lies at an altitude of 2,640 m. In addition to retaining 900 million m^3 of local floodwater, the reservoir can accommodate an additional 1.4 billion m^3 of pumped water. By constructing pumping stations at Xiagu near the west bank of the Jin-I reservoir it will be possible to lift the water over a distance of 740-780 meters. A minimum pumped power of 750,000 kilowatts will be required if we assume that 1.4 billion m^3 of flood discharge is stored at an average rate of 106.5 m^3/sec during the 5 wet months using a seasonally available energy of 4 billion kWh from Jin-I. The resulting hydropower head will be equal to 766-796 meters. If we assume that during the 7 ordinarily dry months an average of 530,000 kilowatts can be generated by tapping the stored water and that the average local yearly river discharge is capable of generating 320,000 kilowatts, then a total installed capacity in excess of 850,000 kilowatts will be needed. An analysis of power reserves and peak power requirements indicates that when suitably equipped with reversible turbine pumps, the Xiagu station will be able to generate from 1 to 1.5 million kilowatts of electric power.

(2) Role of supplementary regulation

We consider the following example in which the Xiagu supplements Jin-I during the 7 dry months by supplying stored water to generate (together with the natural average yearly discharge) 4.26 billion kWh while at the same time feeding tailwater to augment Jin-I's output during the dry season by 1.14 billion kWh, so that the total guaranteed output of Jin-I is equal to 5.4 billion kWh. The average unaugmented output of 1.24 to 1.80 million kilowatts will then be increased by .82-1.35 million kilowatts to a grand total of approximately 2.6 million kilowatts. However, since water is siphoned off during the wet season, the actual output of the Jin-I station is reduced to 1.8 million kilowatts. Thus, the power output curve for the Jin-I station is high during the wet season

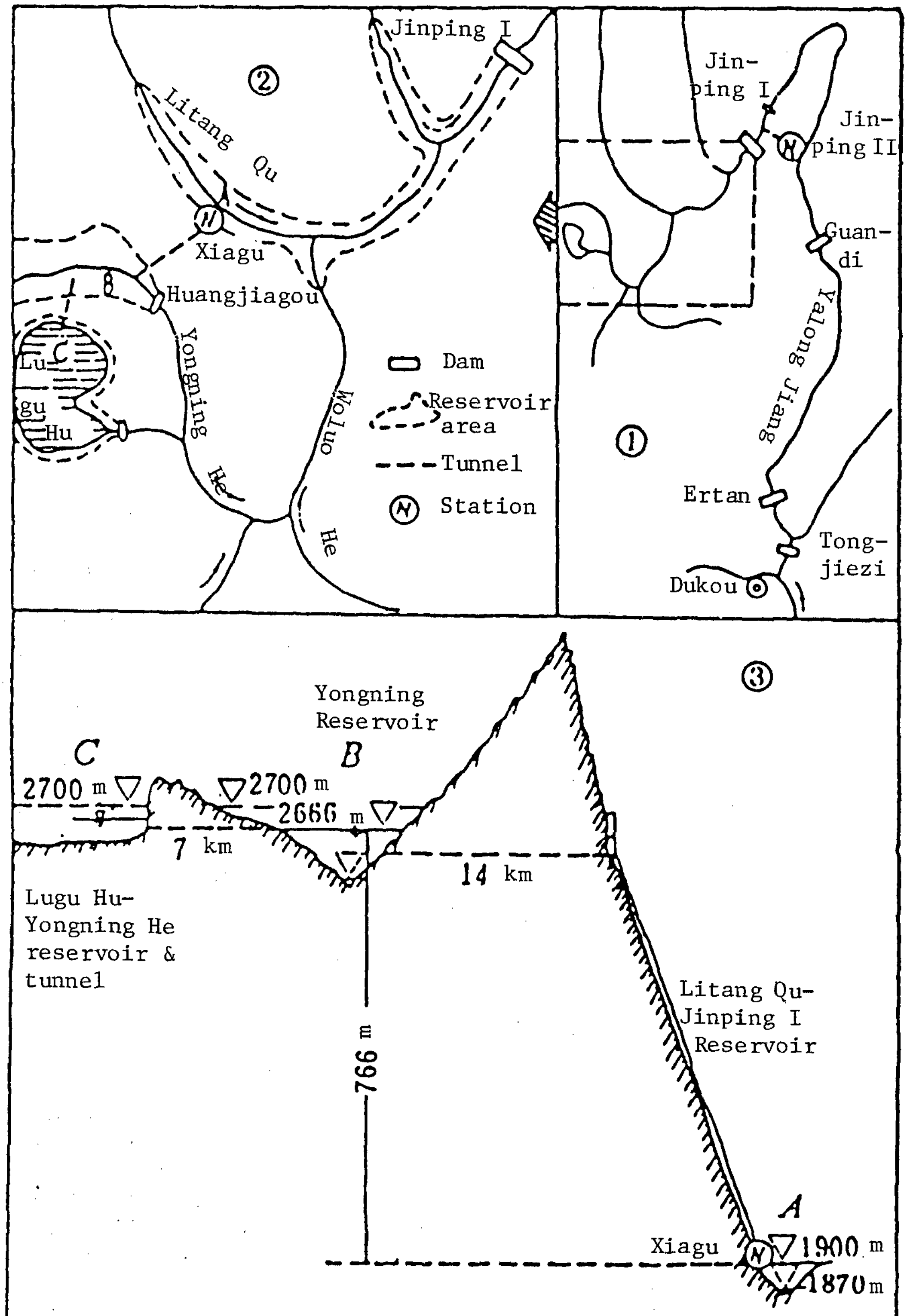

Figure 2. 1 Arrangement of cascades on lower course of the Yalong Jiang;
2 Development scheme for Xiagu;
3 A, B, C sections.

and low during the dry season when there is no regulation from the Xiagu system. On the other hand, when the Xiagu system is connected the power generation curve is higher in the dry season than during the wet months. We see that in addition to equalizing power output throughout the year and improving the reliability of the power grid, this type of supplementary regulation actually inverts the relative power outputs during the dry and wet months, so the system can in turn be used to supplement and regulate other hydropower stations.

Since the flood discharge volume of Jin-I is 6.2 billion m^3 while Xiagu pumps only 1.4 billion m^3, the remaining 4.8 billion m^3 is essentially free runoff which can be harnessed to make another 600,000 kilowatts available over a period of approximately 3,450 hrs (this corresponds to an additional energy of 2 billion kWh). If Jin-I is supplemented and its installed capacity is increased as described above, an actual yearly output power of 2.4-2.6 million kilowatts can be ensured. In the above simplified example, we have assumed that the amount of water supplied to the Jin-I station is the same during all 12 months. In fact, the Xiagu system will be capable of delivering a large amount of power at any time and can meet any type of peak demand made on the system. It will be suitable for supplying power to heavy users such as the metallurgical industry in western Sichuan or national defense or other government agencies.

(3) Reducing flood losses

The amount of flooded land occupied by reservoirs can be decreased by replacing large-scale regulatory reservoirs by ones like Xiagu, which fully exploit the large heads available on Sichuan's rivers. In addition to the 785-meter river drop at Xiagu station itself, there are other drops totaling 886 meters along the five cascades on the lower reaches of the Yalong Jiang, a 690-meter drop over the four hydropower cascades on the lower reaches of the Jinsha Jiang, and a 238.7-meter drop over the four cascade stations above Gezhouba on the Chang Jiang. Hence the actual available head is equal to 2,600 meters. Table 2 compares the storage and regulatory characteristics of the Xiagu station (still only in the planning stages) with those ofseveral large-scale hydropower stations already built, under construction, or planned in Sichuan.

We see that the Xiagu's unit storage capacity is 5-18 times greater than of the other four power stations. Hence the regulatory effects of Xiagu's reservoir volume of 2.3 billion m^3 are equivalent to those of Sichuan's large-river stations with reservoirs over 12 billion m^3 in volume. The average amount of flooded land per 100 million m^3 of reservoir exceeds 890 mu for the first four hydropower stations in the table, and an average area of 9,540 mu is currently submerged in large and mid-size hydropower stations already constructed in Sichuan. A little reflection shows that more than 10^5-10^6 mu would have to be flooded if the regulatory reservoir capacity on Sichuan's large rivers were to be increased to $12 \cdot 10^9$ m^3 or more.

Although the upper reservoir at Xiagu would flood 60,000 mu of land, this land is 2,600 meters above sea level and unproductive (the yield is only 100-150 kg of grain per mu). This contrasts with the 400-600 kg/mu productivity of the farmland along the banks of Sichuan's large rivers. Thus the land submerged by Xiagu's upper reservoir is equivalent to only 15,000 mu of cultivated land

and the benefits derived from Xiagu will be equivalent to those that could only be achieved by flooding 100,000 to 1 million mu or more of farmland on the major rivers. If we recall that Xiagu has an available head of 2,600 m, the actual benefits will be three times greater than the above figures suggest.

Table 2. Comparison of Xiagu's Regulatory and Storage Characteristics Compared to Those of Some Other Large-Scale Stations in Sichuan

Name of station	Gongzui (completed)	Tongjiezi (under construction)	Ertan (planned)	Pengshui (planned)	Xiagu
Average head (m)	47.6	35	169	63	785
Regulatory volume (100,000,000 m^3)	0.96	0.30	32.7	5.60	23.0
Regulatory storage capacity (100,000,000 m^3)	0.107	0.0247	13.03	0.832	42.6
Regulatory reservoir storage capacity per 100 million m^3 (10^8 kWh)	0.112	0.0824	0.398	0.148	1.852

(4) Development of hydroelectric potential in stages

Xiagu's location makes it well-suited for large-scale, flexible hydropower development. In the initial stage, Xiagu could be used to supplement the Ertan station, assuming the scale parameters described above. During the middle stages of construction, the height of the dam at the upper reservoir and the reservoir volume might be increased to permit Xiagu to supplement the chain of hydropower stations on the lower reaches of the Yalong Jiang. Farther into the future, it will be possible to link the system up with the Lugu Hu and Yongning He reservoirs and supplement the main grid system.

4. Summary

1. In addition to traditional methods, we should use regulatory techniques adapted to China's special needs and conditions. Sichuan and China's southwest have many small and medium-sized tributaries suitable for hydroelectric development. Some of the minor rivers originate in high plateaus or lakes and drop hundreds or thousands of meters before joining the main rivers. Since the regulatory capabilities of reservoirs on large rivers are limited, we should make selective use of the basins and lakes at the sources of minor rivers and distribute reservoirs on the hills so as to fully exploit the large available heads. This will permit the reservoirs on the upper reaches of the minor rivers to take over the regulatory function of large reservoirs on the main rivers. One method for supplementary regulation of direct-flow hydropower stations is to construct control reservoirs in basins on the upper reaches of rivers such

as the Longxi He and build stations in stages (or mixed development of single-level reservoirs). Sichuan has other small to medium-sized rivers in addition to the Nanya He which are suitable for this type of development. Examples are the Zhougong He, the Long He, the Modao Xi, and the Sunshui He, all of which are larger than the Longxi He. Sichuan has an abundance of waterpower, and the periods when additional power is required are short. The installed capacity on small rivers such as the ones mentioned above will have to be increased somewhat above current planning levels. The installed capacity of the already developed Longxi He in the southwest can be increased as needed by developing the Yili He, Maotiao He, and other rivers.

In addition, there are some high mountain basins and lakes which collect only a very small area of rainfall, so that reservoir construction is not worthwhile. However, if they are located at the bottom of a steep ascent, they can be used as upper reservoirs for supplementary-regulation storage systems (i.e., systems which employ active pumping). This alternative storage method is suitable for the Ma Hu (Sichuan), Fuxian Hu (Yunnan), Yang Hu (Xizang), and other rivers in addition to Xiagu, and it will be possible to construct large-scale hydropower stations at each of the sites. It is also advantageous to develop energy-storing supplementary regulatory electric power stations of various sizes on both banks of rivers or on the upper reaches of rivers in the vicinity of large direct-flow hydropower station reservoirs. This should be done by selecting a few small basins in the high mountains and constructing high dams to offset the limited reservoir capacity as required. In the future this will provide an economical and very effective method of water power regulation. It will be worthwhile to employ this method to supplement the existing Gongzui, Wujiangdu, Bikou, and other power station reservoirs in the southwest.

2. Dependence on hydroelectric power to guarantee a reliable source of power was an established fact in a number of countries long ago. But there are drawbacks in its regulatory capabilities: in dry seasons, the output is low and the power supply is unstable, a temporary phenomenon. When hydropower is well developed and power sources planning more rational and the proper supplementary and regulatory measures have been taken, this situation may be corrected, making the power system that relies mainly on hydropower more flexible, better able to adjust to load differences, and more capable of assuring reliable power. The above discussion shows that even though Sichuan lacks reservoirs, auxiliary thermal power plants are not necessary because suitable methods are available by which hydropower stations can supplement and regulate each other. Thus, it is actually possible to construct electric power systems in which water power supplies not just the bulk of the electric power, but all of it.

Of course, linking and regulating the cascade reservoirs on the large rivers is not something that can be done overnight. Rational planning therefore requires that power stations of various capacities and types be used to regulate the power supply. Given the present conditions in Sichuan's power system, it is not appropriate to construct additional large-capacity direct-flow power stations (they could actually aggravate the problem). In the future we should consider developing multistage hydropower stations with tapped reservoirs on small and medium-sized rivers. These should be grouped around the large direct-flow stations for optimum performance. The large direct-flow hydropower stations, which fully harness the available water power during the rainy season and provide the bulk of the power, may be regarded as the backbone of the system. Although the small and medium-sized rivers cannot provide this much power, the cascade hydropower stations with control reservoirs are very effective in augmenting power during dry spells when power is most needed, a flexibility that the large direct-flow hydropower stations lack. By combining these two types of complementary hydropower stations it will be possible to gradually ameliorate a long-standing inadequacy of Sichuan's existing direct-flow hydropower stations (and of those currently under construction), namely their inability to provide a stable source of electricity during certain times of the year. The completion of the Nanya He cascade project on or ahead of schedule will be an important step in this process.

However, there are limits to the extent to which cascade hydroelectric stations on small and medium-sized rivers can effectively regulate the power supply as the number and scale of direct-flow stations increase in the future. It is therefore necessary to develop supplementary regulatory stations of the storage type which are coordinated with direct-flow hydropower stations. Although this method draws off some of the available power during the wet season in order to store it and make it available during the dry months, it provides much more effective regulation than can be achieved using control reservoirs. Since Sichuan and the southwest have an abundant supply of water power during the rainy season, the storage method for regulating electric power may become very important in the future in all aspects of the hydropower industry.

12617
CSO: 4013/76

EXPERTS INSPECT HUNAN EXPERIMENTAL POWER PLANT

HK261331 Changsha Hunan Provincial Service in Mandarin 2310 GMT 25 Mar 84

[Text] After Premier Zhou Ziyang conducted an inspection in our province and returned to Beijing, he immediately asked departments of the State Council concerned to attach importance to our province's experiences in generating electricity with bone coal.

On 21 March, (Zhou Peinian), deputy director of the Energy Bureau of the State Economic Commission, and relevant experts of the Ministry of Coal Industry, the Ministry of Water Resources and Electric Power, and the state bureau of building materials came to Hunan to inspect the situation in the Yiyang comprehensive utilization experimental general plant generating power using bone coal.

After (Zhou Peinian) and relevant experts arrived in Hunan, they listened to the reports made by comrades concerned in our province and inspected the Yiyang comprehensive utilization experimental general plant generating power using bone coal. They held: The achievements in scientific research made through experiments are of important significance and open up a way to utilize fuel of poor quality. The data obtained by the experimental works has now gone ahead of that in other countries. However, countries abroad are stepping up this aspect of research. It is hoped that the scientific and technological workers who are taking part in research will continue to march in depth toward technology.

They also exchanged views with leaders of provincial departments concerned on the problems of the development of the experimental works and scientific research. They will take the views back to Beijing and will report them to Premier Zhao Ziyang.

CSO: 4013/127

THERMAL POWER

BRIEFS

WORK BEGINS ON ZHANGZE--On 15 March, construction officially got under way on the big pit-mouth Zhangze power plant in Shanxi Province. The Zhangze power plant is one of the nation's major construction projects, and will have an installed capacity of 1 million kilowatts. It is located in the outskirts of the city of Changzhi. Work has begun on the first-phase installation of two 100,000-kilowatt generators and the state wants the project completed by the first half of 1986. [Text] [Beijing RENMIN RIBAO in Chinese 23 Mar 84 p 1]

CSO: 4013/130

COAL

MORE RESERVES VERIFIED IN LIAONING

Beijing XINHUA in English 1304 GMT 7 Apr 84

[Text] Shenyang, 7 April (XINHUA)--A total of 420 million tons of additional coal reserves have been verified in China's heavy industrial base of Liaoning Province, according to local coal industry sources.

Some of the reserves were discovered near the rising Tiefa coal mining area in the northern part of Liaoning, one of China's key energy construction centers.

The coal seams recently surveyed there, containing mostly long-flame coal and gas coal, average 7 meters thick and some are suitable for mechanized cutting, the sources said.

Tiefa has estimated reserves of 2,100 million tons, accounting for one-third of the province's known reserves. Five mines in the area cut 3.23 million tons of coal last year. Four mines are planned to be built. When completed, Tiefa will be able to turn out 13.5 million tons of coal a year.

The rest of the reserves are located in Kangping xian to the north of Tiefa.

CSO: 4010/76

BUILDING SHANXI ENERGY BASE HINGES ON UPGRADING EXISTING TECHNOLOGY

Taiyuan JISHU JINGJI YU GUANLI YANJIU [RESEARCH ON THE ECONOMICS AND MANAGEMENT OF TECHNOLOGY] in Chinese No 4, 31 Dec 83 pp 44-47

[Article by Zhang Hongshun [1728 7703 7311]]

[Text] Building the Shanxi energy base will require feasibility studies and accurate qualitative and quantitative analyses, and those directions which we consider finalized should be immediately organized for implementation. We cannot vacilate, merely remaining in place until our program is proven by data and documents. We should begin now on the technological transformation of existing enterprises, with the goal of upgrading the technology of the coal industry as the first step in building the Shanxi energy base.

I. First of all, in China's energy consumption structure, coal makes up 70 percent of the primary energy sources. The rate of increase of coal production directly limits the rate of China's economic development. The national energy shortage is becoming more pressing year by year, and annually the energy shortage is the cause of approximately 20 percent to 30 percent of our production capacity not being brought into play, with a loss of 20 to 30 billion yuan in industrial output value and a shortfall of 4 to 6 billion yuan in tax revenues. Shanxi accounts for one-fifth of the nation's coal output, and coal shipped from there constitutes over 70 percent of the nation's commodity coal. For this reason, we should implement those directions which are regarded as certain and those conditions which have been fully decided upon. For example, we should prepare to build a number of large-scale key mines, open up medium and small open pits, and build coal dressing plants. At the same time, we must proceed with the technological transformation of existing coal enterprises in order to economize on investment, and speed up the increase in coal production, thereby easing the tense national energy situation.

Second, if we look at the Shanxi coal shipping situation, we have six routes: Jing-Bao, Jing-Yuan, Shi-Tai, Han-Chang, Tai-Jiao, and Tong-Pu. These have a shipping capacity of 110 million tons, of which the coal shipping capacity is about 90 million tons. In 1982 the actual amount shipped was 89.15 million tons. The province's coal surplus was in excess of 20 million tons, and during the first half of this year that increased to 31 million tons. Although the nation has already invested huge sums to technically upgrade the six above-mentioned routes with such things as multiple tracking, electrification, automatic block signaling, etc., these technical projects will not come on line until the end of 1986 at the earliest. For this reason, for the 4-year period from 1983 through 1986, the Shanxi coal shipping situation cannot be fundamentally improved. Current development trends indicate there will continue to be a sizable surplus of coal for the short term. During this period, the Shanxi coal industry's development policy should be to strengthen the reorganization of the industry and to comprehensively upgrade the industry's quality, especially technical upgrading. We should not inappropriately stress "If you want abundance, open a secret storehouse," by encouraging peasants in remote mountain districts far from the main communications lines to go into communal mining in a big way, without regard to the transportation situation. Given Shanxi's specific conditions, this course of action would only waste the nation's resources and aggravate the surplus coal situation. At the same time, since the reasons already given will prevent the realization of any economic benefits, it could also discourage peasants from taking an active part in mining in the future. We must take full advantage of the opportunity presented by the reform of our rail transport to build a foundation, especially in three areas: industrial reorganization, technological transformation and personnel development. As for the commune-run mines, we should pay close attention to development of joint operations, upgrading technical levels and anti-disaster capability. After suitable improvements in the railways have been completed in 1986, the nation will make even greater demands on the Shanxi coal industry. The coal industry requires a long period of construction preparation, and a long period of attaining production; for this reason, from now on an emphasis on the technological transformation of existing enterprises is not only a requirement of the present, but is also a requirement of the long-range strategy of building an energy base.

Once again, the Shanxi coal industry is China's leader in output, value of output, efficiency and benefits, but this is by no means entirely due to our industry's being high quality and resolute. In a sense, it is due more to natural conditions, the superiority of environment and geologic structure. Our industrial management cadres and responsible policy-makers cannot take credit for these. Strictly speaking, the quality of the Shanxi coal industry is still very low; if we compare our government-run mines with those of the world's several important coal-producing nations, we lag far behind each in tonnage. Taking West Germany as an example, in 1980 the West German coal industry was 99.2 percent mechanized; Shanxi's was 64.7 percent. West Germany was 100 percent mechanized in tunneling and loading; for Shanxi the figure was 51.49 percent. In West Germany, the daily work face output was 1,356 tons; in Shanxi it was 493 tons. In West Germany the daily work face efficiency was 18.9 tons per worker; in Shanxi it was 7.78 tons per worker. In West Germany, the rate of fatal accidents was 0.87 per million tons of coal mined; in Shanxi it was 2.99. Local mines showed an even greater disparity than government-run mines: In 1980, mines administered on the county level were only 7.11 percent mechanized, with an efficiency rate of 1.29 tons per worker. In the entire province, nearly one-third of the total number of mines were administered by commune teams, some 2,686 in all. On average, these mines produce 11,500 tons of coal annually. Of these, 600 were not in compliance with national safety standards, still using the old mining method of men carrying poles on their shoulders. Of the entire province's coal industry personnel of 500,000, technical personnel in the government mines constituted 1.53 percent of the total, locally administered mines above the county level constituted 0.83 percent, and those in commune-administered mines were too few to matter. In order for an industry this low in quality to meet the responsibility of a yearly output of 400 million tons of raw coal by the year 2000, the amount of difficulty that faces us is obvious. Because of this, constructing a Shanxi energy base would be the same as the central leading comrades' proposal to quadruple China's gross annual value of industrial and agricultural output by the year 2000. The problem is to plan the base during the first 10 years, then take off during the next 10. We must begin now by upgrading the technology of existing enterprises, planning the base solidly.

II. In our province, if we proceed from reality, keeping modern technology in mind, and with a plan, then the different stages will follow abruptly.

The technological transformation of government mines must be in accord with Premier Zhao Ziyang's directive, "By the end of this century, we will have selected from those nations which were economically developed at the beginning of the 70s or 80s the modern production technology suitable for China's needs. This will become widespread throughout China's industrial enterprises, eventually forming a system of technology which is characteristically Chinese." For Shanxi to become the nation's energy base, the government mines must move forward in conforming to this spirit. First, we should determine five or six mines which will aim at the world's advanced level by putting an emphasis on restructuring, with widespread adoption of new technology and new equipment, and in the shortest possible time shortening the gap between us and the world's important coal-producing nations. As for mechanization of mining, close attention must be paid to developing and importing, actively developing comprehensive mining, expanding top grade conventional mining, progressively bringing about conventional mining's superiority. We should eliminate steel props and adopt explosive rock bolting, resin anchors, U-shaped steel arch supports, and other new types of support materials as quickly as possible. As for mining methods in the mines being developed by the Ministry, these should be appropriate, and increase the recovery rate of resources. In the period between the Sixth Five-Year Plan and the Seventh Five-Year Plan, the rate of recovery in thin coal seams will reach 85 percent, in medium thickness seams 80 percent, and in thick seams over 75 percent. In regard to safety in production, we must pay closer attention to underground environment, by implementing remote control telemetry, controlling gas, coal-dust, water, fire, roof cave-ins, haulage and other major accidents. During the period of the Seventh Five-Year Plan, we should make it the highest priority to bring the fatality rate down to the current level of the world's major coal-producing nations, that is, less than one in a million. As for economic benefits, we must move in the direction of greater varieties, doing more pulverizing of coal for multipurpose use, and strengthening the dressing process, so that after the Seventh Five-Year Plan period, the proportion of raw coal entering the dressing plant will be over 30 percent.

Technological transformation of local mines should have the aim of bringing them up to the technical level of the government-owned mines, especially as regards transportation, promoting their ability to link up for completeness, and expanding top-grade conventional mining. Mines which have conditions on them, and comprehensive mining units which were brought into use early, in addition to those being opened up by the Ministry, should all be appropriately centralized, expanding per unit output and progress. As for safety, we must go forward in instituting underground ventilation and communications facilities, and strictly enforce the "Mine Safety Regulations" and "Rules for Safety Supervisors" promulgated by the State Council. This will deter the occurrence of major accidents, moving toward modern production.

Technological transformation of commune mines should have as its objective their integration into the system. At present, of the more than 2,600 sanctioned communal mines, 77.6 percent are not in compliance with safe technical standards. Besides these, there are also quite a few unsanctioned, privately operated small mines. We should definitely put this enthusiasm onto the correct course, keeping in mind the local natural environment and the transportation situation, as much as possible avoiding blindness of action. In 1980, the Provincial People's Government carried out a serious reorganization of the commune-run mines; at that time, more than 580 small mines which were not in compliance with safety standards were shut down. This effort was notably successful: in 1980, the rate of fatalities per million tons was 11.46; in 1981, it dropped to 8.34, and in 1982 it fell to 7.11. At the same time, output increased from 30.9 million tons to 44.56 million tons in 1982. However, in the past year, because the rural areas have been implementing the production system of job responsibility, and a sizable number of communal mines have also implemented individual contracts, our managerial work has not kept up; so the unsafe factors in the communal mines were increasing. Because of this, technological transformation of the commune mines must first deal with the question of reorganization, combining those which can be combined, and closing those which should be closed. Less talk, and more coal production. This will be easier if we concentrate on using materials and equipment, concentrate on providing technical personnel, concentrate on strengthening management, and move steadily toward a standardized mine transition. Those mines which have an annual output of over 50,000 tons should, after undergoing transformation, attain the 1960s levels of the government mines in equipment and technical standards.

III. In order to put into action as quickly as possible the plan to establish Shanxi as an energy base, the plan as a whole should arrange for the technological transformation of government mines, local mines and communal mines, and must deal with the several factors which act to restrict the mines' technological transformation.

First, the plan must give consideration to a necessarily high degree of concentration of coal resources and division of well fields, a rational arrangement. According to the demonstrated results of June 1983, by the end of this century the province's output of coal should reach 400 million tons, of which the government, local and communal mines will produce 195 million, 0.95

million and 110 million tons respectively, an increase of 1.9-fold, 3-fold, and 2.7-fold respectively. This is not a slow pace, but this program projects its total on a basis of the three types of mines--state, local and communal--each having its own plan, and the total output being summed up only at the very end. But in resource utilization and in field division, there is considerable overlapping and duplication, with many disputes. So in one coal field, there will be government-controlled mines brought into the 195 million plan, local mines lined up in the 0.95 million plan, and communal mines accomplishing the 110 million plan. But by doing it this way, 195+0.95+110 will certainly not equal 400. By this I mean that the planned output is not synchronized with the planned resources. As I understand it, this sort of phenomenon will cause the six large coal fields in the province, i.e., Datong, Ningwu, Xishan, Huoxi, Qinshui and Hedong, to operate at different levels. As for coal field prospecting, it goes without saying that Shanxi has a situation that is by nature unique and generous, with many varieties of coal, high quality coal, and abundant reserves. Because national prospecting policy took a strategic shift to the south in the 1960s, and as a result of the "Cultural Revolution" upheaval in the 1970's, prospecting work fell a good deal behind. Of 200.9 billion tons kept in reserve, apart from 21 billion tons already taken up from the producing mines, only a bit more than 12 percent of the proposed reserves were actually supplied, with the remainder having to be subsidized. Moreover, as far as the mechanization of mining went, the requirements grew greater. From this it can be seen that coal field prospecting work will be quite strenuous in days to come. If we do not at first catch up on this step, then there will be no means of carrying out the work of construction. We now have three provincial organizations which have prospecting authority: the Geological Department, the Coal Department and the local Bureau of Coal Management. However, owing to the restrictions of the management system, each has its own program of prospecting and geological data, which they do not share with each other. For this reason, there must be immediate decisive measures taken to highly centralize, under the leadership of the Provincial People's Government, the entire province's prospecting for resources and distribution of well fields. There should be established a management organization with special authority (it could be called the Committee on Resource Management) which would plan a long-range development program which recognizes the principles of the actual situation. In our province, the six major coal fields should be checked in turn, making surveys and delineations where necessary. This would unify the direct prospecting authority and utilize rationally our resources, in order that the three forms of mine control, national, local, and communal, each play its proper role, developing in unison.

Next, a coordinated transformation of those enterprises (especially engineering) which service the coal industry should be carried out. The technological transformation of coal mining does not require large quantities of mechanized equipment, electrical products and new type materials. Although the concerned departments of the national government have in recent years given some support to Shanxi, still there are very large gaps, and as we begin to carry out the technological transformation, these gaps are going to get larger. We cannot rely solely on national support, and at the same time we must move forward in transforming in this province the other enterprises which serve coal. These past several years, Shanxi's governmental mines and local mines have annually used funds amounting to over 400 million yuan for technological transformation, with the opening up of pit mines and acquisition of mechanized equipment each taking up about half of the total. About 200 million was invested in equipment annually. If future basic construction, maintenance and simple replacement of equipment still requires much more than this figure, and keeping in mind that Shanxi's engineering enterprises only produced 70 million yuan's worth of equipment for the coal industry last year, then the gap will get even greater. This will to some extent restrict the progress of technological transformation of the coal industry. We must earnestly seek a solution to this problem. At present, in view of the engineering enterprises' long-term deficits, and the realities of funding difficulties, could we not then consider taking a part of the funds earmarked for technological transformation of the local mines and directly appropriating this to the engineering enterprises? This would allow the engineering enterprises to draw up and design a final pattern for production that would be based on mines' different tonnages, that is 300,000, 450,000, 600,000, or 900,000 tons, and which would conform to the special characteristics of Shanxi's coal seams. This would accomplish standardization and seriation. This way, we would accomplish a set pattern of equipment supply, with top quality equipment, and avoid having to purchase a wide variety of equipment in large quantities. It would also help us avoid the disadvantages of having incompatible equipment, and improve the quality of the mines' technological transformation. A second accomplishment would be to promote the engineering enterprises doing their own technological transformation. If we can persevere in this for a few years, and the funds for investment remain constant, both sectors will benefit, with notable results obtained in the technological transformation of both Shanxi's coal industry and its engineering enterprises.

Beyond this, there are still problems in communications and transportation, resource management, etc., which require more study before they are resolved.

12625
CSO: 4013/107

COAL

BUILDING THE ROADS NEEDED TO BRING OUT SHANXI COAL

Beijing GUANGMING RIBAO in Chinese 31 Jan 84 p 2

/Article by Xinhua reporter Cao Wenlong /2580 2429 7893/: "How Are We To Speed Shanxi Road Building To Expand Coal Transport?--Experts Carry Out Studies and Offer Constructive Opinions"/

/Text/ Experts from the Joint Transportation Institute of the State Economic Commission, Shanxi Academy of Social Sciences, and the Economic Survey and Research Office of the Shanxi Provincial Committee recently carried out a survey and offered constructive opinions on how to speed road building in Shanxi, how to expand the outward transport of Shanxi coal, and how to make the most of Shanxi's abundant coal resources.

Shanxi is one of the nation's foremost coal-producing bases, but because of the constraints of highway conditions, the coal cannot be brought out in large quantities. Shanxi has 9,250 kms of truck highways. The ratings for many sections of these roads are low. They are steep, twisted, and unable to handle traffic. The exprerts suggest that reconstruction should be carried out on these existing truck highways in a planned and orderly fashion, and that technical standards should be improved, so as to expand their transport capabilities.

At the same time, new roads out of the province should be built. Before 1985, efforts should be concentrated on three new outlets in the southeastern part of the province: from Jincheng through Zhanglukou to Bo'ai in Henan, from Yangcheng through Yadao to Jiyuan in Henan, and from Jincheng through Sanyao to Jiyuan. There, they can link up with other highways to increase the coal transport capabilities from central Shanxi to Henan, Shandong, and Jiangsu. Projections and planning work should be affirmatively done for new roads from the Yanbei-Datong region and the Xinzhou and central region to Hebei and Nei Monggol. In the period of the Sixth and Seventh 5-Year Plans, there should be rapid construction of special highways for coal transport from Datong to Tanggu or Qinhuangdao, from Shuoxian to Tanggu, from Yangquan to Tanggu, and from Changzhi to Jining or Xuzhou.

The experts feel that the major difficult at present and in the future for building roads in Shanxi is a lack of funds. Therefore, they have suggested taking a portion of local funds used for coal production to use for the road building. According to calculations, reconstruction of 1 km of tertiary highway requires from 200,000 to 300,000 yuan, so that for an investment of 20-30 million yuan, one new road or outlet from the province could be constructed and 1-2 million more tons of coal could be shipped out. This would lead to even greater economic results for the local coal mines than the present strict investment into coal mining construction.

According to statistics, total investment by the national and provincial government in highway matters in the 32 years from 1949-1981 amounted to something over 190 million yuan, which only amounts to .75 percent of the total investment for basin construction for the entire province in that period. The experts think that there is a need for an appropriate investment proportion for road building and that conditions for new road construction and old road reconstruction must be created.

The experts also suggest that within a specified period there be levies on coal mines for road building expenses and to build up a construction fund for Shanxi roads. According to estimates, if 1 yuan of road construction funds is levied for each ton of coal shipped out, 70-80 million yuan could be collected in the province annually. At the same time, funds from both within and outside the province can be put to good use for road building. Especially in the case of improved roads specifically geared for interprovince coal shipment, every province and city which receives the benefit should buy a share to accumulate construction funds. With conditions at present such that incomes for Shanxi residents are increasing, they should be led and motivated to use their money for energy highway construction, to be put together with shares from the state, localities, and collectives to build high caliber public roads. In some locales, bank loans may be used on a trial basis for road construction, with a fixed portion of newly realized profits from mining and shipping sectors earmarked for repayment of such loans.

12303
CSO: 4013/105

WAYS TO SHORTEN UNDERGROUND CONSTRUCTION TIME EXPLORED

Beijing SHIJIE MEITAN JISHU [WORLD COAL TECHNOLOGY] in Chinese No 9, Sep 83
pp 2-6

[Article by Eng. Huang Mingfu [7806 2494 4395], Shenyang Coal Mine Design and Research Institute: "The Technological Approach to Shortening the Time for Underground Mine Construction"]

[Excerpts] In the mid-fifties through the sixties, the time required for underground mine construction in China was relatively short. Table lists the mine construction time for different types of mine shafts at different periods. According to the 1980 statistics, the average time for mine construction for large, medium, and small mines had been over 100 months. Adopting technical measures in mine design which will rationally reduce excavation and accelerate construction time is an important step.

Table 1. Construction Time for Different Types of Shafts at Different Periods (Unit: months)

Period	Large	Medium	Small
1953-1957	42.6	30.2	23.5
1958-1962	33.5	25.3	20.3
1963-1965	72.2	69.8	60.8
1966-1970	74.6	60.2	44.0
1971-1975	72.9	50.3	47.8
1976-1978	75.3	81.5	73.8

I. Rational Selection of Shaft Sites and Multiple Use of a Single Shaft

1. The Selection of Sites of the Main and Auxiliary Shafts

In most cases of deep-lying pitched or steep seams, two to three levels of approach--vertical shafts and crosscuts--are needed. The main consideration for the selection of the shaft sites under these conditions should be the convenience of the first level production. However, it would be better if the second or third level production are taken into account. Furthermore, an appropriate design would not over-emphasize deep-level production, so shaft sites should not be selected solely on the basis of deep level accessibility. In a multiple-level production vertical shaft, in order to keep the ultimate level away from high-pressure water coming from water-bearing limestone, usually locations near the deep level region of the mine field are selected as the sites of the main and auxiliary shafts. This causes the lengthening of the first-level partial crosscut at the primary stage. The shafts in the Panxie Mining District are located in the seam roof which is 1 km from the floor drift, with two to three connecting main crosscuts. If, for example, the shaft site of the No 3 Shaft of the Panji Mine had been shifted northward to the main drift, it would have reduced the length of the crosscut and the return-air drift by 4.9 km, saved an investment of 7.35 million yuan, and shortened the time for heading through about 1 year. Most of the shaft sites of the Su Xian Mining District are also located in the seam roofs, which are about 0.6 to 1.0 km from the floor drifts. If the shaft site had been rationally shifted toward the level drift, and a horizontal shaft station adopted, the long crosscut, which has a large cross-sectional area, would have been significantly shortened. The above are fairly common in mine design. It is unreasonable to make a large investment at the beginning of mine construction in order to meet demands of deep-level production, which would occur 50 to 60 years later. The technique for deepening a vertical shaft is complicated, the safety installations are usually insufficient, and heavy labor is required, thus deepening a vertical shaft will affect the normal production of the mine. It is often necessary to abandon the original scheme of deepening the shaft, start a new shaft, an internal shaft, or a main dip to exploit the deep-level coal. For example, when deepening several pairs of large shafts in the Zhangzhuang Mine and the Yangzhuang Mine of the Huai Bei Mining Bureau, new auxiliary shafts were constructed and the main shaft was extended to the deep level by constructing a subinclined shaft belt conveyor.

2. Multiple Use of a Single Shaft

At mines where prerequisites exist, the multiple use of a single shaft should be developed.

(A) Using Inclined Shaft for Ascending Mining in Work Areas

Inclined shafts should be used as much as possible for directly exploiting the coal located in the upper regions of the shafts. There are seven commercial seams in the No 3 Inclined Shaft of the Gongwusu Mine of the Nei Monggol Mining Bureau. The seam inclination is 12° to 25°, and there are two working areas in the mine. The central working area was originally designed for ascending mining. Coal was transported by conveyor through lateral drifts to the shaft-bottom bunker, and then to the surface by belt conveyor. Because of the overburden of the seam, the state of the technical equipment, and the characteristics of this working area located on top of the conveyor inclined shaft, the arrangement for the central working area was modified. The main inclined shaft is used as a substitute for the ascending conveyor, and coal comes directly out of the belt conveyor in the main shaft. The inclined air shaft is thereby used to replace the ascending rails at the working area as a supplementary lift. When the main and auxiliary shafts have been excavated to the air-return level and the first stage elevation, it is possible to excavate the crosscut, the trough, and the open-off cut, thus permitting the beginning of the preparatory construction of the working area in advance. After modification, the central working area has the advantages of a footwall shaft, which are: low investment, quick production, and short construction time. By using a gathering belt inclined shaft for excavation, Xin'an Mine of the Shuangyashan Mining Bureau has an annual productivity of 900,000 tons. The main and auxiliary inclined shafts are also used for ascending mining at the central working area, and the middle drift is directly connected with the auxiliary shaft. When the excavation of the auxiliary shaft reached schist layer 0 or schist layer 1, by pulling apart the crosscut and the middle drift of schist layer 0 or schist layer 1, raw coal went through the surge bunker and slid onto the main belt conveyor. The result was that the shaft station and the major drift were eliminated, thus the amount of work required for the first stage and the construction time were reduced. There were four working areas at the deepened -400 level of No 2 Shaft of the Shuidonggou Mine of the Tonghua Mining Bureau. In order to reduce the drifts in the working area and shorten the construction time, the No 1 and No 2 working areas of the -400 level were eliminated, and the deepened inclined shaft is used directly for mining coal. The main conveyor inclined shaft in the Zhenchengdi Mine of the Gujiao Mining Bureau was also used as the conveyor for ascending from the working area. Twenty-five hundred meters of drift excavation as well as the equipment required was reduced, which resulted in saving 1.4 million yuan.

(B) Using the Skip Shaft as a Return Air Shaft

The cross-sectional area of a shaft must be large if the exploiting level is deep, the mine is large and the demand for air is great. For the construction of a shaft with a large cross-sectional area, not only is the cost high, but also the progress is slow and the construction time is lengthened. Attention should be paid to reducing the number of shafts and making full use of the shaft cross section. It is relatively common to use the skip shaft as an air shaft in Poland and West Germany. In order to keep the coal away from direct contact with the air flow, it is advisable to use lateral-loading skips with turntable sealing baffles. Dust separators should be installed at the ground discharging station and the rotary dump station at the bottom of the shaft to reduce the underground pollution caused by coal dust. A sealed ship could be used to prevent the coal dust from billowing up. The beneficial effect of eliminating the dust can be obtained either by installing the dust separators or by sealing the skips.

It was relatively common to use the skip shaft as a return air shaft in China in the fifties. It was also beneficial for the separate ventilation of underground magazines and [battery] charging stations by using the skip shaft as a return air shaft. But this arrangement was not widespread because the air leakage problem had not been solved. If the skip shaft is used as a return air shaft, the portal structure must be tightly sealed. Rubber sealing baffles should be installed at the outlet of the belt conveyor, and rubber rings or plastic sheets should be used to seal the cable outlet. The air leakage would be reduced if a certain amount of coal is kept in the portal bunker. As the depth of mining increases, it is possible to consider the use of skip shafts as a return air shaft in mines where the depth of the shaft reaches 600 meters. The total air inlet for the Donghuantuo Mine of the Kailuan Mining Bureau, designed by the Montez Co., West Germany, is 30,000 m^3/ min. The No 2 Shaft (auxiliary shaft) and the No 3 Shaft were used as the air shafts, and the No 1 Shaft (main skip shaft) and the No 4 Shaft (ventilation shaft) were used as the return air shaft. Due to the use of the skip shaft as a return air shaft, sealing is required for all of the portal equipment. In the design, the skip coal-dumping point is totally sealed and dust separators are installed. The two sets of valves for the receiving bunker at the headframe are alternately opened or closed, along with a sealed section of coal, etc., thus avoiding the shortcircuiting of the air flow. When the skips are replaced, the portal is sealed by moving lids at first, then the portal door is opened for operation. When replacement of the skips is finished, the portal door is closed and the covering lids at the portal are removed. An air-tight chamber is designed at one side of the headframe and two air-tight doors are used in the case that long materials must be lowered. This is a relatively good measure. The portal circulating air is 754 m^3/ min., and the loss due to leakage is about 3 percent. The design capacity of the Daxing Mine of the Tiefa Mining Bureau, Liaoning, is 3 million tons/year. The net diameter of the main shaft is 7 meters, with a depth of over 700 meters. The main skip shaft is used as the return air shaft for the three working areas at the primary production stage. Because of this, one shaft is reduced, and the distance for heading through is shortened. Besides, both ascending and descending mining are arranged simultaneously at the primary working areas which are located near the safety coal column of the mine facility area. When separate ventilation is needed, the main skip shaft could be used as a return air shaft for the descending mining area, and the construction time is effectively shortened.

3. Selecting the Site of the Ventilation Shaft

In selecting the site of a ventilation shaft, it is necessary to provide economical and rationally planned ventilation, to use to the greatest extent possible every kind of coal column as the safety coal column for the ventilation shaft, and to make it beneficial for the advance preparation of the working area. Besides this, shortening the distance for heading through should be considered as an important factor in selecting the site of a ventilation shaft. Yaoqiao Mine of the Datun Mining Bureau is a large mine. The total length of the drifts is 22,000 meters. Due to the optimum location of the ventilation shaft, the distance for heading through is only 3 km. It took only 56 months to complete. The overburden of Zhenchengdi Mine of the Gujiao Mining Bureau is shallow, an inclined shaft is designed, and the No 1 working area at both the east and west wings share one return air shaft, therefore the distance for heading through is only 1.6 km. For large mines with thick alluvium and abundant reserves, the site of the ventilation shaft should also be selected close to the working area at the primary production stage. This permits the use of the ventilation shaft for preparing the working area in advance. In order to shorten construction time, drilling should be used as much as possible to construct the shaft, or a ventilation shaft with a small diameter should be drilled.

II. Optimum Conditions for Construction at Multiple Locations Should Be Created in Design

1. Constructing New Mines by Utilizing Existing Producing Mines

In designing the overall plan for a new mining area or reconstructing an old one for exploiting the newly discovered peripheral reserves, the previously constructed mines should be used in multiple drivage, thus excavating the main drifts and drilling the preparatory project for the working area of the new mine in advance, which makes the goal of shortening the construction time attainable. In an overall plan, the level elevation of the neighboring mines should be kept as common as possible in order to provide mutual coordination in construction, and appropriate adjustment of the mine boundary could be made according to the actual situation during the production period. The Lingxi Vertical Shaft of the Shuangyashan Mining Bureau was deepened by utilizing the ventilating shaft and the production shaft, resulting in a 5-month shortening of the construction time.

2. Excavating at Sub-areas and Constructing at Multiple Locations

If the overburden of a coal seam is shallow, and the depth of the ventilation shaft is less than 200 meters, air shafts should be built and ventilation systems should be adopted. Coal from individual areas would be gathered at the belt inclined shaft to be transported. The transportation of personnel and material should form its own system within the sub-area. This not only improves ventilation, but also utilizes the ventilation shaft for excavating the working areas. For example: the annual production of the extra large mines in Shanxi is 3 to 4 million tons. The length of the drifts for one mine are 60,000-80,000 meters. There are many shafts, including four to five groups of air inclined shafts for the sub-areas. The entire construction process could be broken into parts which could be carried on simultaneously. There are no facilities for the ventilation shaft in the working area, not many shaft stations, and the surface mine facility area is simple. When the construction of the shaft is completed, the excavation for the main drift at the shaft bottom could be started. Simultaneously, excavation could be started at every sub-area, heading towards the main drift laterally. Thus the preparatory project for the working area and the excavation for the inclined shaft and the main drift are carried out in parallel operations. According to the experience of the mines in the western district, it is possible to start production in about 4 years, and to complete the total construction in about 5 to 6 years. Therefore, the construction time for the large mines is shortened. Another example: the overburden of Yungang Mine of the Datong Mining Bureau is rather shallow. Air was let in through the auxiliary vertical shaft and the two vertical air shafts. At the first stage, the return air shafts were arranged for ventilation at three panels, creating an opportunity to construct simultaneously at multiple portals. Seven portals were used for constructing. The maximum distance for heading through the drifts was 1.9 km. Construction started in October 1966, and the mine was brought to production in March 1973. It took 77 months to complete the construction of a mine which has an annual output of 1.5 million tons.

III. Improving the Layout of the Mine Facility Area

Depending on the relief of the land and the overburden of the seam, the mine facility area should be laid out to optimize the surface production system, occupy less area, cover less safety coal column, and to economize the overall surface and underground operation. At present, when the overburden of a mine is thick, the mine facility area would usually cover a big amount of coal. The distance between the working area at the primary stage and the shaft is long due to the extensive range of the mine facility area and the large amount of safety coal column reserved. This increases the useless footage during the construction period, and causes the lengthening of the heading-through distance and the construction time. The mine facility area of several new mines of Panji Mining District were designed to occupy 30 to 40 hectares. Actually they occupy more land: the Panji No 1 Shaft occupies 83.6 hectares and the Panji No 2 Shaft occupies 78.9 hectares. The mine facility area of the Zhangji Mine covers 120 million tons of coal which is equivalent to the total geological reserves of a medium-sized mine. The housing area, the social services building and the mine facility area are connected by several new mines of the Yanzhou Mining District. The office and the social services building were separately built, having fewer stories, but occupying more land. The direct reasons which cause more land to be occupied by the mine facility area are: the need for formal symmetry and order, the emphasis on a rectangular layout, a north-south orientation, and the combination of production and services buildings into one. Land occupied by mines abroad is nearly half that occupied by our mines of the same type. For example, the ratio is 0.67 hectare/10,000 tons for the Wilde Mine, West Germany; and 0.52 hectare/10,000 tons for the Red Army Mine, USSR. In order to occupy less land, cover less coal, reduce the underground excavation, and shorten construction time, suitable measures should be adopted according to local conditions, which are: (1) The mine facility area should be laid out as a strip to cover less coal of the first level. (2) If the shaft site is not far away from the coal area, the auxiliary and supplementary buildings as well as the social services building should be moved away from the facility area. Only the combined building for the main and auxiliary shafts should be built on it. (3) According to different conditions, combine the separate production buildings, supplementary production buildings, and the social service building into a multi-story one, and make it compact and convenient to use. In large mines, a building complex taking the main shaft as a center as well as the auxiliary shaft as a center should be considered, so that the level of mechanization and automation can be raised, the employees at different stages of production could be reduced, the efficiency raised, and the work conditions improved. The complex building should be considered for utilization during the construction period. (4) Design the buildings and the structures by making full use of the topographic features and the difference in elevation of the land, and try to adhere as close to the natural environment as possible, thus reducing the earthwork and shortening the construction time.

IV. Preparation of the Coal Field and the Arrangement of the Working Area

1. Arranging the Working Area From the Shaft Towards the Boundary of the Coal Field

The amount of construction at the primary stage for mining in forward sequence is small, the construction time short, and the mine is quickly put into production. Most of the mines have been designed in that manner in the past and at the present. But more construction has been requested in some mines than is needed. The excavation of the drift for the whole level is requested to be finished during the construction period in order to reduce the conflict between mining and excavation during the production period, and to understand totally the seam and geological changes so that ventilation leaks can be avoided. (Or at some units, in order to avoid the difficulty of moving the housing area before the mine is put into production, an arrangement of a working area at the primary stage across the safety coal column for that housing area is requested.) Drifts are then designed to reach the working area at the primary stage, which is located at the boundary of the coal field, greatly increasing the distance for heading through. For a large mine this distance usually comes to 5,000 to 7,000 meters, which causes a big initial investment and prolongs the construction time. This practice must be completely abandoned. The principle of exploiting first the close and then the distant must be carried out in the mine design. The primary working area should be near the shaft.

2. Simultaneous Arrangement of Ascending and Descending Mining

When three or more working areas are needed for excavating seams with an inclination less than 16°, one or two of the wings should have two working areas. The total main drift and the return air drift for a wing having two ascending mining areas would be 2 km longer as compared with one having one ascending mining area and one descending mining area. This prolongs the heading-through distance and the construction time. Under such conditions, even though the efficiency of the excavation for the descending mining is a little lower than that for the ascending mining, the drainage system would be more scattered, and possibly more ventilation leaks could occur, the ascending and descending mine design should nonetheless be utilized. All the above problems could be solved if appropriate measures are adopted. Usually the length of the descending mining should not be more than 500 meters. If the water surge is small, the length could be properly extended. Construction time will be effectively shortened if ascending and descending mining could be arranged simultaneously. The usual method of ascending first and descending last should be modified.

3. Arrangement of Dip Longwall Mining

Dip longwall mining is the direction of technical development for exploiting moderate-dip seams. In China, there are more than 20 mine districts and over 50 mines which have more than 200 dip longwall working faces. The above arrangement, in which the haulage drift and the return air drift of the working face are directly connected with the major drift of the mine, eliminates the ascending and the descending, so excavation is less and the preparation time for the working area is short. The construction time could be shortened 1 to 2 years for a large mine if dip longwall mining rather than cross-pitch longwall mining is utilized. When dip longwall mining is utilized instead of cross-pitch longwall mining in Datong No 1 Mine of the Songzao Mining Bureau, the length of drift excavation was reduced 3,800 meters, the total length of horizontal drifts was reduced 23,250 meters, and the length of the drifts for the whole level was reduced 12,030 meters. Table lists the comparison of the two arrangements for the three working areas in Xinglongzhuang Mine.

If comprehensive mining machines* are used, the best operation would occur where the seam inclination is about 6° and will usually be satisfactory at an inclination of up to 12°.

* Machines that do several mining functions instead of one.

Table 2. Comparison of the Arrangements of Three Working Areas in Xinglongzhuang Mine

Arrangement of working area	Quantities of drifts (m)	Construction time (months)	Investment (10,000 yuan)
Dip longwall	7.971	24	532
Cross-patch longwall	6.678	19	416

V. Raise the Level of Mechanization

At present the level of mechanization is low. In order to meet the plan for the annual production of the mine, the number of working areas and the working faces are usually increased in the mine design. It not only diversifies the production area, but also is one of the main reasons which at present causes the large drift length requirements, large investment, and long construction time for the new mines. The productivity of Yungang Mine is 1.5 million tons for the first stage. It has 12 stopes, including two that are alternate. Blast mining has been adopted at all stopes. The level of outfit for mining and excavation are low, and the unit productivity is not high (an average annual productivity of 150,000 tons per stope). If the level of outfit is raised, the drift lengths could be reduced and the construction time could be shortened. When regular mining in the design of the Xinglongzhuang Mine was changed to comprehensive mining, the working areas were reduced from five to four, the working faces were reduced from 17 to 10, and the drift excavation was reduced by nearly 10,000 meters. Recently, a comprehensive machine with a mining height of 4 meters was imported and has been profitable in raising the unit productivity of the working face and the labor productivity. The annual planned production for the Zhenchengdi Mine of the Gujiao Mining Bureau, is 1.5 million tons, the average seam depth is 3.56 meters, and five to six stopes are required. After it was changed to full-seam mining, the number of work faces were reduced to two for comprehensive mining, and one for regular mining. The total drift length for the whole mine was only 12,523 meters, which is greatly lower than those of the same kind. It could be seen after comparison that it is very beneficial to raise the level of mechanization for the shortening of the construction time. Besides, although the level of outfit in some mines is raised, the capacity at the production phases is intensified, but the productivity of the working area and the working face is still very low. Therefore, the annual design productivity for some of the working faces with comprehensive mining is only 300,000 tons, which would increase the quantities of the excavation in the same way. The unit productivity for some of the working faces with comprehensive mining in our country has broken 1 million tons/year in successive years. The average unit productivity for comprehensive mining has also been increasing year after year. The unit productivity of some high level working faces with regular mining reached 500,000 tons/year. The mines designed at present would be put into production in 5 to 6 years. With the further improvement of the scientific management, a prospect of a general raise in the levels of comprehensive mining and regular mining would definitely appear then. Therefore, at present, the mine design should suit the technological as well as the productive development, and be creative so as to speed up the mine construction.

VI. Doubling Potential Should not be Reserved in the Design

In mine design, a certain unbalanced coefficient and a back-up coefficient is always considered in the selection of the equipment and the arrangement of the system at every phase of the production. Usually there are one or two alternate working faces in large mines. Normally there is a reasonable spare capacity for the lifting system and the shaft station, which would meet the demand for normal production as well as an appropriate increase in the production. Despite the result of the investment, some units try to reserve inappropriate doubling capacity, and demand more or larger equipment, resulting in an increase of excavation and a lengthening of construction time, both very unfavorable to the overall construction of our country. For example, the design output of a certain mine is 4 million tons, but a potential of producing 6 million tons is reserved in the design. This phenomenon, which affects the speed of mine construction in varying degrees, is common. The main production phases of a mine should be determined only by the design scope. If the production level of a mine reaches the design capacity soon after investing, and the potential for increasing the production is really high, it could be further solved by reconstructing the mine.

12631
CSO: 4013/14

INDUSTRY URGED TO FIND MORE USES FOR BONE COAL

Beijing NENG YUAN [JOURNAL OF ENERGY] in Chinese No 6, 25 Dec 83 pp 9-10

[Article by Zhang Jifa [1728 0679 4099] of the Heilongjiang Provincial Coal Board: "Bone Coal Should Become Secondary Resource of the Coal Industry"]

[Text] Under the constraints of the operational principles of coal enterprises in the past, bone coal was looked upon an an inductrial waste material, and work progressed slowly on its multiple uses. This article presents some preliminary views on ways to utilize bone coal and their economic benefits.

Coal is the primary resource of the coal industry. Used mainly to provide thermal energy, it includes anthracite, bituminous coal, lignite, and peat. The main task of coal enterprises lies in the rational exploitation and utilization of these resources.

Bone coal is a secondary resource of the coal industry. It is found in large quantities and there are many kinds, such as clay bone coal, sandstone bone coal, and carbonate bone coal. In terms of carbon (organic) content, there are low-, low intermediate-, intermediate-, high intermediate-, and high-carbon bone coal. In terms of sulfur content, there are low-, low intermediate-, intermediate-, high intermediate-, and high-sulfur bone coal. Different kinds of bone coal have different uses. High-silicone bone coal can be used in making gas concrete products. Clay-type bone coal is a good material for making bricks and ceramic products. After treatment high-carbon bone coal can be used as fuel for fluidized-bed boilers and for building materials. Bone coal can also be used to produce chemical and refractory materials. Thus it is by no means a waste material but a coal mine resource that has many uses.

Mine gas is a third resource of the coal industry. It is called a natural combustible gas together with petroleum-derived combustible gas.

1. Coal Enterprises Should Develop All Three Product Series

Since there are three main types of resources available to them, coal enterprises should as a matter of operational policy actively utilize all these resources to produce multiple lines of products and diversify their product structures. Enterprises operating on this multi-product and multi-use basis will bring maximum benefits to the enterprises themselves and to the state. Based on the different resources and their different products, coal enterprises should carry the following three major product series:

First product series. Raw coal, washed coal for use in industries and homes, coking coal, and other coal products that provide thermal energy.

Second product series. Products based mainly on bone coal, such as low-heat value fluidized coal, coal for use in building materials, bone coal for use in power generation, building materials, materials for back filling mined out areas, and in raw materials for the chemical industry.

Third product series. Products with mine gas as raw material, such as gas fuel and chemical products.

So far, progress has been slow on the utilization of bone coal and the development of bone coal product series, as many coal enterprises have yet to give this matter the attention they should. As for mine gas, coal enterprises have seldom included it as a resource in the reserve estimates in their geological survey reports. Coal enterprises have seldom regarded as a resource, to be developed and utilized, in their overall designs for coal mines. On the contrary, many coal enterprises regard it as a harmful gas to be disposed of. In view of China's energy policy and the needs of economic development, coal enterprises must not confine themselves to developing only coal resources and producing only coal products, but must also develop and utilize bone coal resources, produce bone coal products at a faster rate whenever local conditions permit, and also actively develop and utilize mine gas.

2. Heilongjiang's Coal Enterprises Are Taking the Right Path in Putting Bone Coal to the Serial Production of Heat, Power and Building Materials

The usual steps for putting bone coal the serial production of heat, power and building materials are as follows: Bone coal is first turned into low-value fuel to be buse as fuel for fludiized-bed boilers. The intermediate-pressure steam produced is used to turn the back-pressure generator units. Then the intermediate-pressure steam is turned into low-pressure steam for use in mines, washing plants, other industries, homes, and for use in fabricating bone coal building materials. In the first cycle, steam is used to generate power, and in the second cycle, steam is used to furnish heat. Finally the slag is used to make building materials and for back filling mined-out areas. This completes the whole cycle of serial production based on bone coal.

Coal enterprises in Heilongjiang province have the following advantages for the multiple development of bone coal.

(1) The province's bone coal resources are abundant and their quality good.

There are at present some 70 million tons of bone coal lying on the ground in the various mining districts of the province. Henceforth, with the increased coal output and a greater proportion of the coal to be washed and prepared, the yearly discharge of bone coal will be about 8 million tons. This type of bone coal generally has a heat value of 1500-1800 kilocalories. It is mainly sandstone bone coal, with a high silicon dioxide and aluminum trioxide content and a very low sulfur content. It is suitable for making low heat value fuel and building materials. The fluidized coal made from washed and dressed bone coal is already being used in the province's major thermal power plants, in the Jixi mining district's bone coal power plant with a capacity of 25,000 kilowatts, and for the fluidized bed boilers with a capacity of 10 ton/hr. or above in various mining districts.

(2) The province already has the initial facilities for establishing the serial production of heat, power and building materials.

There are one or more large-size washing plants in every mining district in the province. They are all quite close to the large mines, some are located right in the industrial square of the large mines. Some washing plants already have a large production capacity for fluidized coal. With certain technical renovation, a serial production of heat, power, and building materials can be quickly established at these washing plants and mines. The capital investment would be much less than would be needed for building heat supply systems, power plants and building materials plants separately.

3. Establishing Serial Production of Heat, Power and Building Materials With Bone Coal at the Coal Mines of Heilongjiang Is Technically Feasible

There are four technical requirements for setting up serial production of heat, power, and building materials based on bone coal: The heat value of the bone coal; the furnace for burning the fluidized coal made from bone coal; generator units adapted to the special requirements of the coal mines; and the quality and suitability of the fluidized-bed boiler slags for making building materials. The washed bone coal at the province's various mining districts generally has a heat value of 1500-1800 kilocalories. Almost every mining district now has a large fluidized coal production shop. China can now produce its own fluidized bed boilers with a capacity of up to 35 ton/hr. Using fludiized coal made from bone coal, China long ago started to produce back-pressure generator units which can be used both for power generation and for supplying heat. And it has been proven through lab tests and actual use that fluidized-bed boiler slag fully meet the requirements for wall building materials.

4. Preliminary Ideas About Serial Production of Heat, Power, and Building Materials With Bone Coal at the Mining Districts in Heilongjiang

Measures should suit local conditions, resources should be close at hand, and existing facilities should be put to maximum use. The remodeling of existing facilities should take precedence over the building of new plants. With these principles in mind, our preliminary ideas are presented as follows:

(1) Select a site in a well-developed mining district where there is a large coal mine and a washing plant in the industrial square nearby, convert the existing boilers and low-pressure fluidized-bed boilers into intermediate-pressure fluidized-bed boilers; establish a bone coal power station, usually

with 4-5 generators each with a capacity of 6000 KW, and build a slag products plant of suitable capacity. Today, three mines under the Jixi Mining Bureau are equipped to do this -- Chengzihe Coal Mine, Xiaohengshan Coal Mine, and Didao Coal Mine.

(2) Select a large, independent washing plant in a well-developed mining district, replace the existing heat-supply boilers with intermediate-pressure fluidized bed boilers and build a thermal power station and a bone coal products plant attached to the washing plant. The washing plant of the Shuangyashan Mining Bureau, the washing plant of the Qitaihe Mining Bureau, and the Nanshan washing plant of the Hegang Mining Bureau are equipped to do this.

(3) When building new large-sized mines and washing plnats in the future, consideration should be given to building bone coal power stations at the same time, replacing the existing heat-supply system.

(4) With more bone coal power stations built, workers at the mines will have more electricity to use for home heating and cooking. This would have the advantage of not only improving the workers' living standards and environment, but also saving the coal for use in economic development.

9924
CSO: 4013/80

PROSPECTS SAID BRIGHT FOR EXPLOITING SOUTH'S STONE COAL

Beijing ZHONGGUO MEITAN BAO in Chinese 14 Dec 83 p 1

[Text] After 6 years of comprehensive surveys, the Ministry of Coal Industry organized an appraisal of the findings and concluded that there are good prospects for exploiting and using the south's abundant stone coal.

Since 1978 various interested sectors in China have been exploring the stone coal resources in 12 provinces and regions, including Jiangsu, Zhejiang, Anhui, Fujian, Guizhou, Henan, Hubei, Hunan, Guangdong, Guangxi, and Shaanxi where the resources abound. A preliminary examination has identified 60 different associated chemicals, 10 of which are of usable quality, including vanadium (V), molybdenum (Mo), copper (Cu), gallim (Ga), uranium (U), silver (Ag), rate earth, yttrium (Y) and samarium (Sm). The vanadium, distributed widely, is plentiful in reserves. The preliminary findings also identified eight minerals present with the coal, and they are phosphorus, potassium, pyrite, limonite, barite, dolomite, asbestos and bitumen. This comprehensive survey of the stone coal has identified an important source of energy for those regions, such as Zhejiang, Hubei, Western Hunan, Southern Shaanxi, and Northern Jiangxi, where coal is scarce.

Today, South China produces and uses per annum over 5 million tons of stone coal which is being developed for comprehensive utilization rather than fuel only. According to the preliminary statistics of seven provinces, including Zhejiang, Hunan, and Hubei, stone coal is used to produce each year over 2 million tons of lime, over 700,000 tons of cement, 1.1 billion fire bricks, over 500 million carbonized bricks and over 200 tons of vanadium pentoxide. They also extract many other minerals from stone coal, such as nickle, molybdenum, and vanadium.

The appraisal of the comprehensive survey shows that new technology for exploiting and using stone coal has emerged in recent years. The experimental plant for comprehensive use of stone coal of Yiyang, Hunan, has succeeded in using stone coal slag to generate electricity and to manufacture building materials, and both were officially certified in March and November 1982. Various provinces in South China use stone coal to bake cement and an experiment to make cement out of stone coal slag has been successful. New techniques to extract vanadium from stone coal have brought improved quality and lower costs. The work to extract nickel and molybdenum from stone coal, to produce chemical fertilizers from gasified stone coal and to turn stone coal into formed coal has seen successes. Stone coal concentrate, now being used experimentally on a semi-industrial basis, will enhance the value of use of stone coal.

5360
CSO: 4013/98

XISHAN'S 1984 GOAL: 11.3 MILLION TONS

Beijing ZHONGGUO MEITAN BAO in Chinese 28 Dec 83 p 1

[Article by Xu Ruoqi [1776 5387 3823]]:

[Text] The cadres at all levels of the Xishan Bureau of Mining have gone to various localities and production brigades to firm up the plan for 1984. They are prepared to do their utmost to begin a prosperous new year.

The production plan for 1984 handed down by the state to the Xishan Bureau of Mining calls for 11.3 million tons, a 5.6 percent increase over that of 1983. Even though some comrades fear the plan may fall through, cadres in the Bureau and the mines are convinced that in spite of the difficulties, conditions are favorable enough to push the implementation of the plan by upgrading the mechanization of mining, coordinating the excavation ratio, and improving the ventilation and transportation facilities to accommodate increased production. To ensure full implementation of the plan for the coming year, they will direct their attention to seven different areas:

1. Study the documents on party consolidation, using them as a motivating force for progress.

2. Coordinate the different aspects of work.

3. Strive to increase per-unit output, per-unit tunnelling, and efficiency.

4. Improve maintenance and repair of mining equipment.

5. Properly train newly recruited miners.

6. Ensure mining safety and launch a 100-day safety campaign.

7. Concentrate on immediate tasks and at the beginning of year in order to usher in a prosperous new year and set a new record in all areas during the year.

5360
CSO: 4013/98

COAL

DATONG'S 1984 GOAL: 28 MILLION TONS

Beijing ZHONGGUO MEITAN BAO in Chinese 28 Dec 83 p 1

[Article by Ma Yuxiang [7456 3768 4382]]:

[Text] The 28-million ton production goal for 1984 was handed down in mid-December to the basic levels by the Datong Bureau of Mining, which also spelled out the targets in ten different areas.

Upholding the spirit of the All-China Coal Industry Planning Conference, cadres at all levels of the Datong Bureau of Mining are convinced that the current situation is so favorable that the state plan can be satisfactorily implemented without insurmountable difficulties and that the Datong Bureau should take the initiative to overcome the difficulties, produce more coal and ensure complete implementation of the state plan in the prescribed tonnage and footage. They have specified the targets to be achieved in ten different areas:

1. Implement fully the 1984 plan of 28 million tons of coal production and create conditions conducive to much greater output in 1985;

2. Step up the pace and upgrade the quality of key construction. Each of the two engineering projects should pass the 10,000-meter mark in its annual rate of tunneling;

3. Eliminate serious accidents and cut back the number of casualties to the lowest rate ever;

4. Seventy-four percent of the mining operations and 77 percent of the tunneling equipment must be mechanized;

5. Upgrade per-unit output by 4.5 percent, upgrade per-unit tunneling by 6.7 percent and upgrade the recovery rate by 2 percent;

6. Increase the recovery efficiency by 3.6 percent and increase the tunneling efficiency by 2 percent;

7. Set a new record in the drive to increase production and reduce consumption; to increase revenues and reduce expenditures. Increase the margin of profit by 4 percent;

8. The production technology must be further improved. Modern technology such as computers should be applied to coal mining;

9. Facilities must be further improved. The presence of moisture must comply with the "90 · 5 · 1" standard. Large stationary equipment must be kept in good repair;

10. To train staff employees and workers, the bureau should release 5,000 people from work in turns to receive training in order to upgrade both technology and management.

5360
CSO: 4013/98

COAL

BRIEFS

ANHUI PEAT DISCOVERY--Large-scale peat deposits, along with rich sulphur and iron deposits, have recently been discovered in Fanchang County, Anhui Province. These big peat deposits have verified reserves of more than 2 million tons with the mineral resources spread over a broad area. Of a uniform thickness, the deposits have a humic acid content of 30 percent. This discovery will provide raw material for fertilizer and fuel for the coal-short region of Jiangnan. [Text] [Beijing RENMIN RIBAO in Chinese 18 Feb 84 p 1]

CSO: 4013/130

OIL AND GAS

FIRST EXPLORATORY WELL IN SOUTHERN YELLOW SEA DRILLED

Beijing XINHUA in English 1457 GMT 16 Apr 84

[Text] Shanghai, 16 April (XINHUA)--Drilling of the first exploratory well in the southern Yellow Sea began yesterday under a Sino-foreign cooperation plan.

"This marks the full swing of oil development operations in the southern Yellow Sea," said Hu Kejie, deputy general manager of the Nanhuanghai Petroleum Corporation of the China National Offshore Oil Corporation.

The Nanhuanghai Corporation will cooperate with a consortium led by British Petroleum Devlopment Ltd. (BP) in drilling the well designed to be 4,000 meters deep. Drilling operations on the well, 300 kilometers northeast of Shanghai, are being undertaken by the "Bohai No. 10" rig of the Bohai Petroleum Corporation, a contractor of the BP-led consortium.

BP's partners are the Broken Hill Proprietary Co Ltd of Australia, Petrobras International S.A. of Brazil, Ranger Oil (Canada) Ltd., and Petro Canada Exploration Ic.

The well is located in one of China's six offshore oil and gas bearing basins found so far. Sediments there are estimated at more than 5,000 meters thick.

K.D. Erstine, manager of the Shanghai region of BP (China), said that he was optimistic about oil survey prospects in the southern Yellow Sea.

CSO: 4010/76

OIL AND GAS

SHANGHAI OFFSHORE OIL SERVICE CORPORATION OPENS FOR BUSINESS

Beijing XINHUA in English 1630 GMT 17 Apr 84

[Text] Shanghai, 17 April (XINHUA)--The Shanghai Offshore Oil Service Corporation, the second of its kind in China, started business today.

The corporation will provide support services for exploration and development of petroleum resources in the southern Yellow Sea and the East China Sea.

Since January, it has established business ties with 100 overseas firms and set up subsidiary companies providing vessels, helicopters, communications services and meteorological information. Later this year, it will also establish subsidiary companies providing accommodations, wharves, materials, labor services, equipment maintenance, and marine engineering services.

In cooperation with overseas firms, it has supplied three anchor-handling, tug, and supply vessels, two helicopters, and materials for the drilling of the first exploratory well in the southern Yellow Sea. The drilling began on 15 April.

"Foreign firms are welcome to negotiate on cooperation in providing support services for the development of China's offshore petroleum resources," said Zhou Bi, chairman of the board of directors of the corporation, at an inaugural reception today.

CSO: 4010/76

NEW SHENGLI WELLS PRODUCING CRUDE, NATURAL GAS

OW251656 Beijing XINHUA in English 1557 GMT 25 Mar 84

[Text] Jinan, 25 March (XINHUA)--Production tests show that a newly drilled well at the Shengli oil field in east China's Shandong Province pumped 1,100 tons of crude oil and 33,000 cubic meters of natural gas a day, oil officials said here today.

The new well is 1,674 meters deep and data show that the oil-bearing strata are 40 meters thick, the officials said, adding that the zone where the well is located covers an area of more than 100 square kilometers.

Earlier this month, Shengli also succeeded in drilling a 3,681-meter deep well that produced over 3,600 tons of crude oil and 360,000 cubic meters of natural gas a day--the highest daily output since the oil field was opened 20 years ago.

Shengli is China's second largest oil producer and in 1983 it pumped out 18.36 million tons of crude oil, 12 percent more than in 1982 or about 18 percent of the country's total.

The 20-year-old Shengli field has so far produced a total of more than 210 million tons of crude oil and 13.56 billion cubic meters of natural gas.

The Daqing oil field in Heilongjiang is China's largest oil producer, pumping 50 percent of the country's total annual output.

CSO: 4010/70

OIL AND GAS

RESERVES IN TIANJIN AREA ESTIMATED AT 2 MILLION TONS

OW020915 Beijing XINHUA in English 0702 GMT 2 Apr 84

[Text] Tianjin, 2 April, (XINHUA)--Oil reserves in the Tianjin area, both onshore and offshore, are estimated at 2 billion tons, according to a resources survey just completed in the area around the north China city.

The survey, which began in June 1982, revealed ten depression zones with possible oil reservoirs in the Dagang oil field and on the continental shelf in the Bohai.

The oil reserves that have been verified are only part of the prospective reserves. The onshore Dagang oil field now produces about 3 million tons a year.

Covering more than 10,000 square kilometers of land area and 6,000 square kilometers offshore, the survey was the third of its kind to provide accurate information for a long-term development program. The first was conducted in the 1950s and the second in the 1960s.

The survey also confirmed two geothermal zones, covering a combined area of 300 square kilometers. With water temperature reaching 40 degrees centigrade at a depth of 200 meters, the geothermal resources will provide additional energy supplies to local industry and agriculture.

Analysis of the data obtained indicated possible fresh water resources lying between 200 and 500 meters under the seabed. If confirmed, this means that the fresh water needed by ships and offshore oil rigs will not have to be shipped from the land.

This discovery may also provide clues to the history of the evolution of geological and topographical conditions in the Bohai.

CSO: 4010/70

OIL AND GAS

BRIEFS

SHENGLI RECORD OUTPUT--Jinan, 10 Mar (XINHUA)--A newly drilled well at the Shengli oil field in Shandong Province produced over 3,600 tons of crude oil and 360,000 cubic meters of natural gas a day--the highest daily output since the field was opened 20 years ago, officials here said. Shengli, China's second-largest oil producer, pumped 18.36 million tons of crude oil last year, 12 percent more than in 1982 and about 18 percent of the country's total. Over 460 new wells with a combined annual production capacity of 1 million tons went into operation in 1983. The oil field has produced more than 210 million tons of crude and 13.56 billion cubic meters of natural gas in the past 2 decades. It has contributed 13.06 billion yuan (about 6.53 billion U.S. dollars) in profits and taxes to the state, nearly five times the government investment. The Daqing oilfield in Heilongjiang Province is China's largest producer, pumping 50 percent of the country's total annual output. [Text] [OW100730 Beijing XINHUA in English 0654 GMT 10 Mar 84 OW]

CSO: 4010/67

MINISTRY ANNOUNCES CONSTRUCTION OF SEVEN TIDAL POWER STATIONS

OW160947 Beijing XINHUA in English 0821 GMT 16 Mar 84

[Text] Beijing, 16 Mar (XINHUA)--By the end of 1983, China had built seven tidal power stations with an aggregate generating capacity of 3 megawatts, the Ministry of Water Resources and Electric Power said here today.

These stations, the ministry said, are all located in tidal energy-rich provinces including Zhejiang, Jiangsu, and Shandong in east China.

By January this year, China's largest experimental tidal power station at Jiangxia in Zhejiang Province had two generating units working, with a combined capacity of 1.2 megawatts, to provide power for the area. Jiangxia is designed to have a total generating capacity of 3 megawatts, and its other generators are expected to be installed by the end of next year, the ministry said.

China still lags behind a number of other countries in exploiting tidal energy resources, the ministry admitted. However, the latest survey showed that China is very rich in tidal energy resources. Statistics show that China has a total of 20,000 megawatts of exploitable tidal energy resources which, if used, could produce 58 billion kWh a year.

This renewable energy source, the ministry said, is in the coastal provinces of Zhejiang, Fujian, Shandong, Jiangsu, Guangdong, and Liaoning and in the country's leading industrial city of Shanghai. About 90 percent is in Zhejiang, Fujian, and Shanghai, the ministry said.

Work is underway to build five such small and medium-sized power stations, the ministry said, adding that they will have a total generating capacity of 4 megawatts and are all being built by local authorities. More such stations are being planned. Scientists predicted that tidal power stations with a capacity of more than 2,000 megawatts may be built in the future.

East China's six provinces and Shanghai City produced more than one-third of the country's industrial and agricultural output value in 1982. The demand for energy in the area is bound to grow fast in the present modernization drive, the ministry predicts.

But the area has only 6.2 percent of the country's known reserves of coal, at present the main source of China's energy, and its water power resources account for only 4.4 percent of the country's total. Development of the local tidal energy resources would therefore help the area's energy demands.

CSO: 4010/67

CONSERVATION, ALTERNATIVE SOURCES COULD SOLVE RURAL ENERGY PROBLEM

Shanghai ZIRAN ZHAZHI [NATURE JOURNAL] in Chinese No 2, Feb 84 pp 83, 93

[Article by Hou Xueyu [0186 1331 3558], Botany Research Institute of the Chinese Academy of Sciences: "Comprehensive Solution to the Rural Energy Issue"]

[Text] Need for an Overall Viewpoint

Energy research is a very complex issue, encompassing individual as well as comprehensive disciplines. It includes physical chemistry and biology, applied sciences, and basic sciences, natural sciences and socioeconomics, and microcosmic research. It may serve national defense, industry, transportation, and agriculture. The issue of energy in the cities and the countryside must be resolved. The questions to be resolved encompass both immediate tactical matters and long-range strategic ones. Some of these are work which directly solves energy matters, while others are indirectly related to energy. Of the units participating in the research, some belong to production units and some belong to scientific research organs. The correct handling of the intricate relationships described above is an extremely important factor in formulating the energy research program. That is, there should be unified planning with due consideration for all concerned as well as rational arrangements; an overall viewpoint must be employed in the matter of energy research.

Practicing Thrift With Rural Energy

If 800 million peasants are to eat, they must have energy for living. Rural energy sources are an important part of this and must be given serious attention. But the peasants burn most of their straw, and consequently fodder has become a problem. Without fodder, there can be no fertilizer, which will affect the output of agricultural products. Apart from energy for living, energy resources for production needs are also a big problem. Farm machinery such as tractors, harvesters, water pumps, etc. require energy (petroleum or electrical power). Chemical fertilizer and agricultural chemicals are produced by chemical plants or pharmaceutical factories, and they also need energy. Some persons lopsidedly study certain foreign methods and emphasize that agricultural modernization is "oil-based agriculture." Right now, the waste of energy in this aspect is enormous. For example, in Qinghai's Qaidam Basin the sources of water for farmland come from high places, so gravity irrigation may be used. However, in 1980 I observed that in the use of sprinkler irrigation machinery, bought from abroad by the state farms, water sprayed into the atmosphere would rapidly evaporate because of the very dry climate. Consequently, the irrigation goals were not met, and gasoline was also wasted. In actuality, water sources in that area come from rather high places and gravity irrigation is acceptable. In July 1983, I was undertaking an investigation in the port of Heilong in Hebei Province. I observed there that, because of the long-term emphasis on sinking deep wells, and with each well costing 20,000 to 30,000 yuan, many communes and teams still owed the state for a considerable number of loans for digging wells. In order to bring water up from 300 to 500 meters below the surface, they expended large amounts of oil and electricity, and now most of these deep wells have been abandoned and are worthless. Summer this year was very dry. In the Jing Xian region in Hebei I learned that by investing 30 or 40 yuan a commune member could sink a hand-pumped well. The masses were called these "old man happiness." Two persons could sink a well in half a day, and one person could irrigate several mu of land a day. In this way, investment outlays were reduced and energy (oil and electricity) conserved. Why sink deep wells in areas where water is close to the surface?

After the slogan "the basic path of agriculture lies in mechanization" was raised, all the counties in the country established their own farm machinery research stations or tractor factories, causing much waste. Our agriculture does indeed require every type of machinery, but it must be based on the actual conditions in the country. We cannot onesidedly take agricultural modernization to mean mechanization; in particular, we cannot understand it to be "tractorization." In actuality, there is much mountainous and hilly land in our country, where it is not convenient to use large tractors. On the contrary, their use would cause accidents. Apart from the Northeast, the plateau regions, and such places where the land is vast and the population sparse, most areas in the country can use small-scale tractors and draft animals for tilling the land. In 1977 in Nei Monggol, I saw that horses were being sold to foreigners because there was no domestic market; each horse was selling for no more than 100 or 200 yuan, which was really a shame. Why not use oxen and horses to plow in order to save energy? In addition, manure from oxen and horses can be used as fertilizer to improve soil compositions and this will in part save on energy used in manufacturing chemical fertilizer. In 1980, I undertook an investigation in Qinghai. A farm loan officer in the Golmud City Bank wrote a people's letter for me, which stated that Golmud state farms had 70,000 mu of tillable land, 8,000 agricultural workers, and more than 128 tractors. He believed that 60 or 70 tractors were enough. Each thousand mu of land employed two 55-horsepower tractors and 250 members of the labor force. In effect, this was a great waste of energy resources and manpower. Thus, cutting down on energy use in the countryside should be a priority issue.

For several years now, except for those places which do not apply fertilizer at all, that is, those places practicing "health fields," most of the farmland in China relies solely on chemical fertilizer, a lot of it impure chemical fertilizer. The results are very poor. Rarely do they apply a combination of traditional green manure, night soil, and chemical fertilizer. In this way not only is soil fertility reduced and the environment polluted, but the manufacture of chemical fertilizer requires the use of coal and electricity. At present there is much damage from insects and rodents everywhere. This is because of the exclusive emphasis on using farm chemicals or chemical poisons, which results in poisoning the natural enemies of insects and rodents. The result has been a great increase in the damage caused by insects and rodents. Therefore, if we were to take biological measures to protect their natural enemies, not only would economic benefits increase, but fossil fuels (oil and coal) could be saved. From this we may see that, if we take comprehensive measures, we will both manage every type of agricultural task and duty and conserve energy as well.

What also must be pointed out is the question of why agriculture should consume great amounts of "fossil energy." The reason for this is that for a long time now, in the matter of agricultural modernization, goals and measures have been confused. People have lopsidedly come to believe that "electrification, chemicalization, the pursuit of water conservancy, and mechanization" constitute agricultural modernization. We need chemical fertilizer, water resources, machinery, electrical power, and so forth, but we do not need to overdo it. This is because these measures are means to an end, not an end in themselves. The end is to increase production, and the means to increase production are comprehensive. They do not consist solely of the above-discussed "four transformations." The "four transformations" must be combined with organic measures. We must emphasize the resolution of the question of agricultural production by means of renewable organic energy sources. In order to save China's "fossil fuels," we must do research on how to save on their use in agriculture. This is one of the most important topics in indirectly resolving the issue of energy.

Developing Rural Energy

Apart from conserving rural energy, research may be undertaken in five areas in regard to developing rural energy:

1. Growing Trees and Bushes in Fuel Forests

Climatic and soil changes are great within small regions in every part of China. A top priority today is that we investigate the kinds of trees and bushes suitable for every kind of habitat which will burn well and grow vigorously and that we utilize idle land and earth strips between fields to create fuel forests. For example, in Yunnan in the Xishuang Banna the Dai nationality has a custom of growing tiedao [6993 0430] bushes at the edge of their villages and along roadsides. Every 2 or 3 years they cut down one crop in rotation; in this way they do not destroy the forests. On the mountain slopes in the eastern part of Qinghai, in the north of Shaanxi, and in the west of Shanxi they grow suanci [6808 0459] which is resistant to the dry climate and to cold weather. Along the seacoast in the southern part of Fujian casuarina and sponge trees are grown. These serve as windbreaks and also solve the problem of fuel. Straw from farm crops can be saved to feed farm animals. These animals can supply the power to till the fields. Thus, at the same time we solve the problem of fuel to burn and energy with which to till the fields. However, not only are the climate and soil different in every part of China, but there may also be a different set of conditions even within small regions. How we suit measures to local conditions and make overall arrangements for the entire country is a topic which every area must research.

2. Protect Forest Ecology

In many mountainous regions in the south, destruction of the forests has not only caused soil erosion but has also led to water resources not being preserved. In many small-scale hydroelectric plants generation of electricity is frequently not stable, stopping altogether if the water goes. In 1979, I stayed in the guesthouse of the Xishuang Banna Tropical Plant Station. During the night the electric lights would suddenly go out and suddenly come on. This was caused by the destruction of the forest near the hydroelectric station in the region; the water source was not guaranteed, and so there was no way of generating electricity.

3. Do Research in Plants for Energy

We must do research in the organic and ecological characteristics of cassava, sweet potatoes, and other starchy plants from which ethyl alcohol can be made. How to increase production here is also one of the issues in indirectly solving the energy problem.

4. Develop Rural Methane

As regards rural methane, we must both suit measures to local conditions and link up the parts to form a whole. We must investigate the remaining problems with methane in every area. At present, most of the areas of the country are in the stage of disseminating information and making visits; actual application is still in the future and requires research into, and solution to, a series of remaining questions.

5. "Preliminary Engineering Research Work in Hydropower Exploitation" for Energy

If we were to advocate only engineering geology and aerial remote sensing, it would be far from a sufficiently overall approach. The important thing is to undertake comprehensive investigative work in a planned manner; in particular, we must undertake inspections from the angle of ecology. This is an extremely important item. At present, aerial remote sensing still cannot directly solve the problem. We must rely upon actual inspections on the ground.

I hope that in formulating a program for scientific research in energy, we will consider the connection between energy and the environment, the population, foodstuffs, and other such matters. If we are to use many avenues in solving problems, we must comprehensively study the energy question via many channels.

6722
CSO: 4013/123

PROBLEMS AND MEASURES IN INDUSTRIAL ENERGY CONSERVATION

Beijing NENG YUAN [JOURNAL OF ENERGY] in Chinese No 6, 25 Dec 83 pp 11-12

[Article by Ding Chao [0002 6389]: "Energy Conservation in the Steel Industry"]

[Text] Conservation of energy in the steel industry has contributed positively to the sustained development of China's economy in recent years. Current norms of energy consumption in the steel industry, however, remain high, indicating great potential in conservation. Practice in energy conservation in recent years shows that further efforts in this area should be based on the solution of three questions: guiding ideology, institutions, and comprehensive management of energy.

1. Organize and Direct Production With a Guiding Ideology Based on Energy Conservation

Since the founding of the People's Republic, especially since 1958, industrial production has been carried out under the guiding principle of high output. This has been particularly true in the steel industry. Guided by this principle, the industry has had to meet high output targets and operate in a way to achieve high output. In a word, the idea of high output has guided the organization and supervision of production. This has led to a tendency to attach great importance to output and little importance to quality, with no attention being paid to consumption. Currently there is a "high output, low consumption" view which argues that "when output is high, energy consumption will naturally be low" and that "when output drops, it would be impossible to conserve energy." This view is precisely a reflection of the guiding ideology and management practices based on achieving high output.

The key to achieving low consumption in an enterprise is to operate equipment in a rational way according to output. Energy-consuming equipment should be started or shut down according to production needs in order to reduce idle operation and idle burning to a minimum. The heat load of energy-consuming equipment should also be constantly regulated to the desired level according to production needs so that energy consumption is controlled at an optimal state. This is a guideline to organizing production, an important link in energy conservation.

There are many cases of energy waste in steel production at present, reflected in poor utilization of the heat of intermediate products; irrational use of steam, sometimes to the point of letting huge amounts escape; unsuitable operational temperatures; no planning for the utilization of excess heat; no study being made of rational operations in heat engineering; and problems in the rational use of fuels. These problems occur not because of inadequate technology but because the guiding ideology in production is incorrect.

A guiding ideology based on high output does not suit the needs of China's economic development. What is needed to increase output with existing energy supplies is to establish a whole system of ideology based on conserving energy.

How to establish such a system of ideology? First, evolve a set of strict and impartial methods that reward those who conserve energy and penalize those who waste it, thus effectively eliminating the energy "supply stem." Second, conduct more education on energy conservation. We must recognize that the shift in guiding ideology is a long and arduous process and requires arduous and meticulous work and long, unremitting education.

2. Strengthen Energy Management, Expand Technical Contingents, Improve Energy Structure

Energy management covers very broad areas. It combines quantitative management with the management of production and heat engineering. It involves management of energy conversion, supply and quotas, the operation of heat engineering, and rational and optimal utilization of energy. It involves better servicing of equipment in order to raise heat efficiency. It involves reforms of production processes and structures to raise energy utilization rate. It means involving all production sectors and links in conserving energy and achieving rational coordination, balanced production and economic operation. In a word, attention must be given to every link that affects energy consumption.

More attention should be given to energy utilization and heat engineering operations and to training more people to do the work effectively.

About 80-90 percent of the energy used in the steel industry is in the form of thermal energy generated in furnaces and kilns and by other heat equipment. How well such equipment is maintained and how well heat engineering is managed is a principal factor in the control of energy consumption in an enterprise. Therefore better management of equipment and heat engineering operations is the core of energy conservation in the steel industry and has a direct bearing on product quality and output. Heat engineering has a bearing on both production and energy conservation. But existing personnel are not up to the task and this merits our attention.

Strengthening energy management requires highly efficient institutions. An energy institution in an enterprise must devote most of its efforts to energy utilization and heat engineering management. It should be a system consisting of agencies at all levels, from top management down to work crews. This system and the fuel and power supply sectors form a unified entity of opposites. They should be separately independent and not lumped together. The entity leader gives overall and unified leadership to energy utilization and consumption and all heat engineering operations.

The functions of the energy institution of an enterprise are: implement the state's energy policies and directives; formulate and implement policies and regulations concerning energy composition and rational use; fromulate and implement short- and long-term energy programs and measures; manage the use and allocation of funds for energy technical measures; examine and decide on energy consumption quotas and allocation proposals; prepare energy balance tables, and compile statistics and make analyses; test and adjust energy use and heat engineering operations; collect foreign and domestic technical information and conduct research in energy conservation and its more efficient use; monitor energy utilization; implement reward and penalty systems.

3. Implement Comprehensive Energy Management

To conserve energy effectively, the leaders should not only pay serious attention to the work and bring into full play the role of the technical personnel involved in it but should also mobilize all sectors, all other professional and technical personnel, and the workers and staff in general to take part in energy management. Energy conservation management teams should be set up at all work posts to form a broadly-based network. Only by combining the functions of energy agencies and personnel with the conscientious activities and democratic management by the masses can the work of energy conservation have a solid foundation.

Comprehensive energy management should consist basically of the following:

1. Call for the participation of the entire personnel of an enterprise. Conservation of energy should be the concern of everybody, from the general manager to the office staff, from the plant director to shop chiefs and department personnel, from functionary departments to operators and service personnel on the production line.

We should work to enable the entire workers and staff to develop a correct understanding of the nation's energy situation; correctly implement energy policies, regulations and directives; organize the production, technical and operational activities of the workers and staff to fulfill energy consumption quotas; impose energy consumption quotas in order to reduce and eliminate blindness and unrestrained freedom in energy use and cultivate a stronger sense of responsibility.

Regularly organize workers and staff to discuss what each person's own work can contribute to energy conservation; each level should perodically conduct energy consumption analysis, examine positive and negative experiences and factors affecting energy consumption; work out measures for improvement and strive to implement them.

2. Establish energy agencies, strengthen functions. Each enterprise should set up an energy division (office) to manage the energy of the entire enterprise. The plants should set up their own energy sections to exercise comprehensive management. The shops should set up their own management teams, and the work crews should appoint their own energy managers. The functions, powers and scope of work of each post should be clearly spelled out. In this way a powerful network will be formed and management agencies at all levels will have the power to admonish against and curb energy waste.

Voluntariness is stressed at the shop and work crew levels. Workers should set their own goals, strive to achieve them, and hold regular or irregular meetings to sum up their efforts.

3. Implement comprehensive quota management of all kinds of energy. Quota management should be instituted for all kinds of energy used in the steel industry: coal, coke, oil, electricity, water, wind, steam, oxygen, hydrogen, gas and compressed air, so that no energy source is overlooked.

4. Implement comprehensive measurements and verifying calculations. Measurement is the basis of energy management and should be accurate and comprehensive. Verifying calculations should be exact. Eliminate rough estimates, spreading of responsibilities, and "eating from the common pot."

5. Promote energy conservation at all links of the production process. Formulate and implement guiding principles centered around energy conservation for organizing and directing production; give full consideration to energy conservation when mapping out production plans and raw material and fuel supply plans. Low energy consumption should be a priority consideration in designing, manufacturing and servicing equipment. Prevention of energy waste must be made the focal point in production supervision and technical operations. Efforts should be made to achieve rational coordination, balanced production, meticulous operation by workers, and economic running of machinery. Endeavor to turn out more products with minimal amounts of raw materials and energy consumption.

6. Make rational use of energy according to grades. Make comprehensive plans to make the best use of each kind of energy and lower its consumption.

7. Implement comprehensive monitoring. Monitor the performance of all energy-consuming equipment in all departments, plants and shops.

8. Conduct scientific research. Research of energy conservation covers wide ares, including the study of new energy-conserving materials, furnaces, technological processes and equipment; the study of excess heat utilizaiton, energy-conserving production structures, and energy balance, structure, and rational use. In a word, research on energy should be closely linked to production, making lower energy consumption the general goal.

9. Conduct education. Help workers and staff gain a sober understanding of the energy situation and instill in them an urgency to conserve energy.

9924
CSO: 4013/80

STEEL INDUSTRY GIVEN TIPS ON CONSERVING ENERGY

Beijing NENG YUAN [JOURNAL OF ENERGY] in Chinese No 5, 25 Oct 83 pp 1-2, 18

[Article by Meng Renlun [5536 0088 0243] and Sheng Changzhi [3088 2490 3589] of the Beijing Institute of Iron and Steel Design: "The Direction of Energy Conservation for the Iron and Steel Industry"]

[Text] The metallurgical industry is a large energy consumer. In 1979 the metallurgical industry consumed 83.77 million tons of standard coal (not including energy consumed for steel production outside the system), which is approximately 14 percent of China's total energy consumption and the iron and steel industry accounted for roughly 12 percent of the total national energy consumption. In recent years the iron and steel industry has stepped up its energy management and has made noticeable headway by taking various conservation measures. The average energy consumption per ton of steel has dropped 20.6 percent in the 3 years from 1977 to 1979. The average general energy consumption per ton of steel produced by high priority enterprises has decreased by 17 percent, and the average energy consumption per ton of steel has decreased by 24.5 percent. Even so, China's energy consumption per ton of steel is still much higher than that of foreign countries.

For a more in-depth analysis of the energy consumption in the Chinese iron and steel industry, we compared the energy consumption of more energy-efficient Chinese plants such as the Anshan Steel Mill, the Wuhan Steel Mill, Baoshan Steel Plant in Shanghai with the 1977 consumption of Nagoya Steel Mill in Japan, the 1978 record of the Thyssen [?] steel mills in West Germany and the energy consumption of the model plant published by the International Steel Association in 1976. The energy consumption levels for various processes represent the average advanced level achieved by the international steel industry at the time. In the comparison, the Chinese coking and iron smelting processes are found not far behind that of foreign countries. The reason that the energy consumption in these two processes fared well was mainly because conservation received higher attention in these two departments at an earlier date. Based on the 1979 statistics on priority enterprises, the average energy consumption in the iron smelting process was only 17 percent higher than that in Japan and the consumption in the coking process was 12 percent higher than in Japan.

Energy consumption in the sintering, steel smelting, pre-rolling, and steel rolling processes was much higher than that in foreign countries, and the difference in steel smelting is especially large. According to 1979 statistics of key enterprises, the energy consumed in sintering was 40 percent more than that in Japan; for steel smelting in Bessemer converters, it was 14 times higher than that in Japan; for pre-rolling it was 109 percent higher and for steel-rolling it was 166 percent higher. The high energy consumption in the steel smelting and steel rolling processes has a major effect on the per-ton energy consumption of the entire iron and steel industry. Based on the average energy usage statistics of 34 key enterprises in 1980, the energy consumed in the steel smelting and steel rolling processes accounts for 35.22 percent of the energy consumption per ton of steel (with steel smelting alone accounting for 15 percent) and 28.7 percent of the general energy consumption per ton of steel (with steel smelting alone accounting for 12.2 percent).

The two reasons for the high energy consumption in steel smelting are the high consumption of steel material and the low consumption of scrap steel. The scrap steel usage rate in China, although comparable to that in Japan, is 10-20 percent lower than most major steel-producing countries. Since scrap steel is not figured in the accounting of energy consumption, a higher percentage of scrap steel means more conservation and a lower percentage of scrap steel means a higher usage of molten iron and hence higher energy consumption. In addition, the high consumption of fuel and power in the processes also contributes to the high level of energy usage.

The high level of energy usage in the steel rolling process is mainly caused by the high fuel consumption in the uniform heating furnace and heating furnace. The causes for the high fuel consumption are complex and may include the low level of hot loading, the low temperature of the hot ingot and the high temperature of the final heating. In addition, operating at less than a full load, insufficient billets and the varity in rolling products may all have a direct effect on the energy consumption of the rolling process.

From the above discussion it is easy to realize that since the energy consumptions in the steel making processes of the Chinese iron and steel industry are all higher than that in other countries, the per ton energy consumption is naturally higher. To reduce the energy usage per ton of steel, we must begin with reducing the energy consumption in each process. To further explore the means for conservation, we use the Wuhan Steel Plant as an example (this plant has production processes similiar to those of foreign plants), and conducted calculations for four different cases to reduce the numeraire energy consumption per ton of steel production. Table 1 shows the results of this calculation.

From the four estimates in Table 1 one can see the factors affecting the energy consumption per ton of steel production and the directions for the conservation effort. Case [1]: While keeping the present production structure (iron-steel ratio and continuous casting ratio and product structure of the Wuhan Steel Plant), 20 percent of energy conservation can be achieved by merely dropping the energy consumption of the production process to the model plant level. The energy consumption per ton of steel may be reduced to 0.924 tons of standard coal and the cost is modest.

Table 1. Estimates of energy consumption for four different cases for Wuhan Steel Plant

Process	Wuhan Steel Plant (1980)		Model Plant		Case [1]	Case [2]	Case [3]	Case [4]
	Process Consumption	Per ton Consumption	Process Consumption	per ton Consumption				
Coking	198	104	160	67.36	83.69	83.69	83.69	67.36
Sintering(sphere)	104(209)	138(2)	81.29	75.71	108.12(2)	97.03(2)	97.03(2)	75.71
Iron smelting	503	470	514.57	433.14	480.61	423.53	423.53	433.14
Steel smelting		136	1.714	1.714	92.15[a]	38.59[b]	38.59[c]	17.14[d]
Continuous casting	42	9	19.86	14.24	4.31	30.11	14.24	11.92
Pre-rolling	69	46	48.57	15.71	32.70	17.46	12.29	17.37
Large form	115		101.28	13.14	22.89		22.89	22.89
Hot rolled plate	169	141	91.57	7.86	14.69	141	14.69	14.69
Continuous hot rolling	217		100.57	49.14	31.98		31.98	31.98
Continuous cold rolling	257	24	92.71	29	8.81	24	8.81	8.81
Silicon steel	717	12			12.0	12.0	12.0	12.0
Thick plate			98.29	21				
Electroplating, tin			54.57	3				
Electroplating, zinc			73.43	6.29				
Power and others		30		35.57	30	30	30	30
Loss		38						
Total	Ton standard per ton steel	1.15		0.724	0.924 save 19.65%	0.899 save 21.83%	0.791 save 31.2%	0.728 save 36.7%
Iron-Steel ratio		0.934		0.842				
Continuous casting ratio		21.68%		71.80%				

Table 1 continued on next page

Table 1 (continued)

Case [1]: Using Wuhan iron-steel ratio and continuous casting ratio and using model plant processing energy consumption.

Case [2]: Using Wuhan processing energy consumption and model plant iron-steel ratio and continuous casting ratio.

Case [3]: Using Wuhan processing energy consumption for sintering, coking and iron smelting, and model plant consumption for other processes and model plant iron-steel ratio and continuous casting ratio.

Case [4]: Using model plant figures for all items (except 60 percent for continuous casting ratio).

a. The energy consumptions for steel smelting are calculated separately for the open hearth furnace, converter and arc furnace of Wuhan Steel. Energy consumptions of open hearth furnace and converter are based on domestic high standards.

b. When the model plant continuous casting ratio is used, steel smelting must be conducted mostly in converters. In the calculation converter steel is assumed to account for 71.7 percent of the total.

c. Same as b.

d. Assumes steel smelting entirely by converter. Production of arc furnace is small and has been neglected.

Case [2]: While keeping the present processing energy consumption and product structure of Wuhan Steel Plant, a 22-percent energy savings may be achieved by merely following the iron-steel ratio and continuous casting ratio of the model plant. The energy consumption may be reduced to 0.899 tons of standard coal per ton of steel produced. The energy saving comes mainly from the use of the converter in steel smelting at the increased continuous casting ratio (from the original 21.68 percent to 71.8 percent). In the meantime, at a reduced iron-steel ratio, the consumption of molten steel used in steel smelting is less, and a 22-percent energy saving can be achieved even though the energy consumption in the production process remains the same. The energy conservation effect of Case [2] is comparable to that of Case [1], but Case [2] requires a greater investment and more difficult modifications.

Case [3]: This plan will lead to a prominent energy conservation of 31 percent and reduce the constant energy consumption to 0.791 tons of standard coal per ton of steel produced. In this plan the energy consumption of the sintering, coking, and iron smelting processes remains the same and model plant processing energy consumption is used for all other production processes. However, Case [3] calls for a modification of the production structure and an adoption of the model plant iron-steel ratio and continuous casting ratio, using primarily converters in steel smelting. This plan shares the conservation effects of both Case [1] and Case [2] and also shows that the processing energy consumption of coking, sintering, and iron smelting at Wuhan Steel Plant is comparable to that of the model plant.

Case [4]: In this plan we assume all production processes are at the model plant level except the product structure remains the same and the continuous casting ratio is assumed to be 60 percent. The constant energy consumption per ton of steel production will be 0.728 tons of standard coal and energy conservation will be 36.7 percent, the highest of the four cases. The amount of investment needed is comparable to Case [3].

Based on these estimates and the current situation of existing plants, we believe conservation may be achieved in two steps. Step 1: Under current conditions, improve the operation and the production management standard, eliminate various losses and actively reduce the processing energy consumption. This is the most effective and least costly method for conservation and can generally lead to a 20-percent saving. Step 2: Further conservation calls for changes of the production structure, improvements in technology, and addition of new energy conservation measures. It can usually achieve an energy conservation of 15-20 percent.

Judging from the situation abroad, exemplified by the Japanese steel industry, the direction and steps of energy conservation are basically the same as above. From the many years of conservation experience of Nippon Steel Corporation and Kawasaki Steel Company in Japan, the initial phase (5-6 years) usually brings about a 10 percent saving. Energy conservation relies mainly on improved operating standards and stronger energy management. From 1975-1979, Kawasaki Steel Company actually achieved an energy saving of more than 14 percent in the 5-year period. Through improved operation, energy conservation in the first 3 years was 85 percent and in the last 2 years it was 50 percent. The effort to improve the operation is therefore very important in the early stages. Further conservation in the later stage then relies on improvements in production structure and additions of new energy saving facilities.

After an effort in the last few years, the Chinese iron and steel industry has achieved many results in energy conservation. For further progress in conservation, more efforts should be made to improve the enterprise structure and the production structure, to adopt new methods and techniques in conservation and to raise the operation standard while continue to work on conservation through operation management.

9698
CSO: 4013/46

EFFICIENT, ECONOMICAL MANAGEMENT KEY TO CONSERVATION IN STEEL INDUSTRY

Beijing NENG YUAN [JOURNAL OF ENERGY] in Chinese No 5, 25 Oct 83 pp 38-39

[Article by Sun Hongzheng [1327 3163 6927]: "Economic Operation Is a Key Link in Energy Conservation"]

[Text] I. Organize Economical Operation, Systematically Adjust Equipment

The energy consumption in the Chinese iron and steel industry has decreased substantially in recent years. From 1978 to 1982 there was a 24 percent decrease in the general energy consumption per ton of steel, reaching 1.9 tons of standard coal per ton of steel in 1982. While steel production continued to grow, total energy consumption continued to drop. Compared to advanced foreign standards, however, energy consumption in the Chinese iron and steel industry is still high.

In key enterprises the energy consumption per ton of coke is approximately 10 percent higher than that in Japan and the energy consumed in sintering is about 27 percent higher. Although the raw material conditions for blast furnaces in China are far inferior to those in Japan, the energy consumed for 1 ton of iron differs only by 14 percent. But the energy used in the pre-rolling of 1 ton of billets is twice of that in Japan. In steel rolling the energy is higher by 1.5 tons per ton of steel. The energy consumption per ton of steel is an open-hearth furnace and in an arc furnace is 70 percent more than that in the U.S. As for portable hearth energy consumption, since Japan has almost reached "zero energy steel smelting", the figure in China is more than 10 times that in Japan.

What causes some production processes to consume comparable amounts of energy and other processes to consume much more? The discrepancies apparently cannot be explained simply by invoking the level of sophistication of the equipment and the operators because there would not be a great variation in the same enterprise in China. Analyzing the characteristics of the various production processes in the steel industry, we find that pronounced differences in the mode of operation between coking, sintering, and iron smelting processes and steel smelting, pre-rolling steel rolling processes.

The operating of the coking facility is characterized by: (1) One type of product, (2) Continuous, stable and balanced production operation, and (3) Compatibility between production task and equipment capability and full load operation. As a result, there is almost no idle running, shutdown, under-loading and over-loading in the production of coke and therefore no energy losses caused by them. Hence the thermal efficiency of the machine can be always maintained at a high level and the energy consumption is not far from the advanced foreign standard.

The production operation of the sintering machine and the blast furnace basically share the characteristics of the coking process although to a less degree.

The methods used in steel smelting and steel rolling are quite different. In these processes the product varies greatly and changes frequently, and the equipment is not always compatible with the products. A structural steel plant must roll a dozen different forms of products including square, round, flat, formed, trough and angle structure. For products that are difficult to roll, one heating furnace is adequate; but for structures that are easy to roll, two or three heating furnaces are required. As a result, the equipments cannot always be maintained at a high efficiency level. Due to insufficient raw material and other reasons, the equipments are not fully utilized and there is production capacity to spare, but the extra equipments cannot be shut down. The operating rate and load are therefore very low. For example, the production assignment of a local steel rolling plant in Liaoning Province is less than one-half of the production capacity because of shortages in steel billets. The resulting losses in energy are great.

To reduce the energy consumption, advanced equipment and good operation management are admittedly important, but we must also operate the equipment continuously, steadily, and evenly in the optimal thermal efficiency regime, improve the operation rate and the load factor, prevent idle running, underloading and overloading, and avoid frequent start-ups and shutdowns. We shall call this type of rational operation "economical operation," that is, the most energy efficient and least costly mode of operation.

If economical operation can be broadly organized, the energy consumption of China's existing equipment should not deviate more than 20 to 30 percent from that of similar equipment abroad. The organization of economical operations is indeed a key link in energy conservation.

II. Economical Operation Requires Rational Start-up of Equipment

A major cause for high energy consumption in the enterprises is insufficient raw material, excessive production capacity, and low operational rate. Rational start-up of equipment is therefore an important aspect in the organization of economical operations and energy conservation.

The No 2 steel smelting plant of the Anshan Steel Plant has 10 open-hearth furnaces. After four of the furnaces were modified for top-blown oxygen, productivity has doubled and the oil consumption per ton of steel has dropped from 100 kg to 37 kg. But in terms of oil consumption per ton of steel for the entire plant, the decrease was not large. This is because that, with improved open hearth furnace productivity, the amount of molten steel did not increase correspondingly and the steel billet production did not increase either. As a result, the waiting time of the open-hearth furnaces for molten steel, scrap steel and molds increased greatly and the heavy oil saved by the top-blown oxygen modification was again wasted. Later, three of the furnaces were shut down and the remaining furnaces were properly used at an oil saving of 25 percent.

At the plate mill of the Wuhan Steel Plant, only one of the three heating furnaces is turned on if the monthly production is less than 30,000 tons. If additional production is called for, more furnaces are turned on. This practice has gradually reduced the heat consumption per ton of steel billet from 520,000 kcal to 437,000 kcal and reached the "premium furance" standard.

In a steel rolling plant on the outskirts of Shenyang, oil consumption was high because there was not enough raw material and the plant was underloaded. After changing to the production method of rolling for half a month and shutting down for half a month (this plant has only one heating furnace), they have saved 47 percent on fuel.

This mode of running the equipment wisely has also received attention abroad. For example, more than 20 of Japan's 60 blast furnaces were shut down due to a lack of orders. On the surface, it appeared that production was down, but in terms of efficiency, 40 blast furnaces operating at optimum conditions achieved economical operation. Consequently, Japan maintained the world's highest standard in blast furnace utilization, coking ratio, and energy consumption.

Special attention should be given to the proper start-up of equipment. A blast furnace in an iron smelting plant required 1,400 m^3/min of blast air and had two 1,300 m^3/min air blowers. When the economic responsibility system was put into effect, one blower was shut down and 10,000 tons of standard coal was saved per year. Although the productivity of this blast furnace was slightly lowered, the production quota was made up by other blast furnaces.

To assure high productivity, one steel smelting plant operated two 3,350 oxygen units and lost a great amount of pure oxygen. After measures were taken to stabilize steel production and improve oxygen machine productivity, one machine was shut down and the remaining unit still provided adequate oxygen for steel smelting. The electric power saved was used to operate an extra small steel rolling machine. As can be seen, by wisely shutting down some of the equipment the result is not a "negative balance" but a positive energy conservation and increased productivity.

III. Economical Operations Require Equipment Integrity

Due to incompleteness in the overall system design of enterprise construction, the production force within an enterprise is often unbalanced. This phenomenon is especially common in medium and small iron and steel enterprises. Completeness of equipment is therefore an important criterion in achieving economic operation.

The modification of the converter shop of the Hangzhou steel mill is a typical example. By increasing the furnace capacity from 5 tons to 7.5 tons and expanding the shop space for billet casting, annual steel production was increased from 160,000 tons to 240,000 tons. In coordination with the iron smelting capability of the plant, 90,000 tons of floor iron per year were hot loaded into the converter. The sensible heat of the molten steel was fully utilized and the operation has not only saved energy for the state but also provided more material for the steel rolling shop at the plant.

After the production capacity of the converter shop was increased, all the power needed (including pure oxygen) came from the original power equipment. Hence, even though steel production has increased 50 percent, the power consumption did not increase and the energy consumption has dropped from 64 kg of standard coal to 43 kg of standard coal per ton of steel.

The heating furnace of a Shenyang steel mill was designed with an excessive capacity and consumed large quantities of oil because there was not enough material to be processed. A temporary measure was taken to reduce its capacity. Specifically, a wall was added in the heating furnace to change the double loading to a single loading. This change has made the furnace capacity more compatible with the production assignment and rolling capacity. The operating condition of the furnace was greatly improved and, together with other conservation practices, 58 percent of oil was saved.

Power equipment was often over-designed and became large horses pulling a small cart. After the Anshan water supply plant replaced six of their oversized water pumps, 50,000 kWh of electricity were saved in just 1 day. Five thousand kilowatt-hours of electric power per day were saved at the power plant of the Anshan steel plant by modifying water circulation pumps and soft water pump systems and by shutting down a 165 kW circulation pump and a 135 kW soft water pump.

Economic operation and electrical energy conservation may be achieved for water pumps and air blowers by installing governing devices (such as series excitation speed controls and hydraulic couplers).

IV. Practice specialized production by organizing similiar equipments

Specialized production is a concentrated, economical operation in which the scattered seldomly used equipments are gathered together.

In the case of casting, a specialized machine building plant can melt 10 tons of iron with 1 ton of coke whereas in a machine repair shop of a steel mill and in other similar places only 6 tons of iron can be melted. There is therefore a need for establishing casting centers in the cities.

The Pingding steel mill in Shanxi Province successfully developed the "blast furnace--industrial frequency furnace" direct casting technique. The installation of an industrial frequency furnace solved the low temperature, high sulphur content and composition instability problems of the molten steel from small blast furnaces. The molten steel from a small blast furnace can be cast into parts directly and there is no longer the need to find uses for small blast furnaces. Better equipped places may also serve as municipal casting centers. Although the coke ratio is relatively high for small blast furnaces, the coke for iron melting is eliminated and on the whole the practice still pays.

9698
CSO: 4013/46

CONSERVATION

SWITCH FROM OIL TO COAL GOING WELL

OW261218 Beijing XINHUA in English 1202 GMT 26 Mar 84

[Text] Beijing, 26 Mar (XINHUA)--China cut oil consumption by 11 million tons over the past 5 years by changing 2,182 oil-burning boilers to coal-burning units, according to the State Planning Commission today.

China plans to replace or transform 530 oil-burning boilers this year, a commission spokesman said. Upon completion, about 1.4 million tons of oil will be saved annually.

Using coal instead of oil is an important measure in China's national economic development program. The plan, approved by the National People's Congress, has two aspects: converting boilers from oil to coal burning and constructing new coal-burning equipment.

According to the commission, the oil thus saved will be used to expand production of petrochemicals and increase fuel supply for engines which are growing in number every year. The more rational use of petroleum will bring better economic results.

The Chinese Government attaches great importance to this work, the spokesman said. Since 1979, 1.7 billion yuan has been earmarked to refit the oil-burning boilers.

Premier Zhao Ziyang said recently that China should continue to change oil-burning boilers to coal burners. Emphasis in energy should be on coal and hydroelectricity, he said.

CSO: 4010/67

END