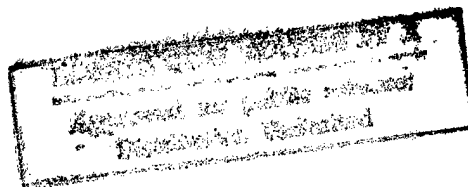


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ENERGY

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13 October 1982

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ELECTRIC POWER

USE OF TURNKEY CONSTRUCTION ON BAYPAZA GES DESCRIBED

Dushanbe KOMMUNIST TADZHIKISTANA in Russian 22 May 82 p 2

[Article by S. Lashchenov, chief engineer of the Tadzhikgidroenergostroy Trust:
"The Experiment is Being Successfully Carried Out"]

[Text] [From the editors] The reader already knows that an economic experiment is being carried out at the building of the Baypaza GES. Here for the first time a new method of erecting a hydropower plant is being employed. This is the "turnkey" method where the construction workers also perform the functions of the client. The aim of the experiment is to increase the responsibility and interest of the creators of the GES and eliminate the discrepancies and contradictions ordinarily arising between the client and the contractor. Ultimately the experiment should provide a tangible economic effect.

It has been assumed that with the organizing of work under the new method in Baypaza there would be no directorate for the GES under construction. However, the Tadzhikgidroenergostroy [Tajik Hydropower Construction] Trust decided not to break the established practice. Certain specialists have viewed this decision as a deviation from the experiment. In an article entitled "Is a Directorate Necessary?" (2 March 1982), the chief of the Nurekgesstroy [Nurek GES Construction] Administration, A. Mel'nikov wrote: "The year-long 'turnkey' experiment has shown that the construction workers can get by excellently without a client. For this reason the creation of a directorate for the Baypaza GES under construction was a surprise for us."

Having discussed the article, the trust's administration felt it necessary to state its position on the question on the pages of the newspaper. The article published below by the trust's chief engineer S. Ya. Lashchenov will serve as a reply to the posed question of whether a directorate is needed.

The introduction of the new method of economic relations, when the functions of the client and contractor in construction were performed by one organization, as any new undertaking, gave rise to many disputes. The most diverse opinions have been voiced both over the essence of the method as well as the form of its realization. The result of the experiment, the "turnkey" construction of the Baypaza GES, will answer the main question of the dispute.

At present, the experiment is being successfully carried out. Last year's plan for construction-installation work was fulfilled by 7 November. The construction collective made many interesting proposals to improve construction methods and design decisions. Merely by changing the routes and designs of the access roads, we will save 1.3 million rubles. The abandoning of the construction of temporary 35-kilovolt power transmission lines by accelerating the construction of the 200-kilovolt one will reduce expenditures by 850,000 rubles. Here in all of this one can feel the creative initiative of the Nurekgesstroy collective and the trust's personnel who have enthusiastically taken up the new management method.

However, not everything has gone smoothly. The basic difficulty has been that the new form is being carried out within the existing legal relationships. This has made an impression on the carrying out of the experiment.

The USSR Ministry of Power and Electrification has assigned the functions of the client to the Tadzhikgidroenergostroy Trust. In turn, the trust has turned over the construction of the hydropower plant to the Nurekgesstroy Administration. For exercising the functions of the client, a subdivision of the trust, the directorate of the Baypaza GES under construction, has been organized.

The decision to create it was dictated by the existing legal standards for the cooperation between the financing bodies, the client and the contractor. These provide for the creation of an organization of the client at the project. "Such an organization can be the directorate of the enterprise under construction or the technical supervision or the directorate of the existing enterprise ("Reference Aid for the Client-Builder," 1977, p 9).

In the course of working out the provisional regulations for the construction of the Baypaza GES, the question was discussed of the possibility of dispensing with the DSP (directorate of the enterprise under construction). As a result, the decision was taken not to impose an experiment in creating new legal standards on an experiment to create a new form of economic relations. Nurekgesstroy which initially was assigned a portion of the functions of the DSP could not order the equipment. As a result, at the end of 1980, the threat arose of stopping deliveries and crediting of the work. For this reason the trust's leadership was forced to take a final decision to concentrate the forces of Nurekgesstroy on the accelerated construction of the GES.

All these questions were widely discussed and for this reason one is perplexed by the statement from the chief of Nurekgesstroy A. Mel-nikov in his article "Is a Directorate Necessary?" that the decision to create the DSP was something unexpected.

We must also point out a number of inaccuracies made in this article. Thus, the delay in drawing up the specifications for the Uralelektrotyazmash [Urals Heavy Electrical Machinery] Plant was due to the fact that the plant mistakenly sent the documents to the directorate of the Nurek GES instead of the Baypaza GES. The total expenditures for maintaining the directorate is 390,000 rubles and not 8 million rubles, as pointed out in the article. No comments were received from Nurekgesstroy over the quality of inspecting the design and estimate specifications and the mistakes by individual workers cannot be used as grounds in deciding the question of whether one or another enterprise should be or not.

If one disregards the lamentable inaccuracies, in the article by A. Mel'nikov a painful question is raised: What should the new forms be for managing construction? Increased construction efficiency depends upon its solution and the very tone of the article shows the interest of the construction workers in quickly achieving the designated results. Hence, the new form of economic relations meets the demands made on construction.

At present it is premature to pose the question of whether or not a directorate is essential. It is necessary first of all to study the possibility of abandoning this from the viewpoint of the long-range consequences, as this is reflected in the organizing of the temporary operation of the first units which should be on line 18 months before the "turnkey" delivery of the GES.

The republic's scientific research institutes should study and work out proposals on altering the legal standards as well as accounting and reporting. They, in our view, could wisely be included in conducting the experiment to create new economic relations which have arisen in the course of building the Baypaza GES. Without a scientific generalization of the experiment and the elaboration of recommendations, the result of the experiment will not go beyond the confines of the Tadzhikgidroenergostroy Trust and will not be properly disseminated.

At present, the basic task is to reduce the time and cost of construction, after which one can judge the advisability of a DSP for other projects.

From the Editors. In publishing the article by S. Lashchenov, the editors do not feel that all the "i's" have been dotted. The experiment is called an experiment because it does not fit within the confines of the existing economic forms and proposes new solutions. For precisely this reason reference to the existing "legal relations" in the given instance sounds dubious. "Turnkey" construction is already the abandoning of both economic and legal traditional relations. So the question of whether a directorate is needed remains moot.

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ELECTRIC POWER

CONSTRUCTION OF CONVEYER SYSTEM FOR ROGUN GES DESCRIBED

Dushanbe KOMMUNIST TADZHIKISTANA in Russian 29 May 82 p. 2

[Interview with L. G. Osadchiy, chief engineer for the Rogun GES project, by A. Pal': "A Conveyor for a Dam"]

[Text] A meeting was held at the construction site of the Rogun GES involving representatives from Gidroproyek [All-Union Planning, Surveying and Scientific Research Institute], its Central Asian Division, a number of other design organizations and scientific research institutes of the nation. Along with the general contractor, the questions were examined of employing a cyclical flow method in building the dam of the GES.

For this reason the correspondent of KOMMUNIST TADZHIKISTANA requested an interview with the chief engineer for the project of the Rogun GES L. G. Osadchiy.

[Question] First of all, Leonid Georgiyevich [Osadchiy], what has been the reason for this conference?

[Answer] Such a widely represented meeting is probably a first here at the construction site of the Rogun GES. It was caused by the fact that the GES builders are beginning their main task of constructing the basic elements. Work has been completed in the preparatory period and basic work is starting.

As is known, the earth-stone dam of the Rogun GES will be the tallest in the world, 335 m. It will be built from local materials including coarse gravel, rock and a loam-gravel mix. How can we move 71 million m³ of building materials from the quarries to the dam? At Nurek, the analogous work, in truth of a smaller amount, was done by motor transport. But here a discrepancy arose between the method for erecting the dam and the size and design of it. In the expression of one of our opponents, the dam was being built--with a teaspoon. The construction times were greatly drawn out.

For this reason it was decided to erect the dam of the Rogun GES using the progressive cyclical-flow method, employing conveyor and gravity-fed transport. This made it possible for us to eliminate the discrepancy in the

production method. In 1980, the technical plans were defended. Last year was spent on coordinating this with the preparatory construction period. Now the time has begun for the working designing of the conveyer complex.

[Question] At the conference special emphasis was made that this is a complex and not just a conveyer line. What is the difference?

[Answer] This is the first time that a cyclical-flow method has been employed on such a scale in Soviet hydraulic engineering construction. Conveyer lines have been employed in the ore-mining industry and in other sectors of the national economy, but there is no precedent for what is to be created at the Rogun GES.

The building materials for the dam come from three quarries. The greatest total length of the heavy conveyer lines is 10,600 m. The heavy conveyers have been designed with a belt 2 m wide for transporting the gravel and stone and 1.2 m wide for the loam-gravel mix.

The complex consists of the conveyer lines, a loading unit with a crushing-grading installation, self-propelled belt loaders, self-propelled hopper-batchers, transloading units, gravity-fed transport in the form of covered rock shoots or drops, large capacity dump trucks operating on a short run in the quarries and at the dam as well as highly productive rollers for packing the fill. Here we needed special non-standard equipment and metal structural elements. It has been proposed that one line would deliver 2,000 m³ of building materials to the dam per hour.

[Question] Is that much or little?

[Answer] That is more than was ever delivered by all transport at Nurek. Here, in Rogun, three lines will be in operation.

[Question] What is the proposed economic effect from introducing the cyclical-flow method for building the dam?

[Answer] For the sake of comparison we will use the technical and economic indicators for the closest analogue, the Nurek GES. First of all, we must say this. The use of a conveyer delivery system for building materials excludes the construction and maintenance of roads. The conveyer lines can be built where road construction is virtually impossible or too expensive. The amount of auxiliary work is reduced. The number of 40-ton BelAZ trucks is reduced by 350-370 vehicles. The amount of construction and installation work for putting up the conveyer lines is small. Extensive opportunities are provided for entrusting control and supervision of the complex's work to automation. Finally, the operation of the conveyers will be continuous.

In Nurek the dam was built in 12 years, while in Rogun it can be built in 7. The economic effect, according to our estimates, will be around 80 million rubles. This is a step forward in the development of hydroconstruction science and technology.

[Question] At what stage is the designing of the conveyer complex?

[Answer] The complex employs the heavy domestically-produced conveyers which have already proven themselves in the ore-mining industry. The complex and new feature is the elaboration of the units for loading the bulk onto the conveyer in the quarry, the transloading of it from the previous line to the following one, as well as the receiving of materials at the dam. There are also other problems.

The meeting introduced clarity for a number of questions. It must be pointed out that the general contractor, Rogungesstroy [Rogun GES Construction] Administration, has showed great attention to our problems and supports everything that is progressive and new.

The amount of work for the designers is certainly enormous. In a short period of time design and estimate specifications must be provided worth 1.5 million rubles. Then the orders must be placed. Incidentally, a portion of the equipment has already been ordered from the major plants of the nation. The work involves design institutes not only from the USSR Ministry of Power and Electrification but also the ministries of coal industry, heavy machine building and other sectors.

[Question] Leonid Georgiyevich, the conveyer complex should be in operation in 1986. For working out the parameters for the filling of the dam, the transloading units, the newly created rollers and other such, experimental work must be carried out particularly as the cyclical-flow system is being employed for the first time in hydroconstruction. Is there time enough for this?

[Answer] The time is very short. There is not time for a full study. We have some experience in operating a conveyer at Nurek. The gravity feed of materials has been tested out. Unfortunately, it is not applicable under our conditions. In the near future we will test the hydraulic washing out of gravel.

The construction of the complex has been so planned that the head section of the line from the quarry to an intermediate storage area some 1,200 m long will become an experimental production range. Here we will basically test out all the necessary parameters of the method, the machines and mechanisms, including the receiver units in the quarry and at the dam. Here also the construction workers can train the service personnel. With the completion of construction on the complex, this range will become a part of the production line. This will gain us time and the experiments can be conducted directly under production conditions.

[Question] During the conference, the idea arose of using the "worker relay" for the designers, the collectives of the plants manufacturing the equipment, the construction workers, installation workers, that is, everyone who will be involved in creating the unique conveyer complex for building the Rogun GES. The "worker relay" which arose at Nurek helped to put the hydrounits of the plant into operation ahead of time and with good quality. Rogun has taken

over the relay from Nurek. Here it has acquired a new quality and has incorporated one other, initial element, the designers. One can speak of a single chain: plans--manufacturing of equipment--completion.

[Answer] The further development of the "worker relay" undoubtedly will bring enormous benefit. The construction of the Rogun GES is not only a new stage of the Southern Tajik Complex, but also a link in the unified, all-Union national economic complex. I feel that each person involved in erecting the Rogun power giant will feel a sense of involvement in the life of the entire nation. The creative association commenced during the year of the 60th anniversary of the USSR will help us carry out the immediate task of starting up the first unit in 1989 and successfully completing the construction of the entire plant.

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ELECTRIC POWER

CONSTRUCTION PROGRESS AT SHUL'BINSK GES REVIEWED

Alma-Ata KAZAKHSTANSKAYA PRAVDA in Russian 12 May 82 p 2

[Article by L. Reznikov, KAZAKHSTANSKAYA PRAVDA correspondent from Semipalatinskaya Oblast: "The Irtysh Constellation"]

[Text] From the steep left bank of the Irtysh, an impressive panorama of the construction site opens up in front of you. A large amount of earth-moving equipment, powerful BelAZ trucks and other equipment is concentrated in the plant's pit which is reminiscent of a giant horseshoe. It has been necessary to move hundreds of thousands of cubic meters of sandstone and rock and divert the river's water through a man-made channel in order to begin construction on the largest electric power enterprise in Kazakhstan with a capacity of 350,000 kilowatts. This is more than the electric power produced by the first two plants of the Irtysh series, the Ust-Kamenogorsk and Bukhtarma, taken together.

The new hydropower installation must not only provide chief electric power for the large industrial regions in the northeast of the republic. Behind the dam of the GES a man-made sea will fill up, the life-giving moisture of which will be delivered to more than a half million hectares of arid lands in Vostochno-Kazakhstanskaya and Semipalatinskaya oblasts. Navigating conditions on the river will be improved and there will be a possibility to sharply increase the volume of national economic cargo shipments.

Almost 6 years have passed since the first group of construction workers landed in the completely open steppe not far from the village of Bazhenovo. They were housed in well equipped vans. The foundations of the first multistory buildings also began to be put down then. Time has confirmed the correctness of the chosen strategy. The creation of a modern settlement with the necessary trade and service facilities, a large secondary school and two children's pre-school centers has helped to form a stable labor collective.

Of the 6,000 inhabitants of Shul'-binsk, one-third is directly employed on building the facilities of the hydropower plant and the production facilities. These are workers and specialists from two basic administrations, the Shul'binsk GES and Grazhdanpromstroy [?Civil-Industrial Construction Trust] as well as a number of sections from the all-Union trusts Gidrospetsstroy [Special Hydraulic Construction], Spetsgidroenergomontazh [Special Hydropower

Installation] and other subcontracting organizations. But there still is a shortage of manpower needed to carry out the program planned for the present year. The manpower shortage is particularly felt in the most crucial areas of the project, the laying of concrete for the basic structures.

The chief engineer from the construction administration of the Shul'binsk GES, V. Kreknin, has provided the following information. Two brigades are presently engaged in this work. One of them is headed by the experienced specialist, V. Kirin, while the other, a Komsomol-youth brigade, is led by the recent graduate of the All-Union Correspondence Power Construction Technical School, V. Nikolayev. In the first collective there are 46 persons and in the second 40. Split into three shifts, they work around-the-clock. They have already laid around 10,000 m³ of reinforced concrete. And just 3,000 in April alone. With the onset of warm weather, the pace has been increasing every day. But it still should be significantly higher. In the time remaining until the year's end, the monthly volume of concrete work must be brought up to 6,000-7,000 m³.

"For this it is essential to organize at least one other brigade," Vladimir Dmitriyevich [Kreknin] feels. "But where will the people come from? Our only hope is the student construction detachments from the oblast center which we are expecting in the summer. We are also counting on aid from the Kazakh Komsomol Central Committee which has recently declared the Shul'binsk GES to be a republic Komsomol shock construction project."

The lack of personnel is not the only reason which prevents the concrete workers from working precisely and smoothly. Recently their associates failed them. In building the right-bank retaining wall stoppages continuously occurred caused by electric welders from a section of Gidromontazh [Hydraulic Installation Trust] who did not promptly ready the reinforcing for laying the next concrete blocks. The tower crane put up on the site should speed up this work. Subsequently it will be employed for delivering assembled units to the plant's turbine room.

Will it be possible to have the first three of the six units on line by the end of 1984? Undoubtedly. Only for this it is essential to immediately resolve all questions related to completing the concrete plant, the gravel-grading installation, the reinforced concrete products yard and other facilities for the production base. Incidentally on 3 January 1979, an order from the USSR Minenergo [Ministry of Power and Electrification] stipulated that the above-mentioned plant would be in operation in 1981. However, this document was not backed up by the corresponding equipment deliveries. No major changes occurred at the beginning of the present year either. Only quite recently did the union ministry begin to specifically examine the state of affairs at the Shul'binsk GES.

At present, measures have been outlined to ensure the prompt completion of the three units and tasks have been set for the entire prestart period. The necessary material and technical resources have been allocated, primarily for completing construction of the production base. The difficulty is merely that the deliveries of many types of materials and equipment have been planned for

the 4th quarter of the current year. For this reason there are serious fears that the concrete plant will not be operating fully for a long time to come. Hence, the acute need has arisen for shortening these delivery dates.

Another, equally important task in the prestart period is the preparing of the bed of the future reservoir for flooding. Three population points in Semipalatinskaya Oblast and a number of villages in Vostochno-Kazakhstanskaya Oblast will be moved from its bottom. Construction has started on the central farmsteads of the rayon specialized farm association Novoshul'binskoye and the Kolkhoz imeni Kalinin in Novoshul'binskiy Rayon. The first streets, nurseries have appeared in the barren area, schools, trade centers, service facilities as well as livestock buildings are under construction. However, until recently the pace of construction at the kolkhoz farmstead caused justified alarm. In truth, a change occurred in April and as a result of this it has been possible to overfulfill the designated plan. It is important to reinforce this success and the construction workers of Semkolkhozstroy [Semipalatinskaya Oblast Kolkhoz Construction] and Stepsel'stroy [Steppe Rural Construction] No 22 trusts still have much to do. More than 300 apartments and many other projects must be completed and excellent conditions for work and leisure must be created for the rural workers in a new area. Several thousand cubic meters of lumber must be removed from the flooding area as well as trees which subsequently could impede the movement of vessels or be partially submerged in the water.

People always determine the fate of a major construction project. Their enthusiasm, professional skill, tenacity in achieving the designated targets combine with technical ability guarantee success in erecting such a large and complicated project as a hydropower plant. The collective from the construction administration Irtyshgesstroy [Irtysh GES Construction] commenced the building of the Shul'binsk GES having among its assets the first two Irtysh hydropower plants, the Kapchagay and Gilevskiy hydropower projects, as well as other national economic projects in Kazakhstan and Western Siberia.

A majority of the construction workers, having left populated areas, arrived here in the Irtysh steppe in order by their hands to transform this corner of the oblast, to reconquer the Irtysh and put its power resources to serving the state. Along with the veterans of Irtyshgesstroy, also working now are those who erected the power giants on the Zeya, Naryn, Vakhsh and other rivers and the young enthusiasts who recently completed secondary schools and served in the ranks of the Soviet Army. The novices are immediately sent to the training center, they are helped in choosing a job to their liking and receive a worker category. Providing tutelage over them are such experienced communist mentors as the brigade leader of carpenter concrete layers, the winner of the Order of the Labor Red Banner, V. Dotsenko, the team leader of concrete workers V. Kyukov, the brigade leader of finishing workers N. Kalugina and others.

Without leaving the settlement, many construction workers have begun studying at the All-Union Correspondence Power Technical School. The admission commission arrived in the settlement and accepted the entrance exams on the spot. The first group of graduates has already received their diplomas. Among them

is the above-mentioned V. Nikolayev, who in the past was a regular concrete worker and now heads the Komsomol-youth brigade.

Did Bogdan Tkachuk, a graduate of the L'vov Polytechnical Institute imagine that arriving in Shul'binsk he would gain not only an interesting job at the motor transport enterprise, new friends but also family happiness? Here, thousands of kilometers from home, he met and fell in love with an English teacher Asya Zhakperov, who had completed the Alma-Ata Foreign Languages Institute. The young people had a happy wedding in a well appointed apartment the keys to which they received as a present for this significant event.

The people have settled in securely on the new spot. Shul'binsk received the status of a settlement in 1978 and at present already around 6,000 persons live, work and study in it. Here are some other curious figures. In 1979, 34 weddings were celebrated here, 62 in 1980 and around 100 last year. The birthrate figures are also good. But there are still places in the preschool institutions. They have been built considering the growth prospects of the settlement.

In describing this, the chief of the construction administration, Yu. M. Panfilov, did not conceal his feeling of pride. He, an experienced hydropower construction worker, perhaps more than anyone else understands how important it is to create a well organized life for the people. Only in this instance can the personnel be kept and all the set tasks successfully carried out.

"The expansion of the work scale," said Yu. M. Panfilov, "requires an increase of 400 workers this year, and in the following 2 years another 1,100 persons. Hence, we are waiting for volunteers. And we are not merely waiting, but are preparing an additional amount of housing for their arrival. Now we are planning 18,000 m². The foundations of new buildings are being laid, a social center, hospital complex and hotel are going up. The oblast party committee, and oblispolkom have also shown great concern for the integrated development of Shul'binsk. They have endeavored to effectively settle all arising questions and provide professional help."

Thus, all prerequisites are being created to ensure the stability of the labor collective which in 1984 is to begin construction on another GES the Semi-palatinsk. We are very pleased that an entire constellation of hydropower plants is being born on the Irtysh and they will ensure the accelerated development of the national economy and the rapid growth of new industrial centers in the republic.

...The worker settlement wakes up early. The adults and children hurry along the concrete pathways which have been washed by a warm spring rain. They are heading to work, to school, and to preschool institutions. A bus pulls up to the stop and this will take the morning shift to the site of the future plant. Around 1,000 days will pass before its units begin to operate. But this joyous day will inevitably come. In order to bring it nearer, sparing neither force nor energy, persons from the most different professions are hard at work. They have come to the Irtysh area in order to transform this steppe region which they have already fallen in love with with all their hearts.

ELECTRIC POWER

LEVEE CONSTRUCTION AT ROSTOV NUCLEAR POWER REPORTED

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 27 Apr 82 p 1

[Article by SOTSIALISTICHESKAYA INDUSTRIYA correspondent V. Askenov from Volgodonsk: "the Levee"]

[Text] It stretches 4-1/2 km into the Tsimlyanskoye Sea and then makes a semi-circle back to the shore, forming the cooling pond for the reactor division of the Rostov Nuclear Power Plant [AES]. The 10 km levee is a complex technical engineering structure the building of which will require 8.5 million m³ of rock, gravel and sand. Each kilometer of the levee means 3 million rubles of construction and installation work. Its building will take 4 years.

Here there are special technical requirements including the strictly established sizes of rock; the laying of the foundation at the multimeter depth of the sea; the installing of enormous sized but very fine filters. The difficulty is not merely in the engineering. The cooling pond is being built on an already complete body of water. The AES construction workers have to win the pond away from the Tsimlyanskoye Sea in the winter when it is covered with ice, in the spring when the ice begins to move, and in the summer and autumn when a rough chop can develop on the sea. It is difficult for the men at any time of the year. The construction workers are aided by divers. They lay the underwater portion of the levee, they determine the position of its foundation and the security of the bonding with the sea's bottom. And so it goes meter by meter. Last year, the spring sea tested the levee for the first time. For several weeks running the storms "plundered" the dam. Waves rolled over it, carrying away rock, gravel and washing out the sand. The still uncemented body began to grow thinner before your very eyes. The levee had to be saved. Special brigades were organized, rock and gravel were brought in and the vehicles were ready. But the levee survived. This was the first victory for the construction workers. Considering last year's lesson, the construction workers raised its level up 1.5 m and broadened the base by 5-6 m. This guaranteed the strength.

The levee slowly but noticeably has cut into the sea. Now it is 3 km long. The construction workers of the specially created hydraulic construction section are doing everything so that the cooling pond is ready for use precisely on schedule. The organized columns of KamAZ truck drivers and equipment operators are picking up the pace. The first records were set in February and March.

Full capacity was reached for the processing of rock. While last year even during the most favorable summer months each day 1,000-1,200 m³ of fill were laid, at present it is up to 3,000 m³. And this has been achieved at a time when the sea was covered by a thick layer of ice. The stone did not always break through the 2-meter ice mantle. A way out of this situation was found. An excavator was placed at the very end of the levee. It made holes through which the divers released the rock and gravel.

The people are maturing in building the levee and are becoming high-class masters. V. Selin and A. Yepifanov are bulldozer operators. Just 2 years ago they put the first cubic meters of rock fill at the base of the dam. Now the bulldozer operators are able to handle at least a 1,000 m³ of rock per shift, just as much as is moved by the 20 KamAZ truck drivers from the brigade of G. Kudryavtsev. The brigades working on this crucial section have repeatedly emerged the winners of the competition "60 Shock Weeks for the 60th Anniversary of the Formation of the USSR." On the levee there are no lagging collectives.

"But still we are 6 months behind schedule," admits the chief of the special section A. Krasnopol'skiy. "This is the heritage of previous years. Now we must make up for lost time. We feel that we will do this. The railroad line is being lengthened along with the freight and loading areas. This will make it possible to receive double the amount of rock and stone for the levee. The plans are ready but Atomenergostroy [Nuclear Power Construction Administration] is in no hurry. The question is limited to numerous talks at planning sessions, conferences and meetings."

The section chief is right. The delivery of rock to the site has still not been sufficiently well organized. The overcoming of this should be aided by the agreement concluded on the basis of a "worker relay" for cooperation between the construction workers, the collectives of the rock quarries and the transport workers. As yet, the shuttle trains do not deliver the materials steadily.

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CSO: 1822/210

TACTICS, TECHNIQUES FOR STRIP-MINING KANSK-ACHINSK COAL DISCUSSED

Moscow UGOL' in Russian No 7, Jul 82 pp 3-12

[Article by M. I. Shchadov, first deputy USSR minister of coal industry: "Urgent Problems in the Development of KATEK"]

[Text] In light of 25th and 26th CPSU Congress decisions and the CPSU Central Committee and USSR Council of Ministers decree, "On Additional Measures for Speeding Up Development of Coal Strip Mining During 1981-1990," establishment of the Kansk-Achinsk Fuel and Power Ecomplex is a most important step on the road to solving the fuel and energy problem not only of Siberia but of the whole country. The coal reserves in the Kansk-Achinsk basin that have been explored for strip mining will enable the construction of strip mines with a total capacity of up to 900 million tons per year, with a lengthy period for developing them. The total capacity of the KATEK [Kansk-Achinsk Fuel and Power Complex] operating strip mines is now 41 million tons, and the amount mined from them is 35 million tons.

The first strip mine, Berezovskiy No 1, with a capacity of 55 million tons of coal per year, is already under construction, and its first phase (27.5 million tons per year) should be put into operation in 1985. From the standpoint of the basin's overall prospects for development, the introduction of this strip mine, although it will be an important contribution to the country's fuel and power balance, will be only the start of the execution of large tasks in whose realization practically all the main branches of the country's economy will take part. At present, a major complex of geological exploration and engineering geological work has been carried out on the "takes" of the first strip mines, as has a complex of studies on substantiation of the basic hydrogeological, engineering-geology and operating parameters of the first strip mines. Technical and economic substantiation of the parameters of new continuous-action mine-transport machinery, the initial requirements thereof and the engineering tasks for creating them have been developed. Design work is being done and the manufacture and delivery of various machines have commenced. The preliminary design for the first phase of Berezovskiy Strip Mine No 1 has been approved, and design work on Irsha-Borodinskiy Strip Mine No 2, with a capacity of 40 million tons per year, is being performed. The TEO [feasibility study] is being made up for the Uryupskiy Strip Mine, with 52 million tons per year capacity. The preliminary design of Berezovskaya GRES-1 has been approved, and design work is being performed on the Uryupskaya GRES.

At the same time, a number of challenging questions still have not received proper solution, and this is explained by the specific operating conditions of KATEK enterprises, and also by the inadequate attention given these factors by the organizations and agencies responsible for solving these questions.

Mining work at Kansk-Achinsk basin strip mines is directly affected by the following factors: the complicated climatic conditions; and the presence in the overburden rock, which is represented mainly by mild differences, of rock interlayers which, although sparse and thin, are in some cases hard;

the gently inclined (less than 6-degree) bedding and the great thickness (up to 65 meters) of the coal seams and the large horizontal dimensions of the main deposits. On the one hand, this paves the way for the construction of large strip mines at which machinery of large unit capacity will be used and a substantial concentration of operations will be achieved, and, on the other hand, with the increase in the thickness and volume of the overburden to be stripped as the mining proceeds at the mines, it will lead to definite difficulties in the definitive selection of operations schemes for excavation; and

high requirements for supplying coal uninterruptedly to the main consumers, and these, given the existence of seasonal fluctuation in coal consumption and the unevenness of the coal mining, lead to the necessity to solve a number of complicated organizational and engineering tasks about insuring the reliability of operation of the mine-customer system.

The main technological problem of KATEK is the creation of highly effective, reliably operating strip mines with progressive technology and a high level of mechanization of the mining work. For this purpose it is necessary to provide: continuity of the basic technological processes for the stripping and mining work; the effective operation of both individual machines and of sets of them; reliability of the excavation operating schemes; a rise in the intensity of working of the mine "takes" and the mine fields; and continuous delivery of coal to the customer by creating buffer storages and intermediate storage capacity within the mine-customer system (in case of necessity).

Let us examine ways of solving the various aspects of this problem.

The Introduction of Continuous Operating Processes for Mining Operations

USSR Minugleprom [Ministry of Coal Industry], in collaboration with USSR Mintyazhmash [Ministry of Heavy and Transport Machine Building], has done much work on the development, creation and introduction of large domestic rotary excavators for strip mines. During the last 10-15 years they have mined 116.2 million tons, or 43.7 percent of the entire volume mined at strip mines; and rich experience has been gained in year-round operation of rotary excavators under the difficult mine-geology and climatic conditions of Siberia, Kazakhstan and the Far East.

At the same time, it must be noted that USSR Mintyazhmash still has not completely satisfied the coal industry's requirements for high-capacity continuous action machines. This leads to the need to order such machines abroad and also to outfit strip mines with equipment of different types, domestic and foreign.

The Kansk-Achinsk Coal Basin fields that are to be developed first (the Berezovskiy, Irsha-Borodinskoye, Uryupskoye and Itatskoye) are suitable in relation to mine-geology conditions for the operation of high-capacity continuous-action machines. Factors that can complicate the operation of machinery of this type and which must be considered in choosing the technology and schemes for mechanizing mining operations are the severe climate and the presence of hard inclusions in the

rock. That is why the new machine should be of a design-development version that will enable normal operation at temperatures of +40 to -40 degrees C and have a potential for restoration of efficiency after temporary stoppages at temperatures as low as -53 degrees C. The machines should also be supplied with means for dealing with adhesion, and especially with freezing of the coal and rock to the working surfaces. This factor determines to a great extent the duration of the period for performing stripping work. Calculations have indicated that excavators with a specific digging strength of up to 0.14 kN/cm² can mine coal and strip rock the year round at temperatures from +40 to -40 degrees C, taking into account the seasonal freezeover, without reducing equipment productivity. This also is specified by the engineering assignment for creating the new machines.

At the same time, taking into account the importance of providing for steady operation of the machinery during winter, the development of effective methods and means for reducing bench-surface freezing and the output of large lumps when excavating frozen rock layers, and also of means for dealing with adhesion of rock to the machine's working surfaces, is necessary. For KATEK strip mines, the drive against rock adhesion is of paramount importance. Especially important here is reliable operation of the conveyor arrangements that transport the stripped rock. Experience in year-round operation of coal conveyors already exists at Urals strip mines. However, USSR Mintyazhmash has practically been eliminated from participation in the solution of these problems, which have been coordinated on only when equipment that will be developed by USSR Minugleprom will be installed on the machines, although integrated solution of the tasks of insuring efficiency of the machines under the prescribed conditions is, as is well known, the direct responsibility of the supplier of these machines.

A similar situation exists, unfortunately, also with solution of the problems of coping with vibration and noise, dust formation and so on, which, of course, cannot be considered normal. Therefore, USSR Minugleprom has been compelled to work out measures for dealing with rock adhesion with the resources of the industry's institutes, a factor that complicates the conduct of research and delays the dates of its fulfillment.

According to the results of institute-conducted research, the combined method is recommended as the primary method for dealing with adhesion: the application of the hydrophobic liquid KOS [not further identified], which resists freezing, and the use of a set of mechanical cleaning devices. This method was tested at Vakh-rushevugol', Aleksandriyugol' and Dal'vostugol' [the Vakhrushev, Aleksandriya and Far Eastern Coal Production Associations]. However, use of the combined method does not completely solve the problem of dealing with stickiness. It can be recommended only for machinery of the first phase of Berezovskiy Strip Mine No 1 with short conveyors (on the stripping excavators, transfer conveyors and pile formers), and for conveyors that transport coal, which freezes to the belt less intensively than stripped rock does.

Research on this problem must be speeded up, with the involvement of many operating organizations in their solution. They should be solved at the interindustry level on the basis of an integrated coordination plan worked out under the supervision of the USSR State Committee on Science and Technology, with USSR Academy of Sciences participation.

In considering the inadequate experience in using stripping conveyors under severe climatic conditions, USSR Minugleprom adopted 8 months per year as the period for stripping work. In this case, the temperature intervals for this period will be nearly similar to the annual temperature intervals of the middle zone of our country and of East European countries, where there is already adequate positive experience in the operation of high-capacity continuous-action machinery throughout the year (for example, the manganese quarries of the Ukraine and strip mines of the Polish People's Republic, the GDR and the Czechoslovakian Socialist Republic) without using special complicated means for dealing with adhesion.

Definite reserves have also been specified for computing the annual productivity of sets of machinery. Thus, of the total 5,860-hour period for stripping work, the calculated time for net operation of the machinery (not counting planned, climatic and emergency downtime) is 4,000 hours, while for mining work the indicators are, respectively, 8,760 and 4,550 hours. Such solutions for the first high-capacity strip mines have been substantiated technically.

The operating effectiveness of rotary excavators at KATEK strip mines is complicated by the presence of hard inclusions in the stripped rock. Research performed by Soyuzuglegeologiya [not further identified] and NIIOGR [Scientific-Research Institute for Surface Coal Mining] for the purpose of evaluating the nature of the distribution and the physical and mechanical characteristics of the hard interlayers at the site of the field that will be worked during the first 16 years of operation of Berezhovskiy Strip Mine No 1, indicated that the hard inclusions have been concentrated in certain fairly uniform lithological horizons that have been deposited in the form of seams with breaks. Rock inclusions for the horizon within the indicated area of the strip mine is about 0.16 percent of the total amount of stripped rock.

About 60 percent of all the interlayers have a hardness factor of $f < 2.5$ and a thickness of 0.4 meter. The ratio of interlayerings with a hardness factor of $f \geq 3.5$ is 26 percent, including 6 percent that are less than 0.2 meter thick. Approximately the same data are obtained in the proportion of the "take" of the two other strip mines slated for priority development--the Uryupskiy and Irsha-Borodinskiy Mine No 2.

Direct excavation of the interlayers by rotary excavators with a productivity of 5,250 m³/hr (not counting the drilling and blasting work) is permissible, according to UkrNIIProyekt [Ukrainian Scientific-Research and Design Institute for the Coal, Ore and Gas Industry] computations, where the interlayers are less than 0.2 meter thick, regardless of hardness. The possibility of direct excavation of thicker interlayers depends upon their hardness and degree of fissuring. In particular, where $\sigma_{cm} < 0.3 \text{ kN/cm}^2$, direct excavation (at reduced productivity) is permissible where interlayer thickness is less than 1.5 meters. Interlayers whose characteristics go beyond the indicated limits require preliminary destruction. As calculations and experimental studies have shown, the size of the lumps of hard interlayers that have been blasted should not exceed 600 mm (where they will be excavated and transported jointly with soft rocks by machines with a productivity of 5,250 m³/hr).

With a view to working out parameters for the drilling and blasting destruction of hard inclusions that are characteristic for the fields of the primary KATEK strip mines, UkrNIIProyekt, jointly with Krasnoyarskugol' [Krasnoyarsk Coal Production

Association] workers, did experimental work in 1975-1981 on the existing Borodinskiy Strip Mine. As a result, the following were established:

the hard inclusions must be crushed by means of vertical or inclined intersecting deep-hole charges of explosives in the thicker soft overburden rock (without outcroppings of hard inclusions). The parameters of the drilling and blasting operations: diameter of explosive charges 125-160 mm, specific consumption of explosives (depending upon charge diameter) 3.5-4.5 and 4.5-5.5 per 1 m³ of inclusions, and the grid of holes 2x2 meters. The effectiveness of the explosion is increased as hole diameter is reduced to 125 mm;

with the recommended technology and parameters of explosive breaking, the following composition of blasted rock mass is expected: yield fractions of 0-200 mm are 55-75 percent, 200-400 mm--30-18 percent, 400-500 mm--8-5 percent, and 500-600 mm--7.2 percent; and

during the excavation of loose rock (and sand loams) jointly with blasted hard inclusions, the specific resistance to excavation does not exceed the resistance to the excavation of sandy loam in a block in a thawed state.

For high-quality crushing of hard inclusions, it is necessary to establish precisely their contours (by geophysical methods) and their thickness and strength (by means of operational holes).

Work on the preliminary observation of inclusions is still being conducted with inadequate effectiveness. Despite the prolonged duration of the studies, the results achieved (the inclusions were observed only at benches less than 10 meters high) are still insignificant. Under the operating technology adopted, methods and means for observing the inclusions at depths of up to 45 meters are necessary. In view of the fact that this problem is, in essence, also an inter-industry problem, the efforts of all interested ministries and agencies must be united under the supervision of the USSR State Committee on Science and Technology, with USSR Academy of Sciences participation, with a view to solving the problem successfully during the 11th Five-Year Plan.

The use of continuous-action machines to excavate coal with hard rock interlayers has been mastered in practice at the Ekibastuz field. There is much experience in excavating overburden with hard inclusions in the GDR, People's Republic of Bulgaria, the Czechoslovak Socialist Republic, Canada, Greece and other countries. Rotary excavators that work massifs with hard inclusions have been equipped in most cases with special devices that prevent oversized pieces from dropping into the working implement's area, as well as devices for extracting and discarding oversized pieces that fall onto a conveyor belt. The use of progressive foreign and domestic experience is, undoubtedly, necessary and useful.

For KATEK conditions, UkrNIIproyekt, in accordance with a USSR Minugleprom task, is developing a design for working implements for excavators that work rock with hard inclusions and devices that will prevent oversized pieces from falling into the working implement's area. USSR Mintyazhmash organizations almost must be involved in this work.

The colossal amounts of mined-mass transporting, which will come to 150-200 million m³ per year at each strip mine when operations are fully developed (this is

primarily coal and stripped rock of the advance benches that are moved along the operating front), can be carried out more effectively, as the mining work constantly deepens, only with the use of continuous-conveyor transport. USSR Minugleprom considers that it is more desirable to use high-capacity continuous-action excavators and transport and heaping machinery at KATEK strip mines for both mining and stripping work, and it is necessary to take all measures to insure that it is used effectively.

Work should be promoted to create for excavators special protective devices that will prevent the accidental dropping of outsized lumps onto conveyors, as well as warning-signal devices in case of encounter with individual unobserved and unblasted hard inclusions.

The Operating Reliability of Machines and Complexes.

One of the main prerequisites for successful operation of strip mines is the correspondence of the machinery's parameters with the conditions of machinery operation. The primary data and the necessary requirements for the machinery are contained in the engineering tasks for creating them that were developed by USSR Minugleprom institutes and adopted by USSR Mintyazhmash. It is a matter now for USSR Mintyazhmash, since successful operation of the machines will depend to a great extent upon the quality of their manufacture and upon their operating reliability under the given conditions.

The first machines that arrived at the strip mines, unfortunately, did not always give the expected results. The stripping complexes of 5,000 m³/hr productivity at the Morozovskiy Strip Mine of Aleksandriyagol' and those of 1,250 m³/hr productivity at the Shirokiy Strip Mine of Dal'vostugol' did not work with adequate effectiveness because of accidents, and the ERShRD-5000 excavators were often idle at Ekibastuz and Krasnoyarskugol' Strip Mines.

For the circumstances of the KATEK strip mines, it is the reliable operation not only of individual machines but also of complexes of them that is extremely important. Special attention must be paid to the operating reliability of intermediate links between the individual machines of complexes that provide for rapidity, precision and accident-free operation of their mutual actions during the process of shifting machines along a front and when making incisions into new stopes, for prevention of the spilling of soil and the falling out of large lumps, for insuring convenience of energy feed, and so on. Under the current organization of the process--of various enterprises creating individual machines that are included in the complex, it is difficult to expect successful solution of these problems without proper coordination of their design by one prime coordinating organization of USSR Mintyazhmash.

The operating effectiveness of large machinery complexes will depend considerably upon the mechanization of auxiliary machinery. However, this question still has not been resolved. The conveyor movers, the collectors of spilled rock and coal, the vulcanization presses and the units for mechanizing track work, and other mechanisms that are working at the strip mines, are, as a rule, experimental or of the test type. This equipment is being manufactured basically at USSR Minugleprom enterprise experimental or repair plants (plants of the Aleksandriyagol', and Dal'vostugol' Associations and UkrNIIproyekt). The plants that manufacture the basic equipment deliver to the strip mines machines that have not been outfitted

with means for mechanizing auxiliary processes, and there are no specialized plants for manufacturing the auxiliary equipment.

UkrNIIProyekt has developed documentation for a conveyor mover, a collector, a vulcanization press and an assembly for the suspension--replacements for the idlers, and equipment for replacement of belts up to 2,000 mm wide. Based on the manufacture of auxiliary equipment for a complex of coal conveyors of 5,250 m³/hr productivity, the Novyy Kramatorsk Machinebuilding Plant has received documentation from UkrNIIProyekt for a conveyor mover, a collector and a vulcanization press, but their manufacture still has not been undertaken.

USSR Mintyazhmash still has not received engineering tasks for the manufacture of auxiliary equipment for conveyor complexes with a productivity of 12,500 m³/hr and a belt up to 2,500 mm wide, which UkrNIIProyekt worked out in 1973.

The Kursk Industrial Rubber Products Plant is producing conveyor belts of extremely low quality. The existing TU's [specifications] for producing the belts permits their manufacture with a "falciformness" of up to 5 percent on a 20-meter length, which, over the length of the conveyor flight, causes a deflection of up to 1 meter or more. This leads to substantial spills of coal and rock and sharp reductions in the complex's operating reliability and the belt's longevity.

Solution of all the questions touched upon cannot be delayed any longer and should be adopted jointly by USSR Gosplan, the USSR State Committee on Science and Technology, and USSR Mintyazhmash, as quickly as possible.

The condition of the repair base and the status of spare-parts supply determines in great part the operating reliability and operating effectiveness of the high-capacity machinery, and even short-term unforeseen idle time, which disorganizes the operating processes considerably, reduces the strip mine's operating productivity as a whole and increases irregularity in the mining of coal.

The preliminary design for the first phase of Berezovskiy Strip Mine No 1 calls for an adequate amount of repair capacity, but promotion of the construction of that capacity is being hampered by inadequate amounts of financing and construction-base capacity. All measures must be taken to insure that the whole complex of facilities for the repair activity, including a plant for repairing stripping and transporting equipment in the city of Achinsk and a plant for electrical-equipment repair in the Sharypov industrial park, are introduced by the time the strip mine is turned over for operation. Questions of factory servicing of specially made equipment by the manufacturers and the guaranteed provisioning of the strip mine with supply parts and materials for the current servicing thereof should also be solved in timely fashion. Otherwise, the designed productivity of the individual machines and the capacity of the whole strip mine cannot be assimilated within the periods stipulated.

The reliable operation of high-capacity continuous-action machinery complexes will also depend greatly upon the servicing personnel, qualified cadres of which must be trained in time. There are production bases for training personnel.

The Reliability of Excavation Operating Schemes

The comparative evaluation and choice of operating schemes (or systems) for excavating that are found in scientific research and in designs have been and are being produced, as a rule, on the basis of feasibility calculations, with determinations being made of the number of workers and the capital, operating and adduced expenditures per unit of coal mined for several prescribed situations (at the time of turnover of the strip mine for operation, at the time of assimilation of the design capacity, and during the 10th year of operation). In individual cases the total adduced expenditures for a certain period of operation (5-10 years, the maximum is 15 years) are determined. In so doing, calculations of the productivity of the machines and complexes consider the mechanical reliability (or readiness) indicators only of their individual components and parts. Such a method for evaluating and choosing technological schemes (or systems) for excavation is not effective enough, if only because it does not answer the question of overall effectiveness of development of the whole "take" of the strip mine, especially where there is a substantial change in the overburden thickness (gently sloping and inclined seams) as the mining operations develop. The chief deficiency of this method is the lack of detailed evaluation of the reliability of the operating scheme itself, that is, an analysis of the organization and mutual dependence (or, more precisely, the independence) of the operation of the machines and complexes that implement the scheme, in space and in time.

The modern coal strip mine is a complicated, dynamic system, since the location of the stripping and mining complexes will, under various circumstances (during operation and during planned or unplanned stoppages) lead to change in the mutual disposition of the various complexes. In so doing, situations will inevitably arise that will lead to restrictions on the possibility of continuing to operate the various complexes to increase work-front preparation.

The duration of normal operation of the various complexes (or machines) when a complex that precedes them (according to the adopted technology and organization of operations) stops should be one of the most important indicators of operating-scheme reliability. By virtue of the dynamicity and unevenness of the excavation process, this indicator is not constant but will change during strip-mine operation.

In order to provide for continuity of coal output, the permissible amount of time reserve for mining complexes should be at least as much as is necessary for eliminating the more likely serious causes of stoppage ahead of the operating complex. An increase in this time reserve increases the operating scheme's reliability.

In considering the great production capacity of promising strip mines and the importance of a continuous supply of coal to large customers, USSR Minugleprom has charged UkeNIIProyekt with working on an additional evaluation of the reliability of technological schemes for the operation of individual strip mines, beginning with Berezovskiy Strip Mine No 1, the technical design for the first phase of which has already been approved (figures 1 and 2).

The complex of primary tasks for additional evaluation of reliability of the technological scheme that was adopted in the preliminary design of the first phase of Berezovskiy Strip Mine No 1 included, in particular, determination of: the nature and intervals of change during the year in the dimensions of the coal reserves that

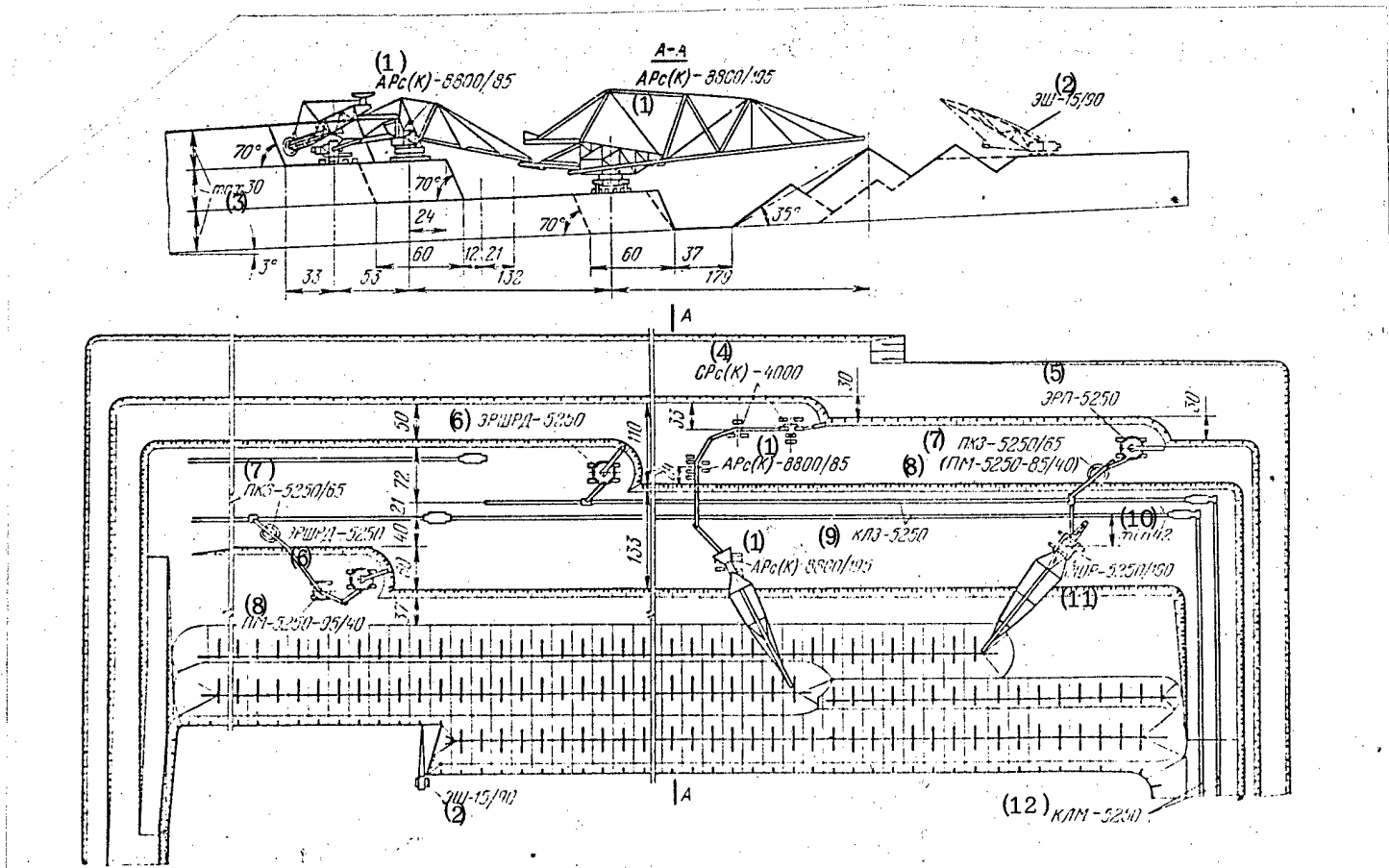


Figure 1. System for Excavation During the Initial Period of Operation of Berezovskiy Strip Mine No 1.

Key:

1. ARS(K).	3. max.	5. ERP.	7. PKZ.	9. KLZ.	11. ØShR.
2. ESh.	4. SRs(K).	6. ERSHRD.	8. PM.	10. min.	12. KLM.

are ready for excavation for each mining complex; the time reserves for independent operation of each of the stripping and mining complexes; and the expected computed unevenness in the stripmine's coal output over the year. This required additional detailed review of the organization of stripping and mining work (figure 3), the development of a refined regime for the operation of stripping and mining complexes and the construction, based thereon, of calculated schedules for mining coal from the strip mines, by day and for the year. The dynamics of the amounts of reserves ready for excavation and of daily mining and of the work front prepared by stripping are shown in figures 4 and 5.

The results of the computations indicate the following.

1. With the procedure for developing mining operations for the first phase of the strip mine during the initial operating period (10-12 years) that was adopted in the design, the overburden rock thickness does not exceed 30 meters, and the rock is worked by two stripping, transporter and dumping complexes with a productivity of up to 5,250 m³/hr from one bench. The annual amount of stripping work in this

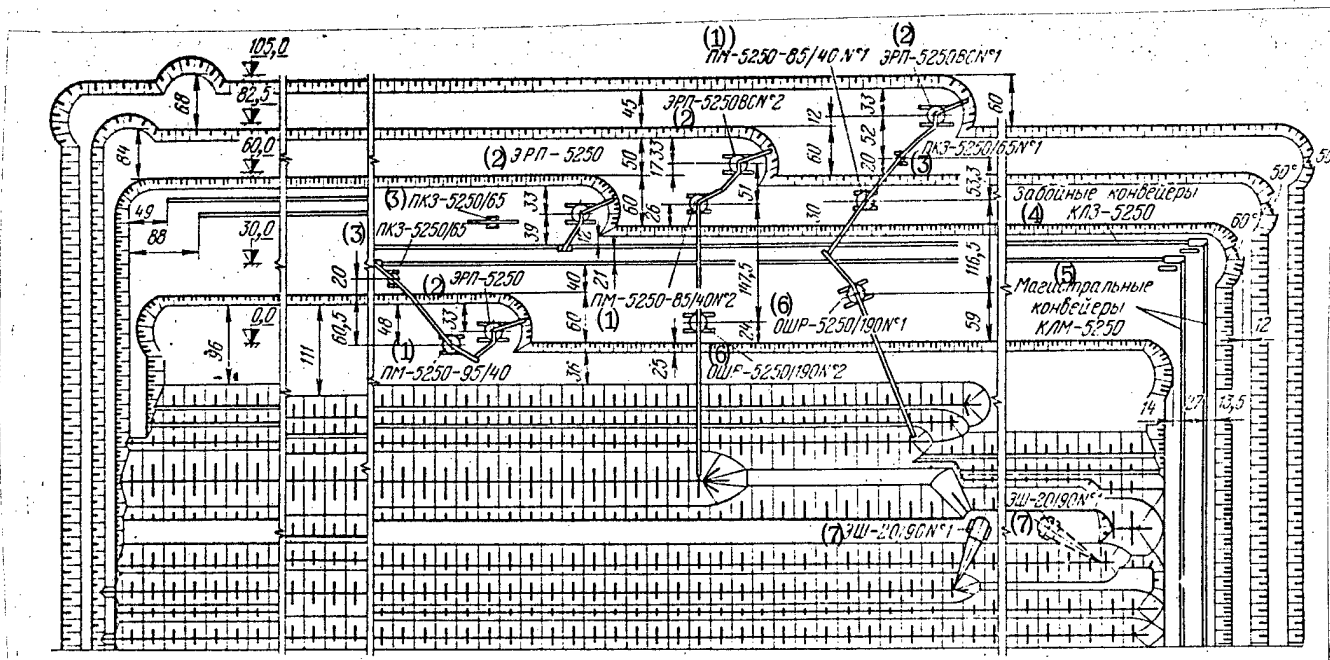


Figure 2. System for Excavation During the Stable-Operation Period of the Berezovskiy Strip Mine No 1.

Key:

- | | | |
|----------------|-----------------------------|-------------------------------|
| 1. PM. | 3. PKZ. | 5. Trunk-line conveyors, KLM. |
| 2. ERP-5250VS. | 4. Mine-face conveyors KLZ. | 6. OShR. |
| | | 7. ESh. |

case does not exceed 13 million m^3 per year, that is, it makes up something more than half of the total calculated annual productivity of the two complexes (22 million m^3). The front for independent stripping work (on 15 March) consists of 1,600 meters, or 28 days, and it is restricted by the possibility that stripped material will be dumped into the mining stope of the lower coal bench. By the start of the stripping-operations season, 5.3 million tons of coal reserves are ready for excavation (78 days, where the maximum requirement of GRES-1 in March is 68,000 tons per day) with approximately equal distribution thereof over both coal benches.

Thus, for the initial period of operation of the strip mine, the operational scheme is sufficiently reliable and has a considerable reserve of productivity of the stripping complexes, which, considering that the work starts with equipment that has not been mastered in the severe climatic conditions, should be considered justified and even necessary.

2. At the ending of the first period of operation of the strip mine, the overburden-rock thickness (at the eastern half of the quarry floor) reaches 40 meters, and it will have to be developed with two benches. The annual amount of stripping will be increased to 17 million m^3 (about 80 percent of the strip mine's total calculated productivity for stripping work).

Operation of the strip mine at two stripping (transporting and dumping) benches will be more complicated organizationally. During the year three characteristic

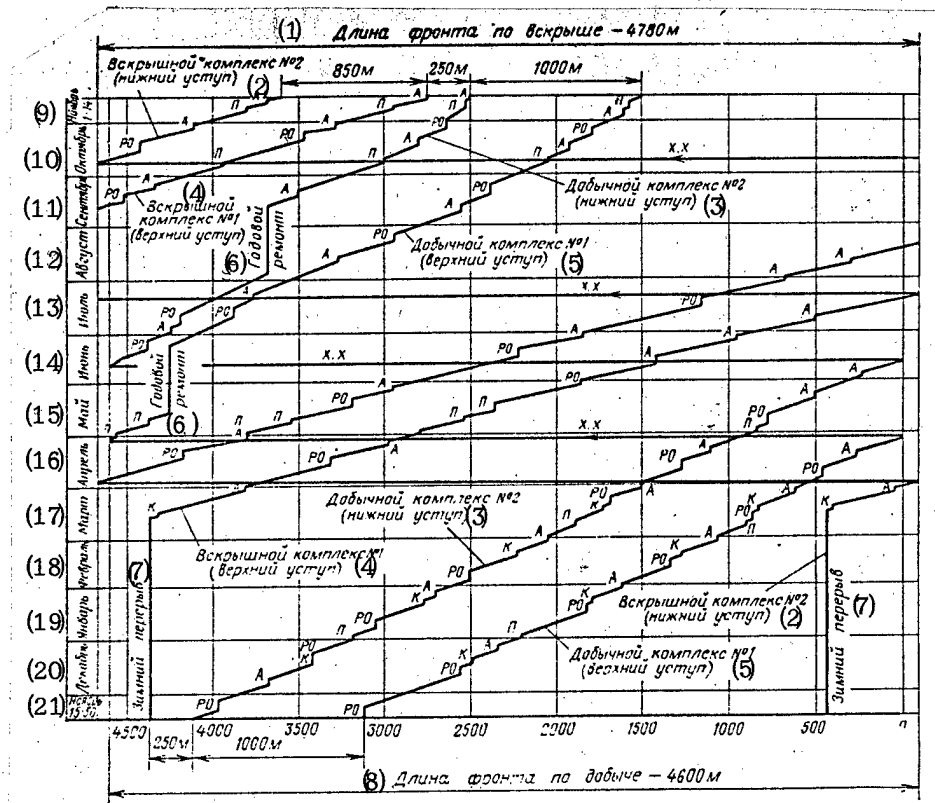
Figure 3. Planning Diagram for the Stable Operation Period of the Strip Mine.

Key:

- П. Downtime of complexes for holidays.
- К. Downtime of complexes for climatic conditions.
- А. Emergency downtime of complexes.
- Р0. Downtime for monthly repair inspections.
- Х.Х. Idle running of the equipment.

- 1. Length of overburden front--4,780 meters.
- 2. Stripping complex No 2 (lower bench).
- 3. Mining complex No 2 (lower bench).
- 4. Stripping complex No 1 (upper bench).
- 5. Mining complex No 1 (upper bench).
- 6. Annual overhaul.
- 7. Winter interruption.

- 8. Length of mining front--4,600 m.
- 9. November 1-14.
- 10. October.
- 11. September.
- 12. August.
- 13. July.
- 14. June.
- 15. May.
- 16. April.
- 17. March.
- 18. February.
- 19. January.
- 20. December.
- 21. November 15-30.



situations can arise at the strip mine during which the operation of the complexes can be restricted.

By the start of the period for performing stripping operations (15 March), the distance between the upper mining bench and the complex of the lower stripping bench is reduced to 500 meters. Where a stripping complex has stopped, the potential front for independent work by a mining complex is 250-300 meters, which provides for its operation with a productivity of 60,000 tons of coal per day for 9-11 days. During this time, in considering the preceding winter repair, the stripping complex should be prepared and started into operation, although at reduced productivity. Independent operation of the lower mining excavator is limited by the distance to the heap-former of the lower stripping complex; at a productivity of 60,000 tons per day, operation can be continued for 40 days (a work front of 1,200 meters). The total amount of coal that can be taken out by two mining excavators after 15 March where the start of operations of both stripping complexes is delayed, is 2.6-2.8 million tons. This will support the total requirement of GRES-1 and USSR MPS [Ministry of Railways] customers being served (75,500 tons per day) for 34-37 days, which is a completely adequate reserve.

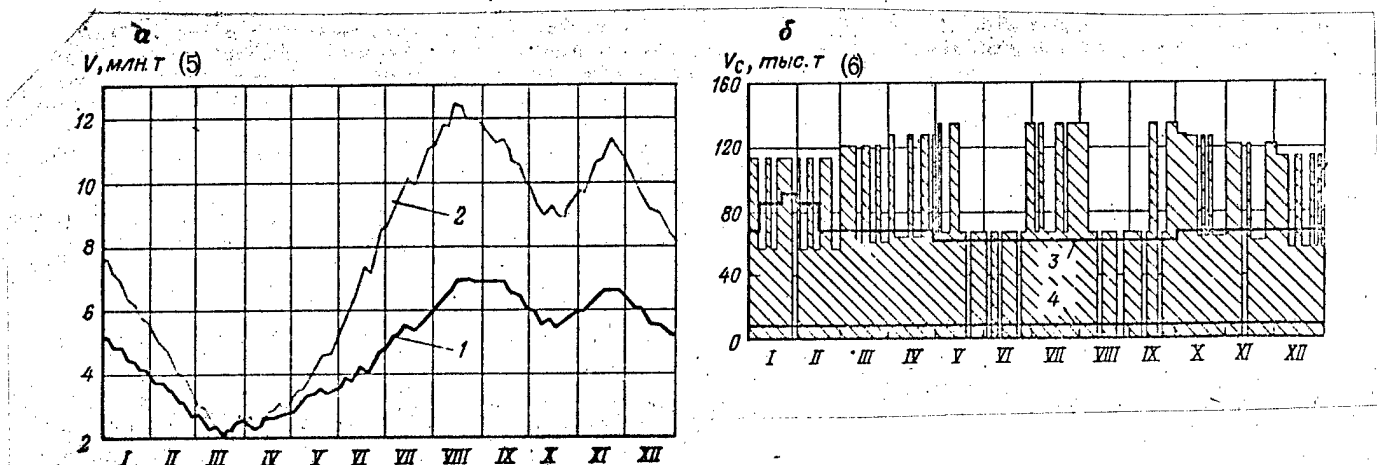


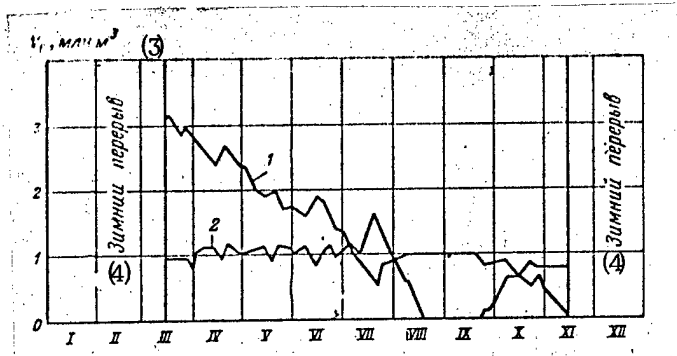
Figure 4. a. Amounts of Coal Reserves Ready for Excavation, V; and
b. Daily Amounts of Coal Mining, V_s :

Key:

- 1 and 2, respectively: upper and lower benches.
- 3 and 4, respectively: GRES-1 requirement and dispatch in MPS [Ministry of Railways) railroad cars.
- 5. V--millions of tons.
- 6. V_s --thousands of tons.

Figure 5. Dynamics of a Front Prepared for Stripping Operations, by Month:

- 1. Mining complex No 1 (upper bench).
- 2. Mining complex No 2 (lower bench).
- 3. V_f --millions of cubic meters (amount of reserves ready for excavation).
- 4. Winter interruption.



In the middle of the year (June-July), after stopping for repair of the upper mining complex, the distance between the mining complexes is reduced to 200 meters. However, the lower mining excavator can continue operations independent of the upper one. The potential front for its independent operation will be determined by the position of the lower-bench stripping complex, which precedes it, and in case of an emergency shutdown of it, the potential front will be 1,600 meters on 1 July and 2,100 meters on 1 August, which correspond to 53 and 68 days of operation (at a productivity of 67,000 tons per day).

At the end of the stripping operations period, the upper stripping complex will be restricted in its work by the possibility that overburden rock will be dumped into the slope of the lower mining bench. The distance between it and the mining complex during stripping operations at full productivity is reduced by this time to 250 meters (at the start of the performance of stripping work it is 2,600 meters). Such a situation is not critical, since the stripping complex has completed its annual work volume, and, if climatic conditions are favorable, can operate with

reduced productivity with an advance equal to the advance of the mine work face (28 instead of 45 meters per day). The mining complexes have been provided with the full amount of prepared winter reserves.

Thus also in the second period, despite complication of the scheme for strip mining work, the indicators of its reliability are high enough.

3. The calculated unevenness of mining coal from the strip mine (the first phase) under the design for two mining complexes with a productivity of 5,250 m³/hr each that has been adopted, the operating regime and also the planned idle time of machines (for annual repairs--40 days, for monthly maintenance inspections--5 days, for climatic conditions--7 days, and for holidays--8 days per year), forecast emergency downtime (30 days per year, with a maximum duration of 3 days per month), and unforeseen operational downtime (10 percent of the annual work time budget, with uniform distribution by days) are determined.

In accordance with the schedules for the work-time balance by complex over the year, the daily mining of coal from the strip mine can change from zero, for example, during downtime of the strip mine for climatic conditions, to 134,000 tons during normal operation of two excavators. A more appreciable reduction of coal mining will occur during the two annual repair periods of the excavators. Such downtime and changes in the daily "take" are considered in determining the annual productivity of each complex (13.75 million tons).

When coal is dispatched from the strip mine in the amount that is planned to be mined daily, the annual design productivity of the strip mine--27.5 million tons--will be supported with the creation at the coal mine of some kind of special buffering coal storage. The necessity for creating such storage at the strip mine arises where there are restrictions on the conditions for acceptance of coal by the customer, and it is not a deficiency of the strip mine's operating scheme.

Questions of Creating Buffer Coal Storage in the Mine-Customer System

The necessity for creating buffer coal storages is dictated by the unevenness of coal mining and of USSR MPS rail transport operations, as well as of coal consumption by the electric-power stations. Given the designed scale of the mining and consumption of coal at KATEK facilities, the organization of a storage activity within the mine-customer system is an extremely important problem from the point of view of both the reliability and the continuity of the system's operation, thus providing for national-economic effectiveness of capital investment and a reduction of operating expenditures.

From the parochial point of view, the creation of buffer storages that smooth out unevenness in the work of the overall system is not undesirable for any one enterprise. It is also obvious that the creation at each enterprise of in-house buffer storages that will smooth out only in-house unevenness of consumption during the simultaneous imposition of rigid requirements on regulating the rate of delivery of coal to it will be less effective from the national economy's point of view and will not yield the desired result. This is manifested most graphically if the customers are located near the reserves, which basically is called for by the integrated design for KATEK development.

Combined calculations carried out by USSR Minugleprom institutes for the first phase of Berezhovskiy Strip Mine No 1 showed that, in order to insure uninterrupted and uniform delivery of coal to GRES-1 in the amount of 68,000 tons per day (the annual average daily consumption) for 365 days of the year, a buffer storage with a capacity of 750,000 tons must be created at the strip mine. Simultaneously, a buffer storage of about 850,000 tons capacity is needed at GRES-1 for smoothing out unevenness of coal consumption. Thus, the total capacity of the two buffer storages with separate solution of the storage-activity question is 1.6 million tons. The total storage capacity at GRES-1 (taking into account an irreducible reserve of 740,000 tons) is found to be about 1.6 million tons. The total capacity of the storage within the strip mine-GRES-1 system is about 2.4 million tons.

When the terms for delivering coal to GRES-1 are fully met (the seasonal variation in consumption is 62,500 to 93,000 tons per day and the constraint on the rate at which coal is received from the strip mine is 4,000-4,500 tons per hour), the total required buffer storage for the whole system will be 1.2 million tons. Taking the irreducible coal reserves for the GRES-1 into account, the total storage capacity is about 2 million tons, that is, it will be 0.4 million tons, or 20 percent, less than in the case for individual (agency) storage. For the GRES-1 design, the total capacity of its storage, taking the irreducible reserve of 740,000 tons of coal into account, is 1.4 million tons.

Taking into consideration what has been said, it would be desirable to increase storage capacity at GRES-1 (with USSR Minugleprom sharing in the expenditures) up to 2 million tons. This would eliminate the necessity for duplicating the storage activity and allow the equipment to be cut in half and the total capital and operating expenditures to be reduced considerably.

It should be recognized that these questions had not been studied in adequate depth during the preliminary coordination among the interested organizations and agencies, so USSR Minugleprom considers it necessary to return anew to a more detailed examination of them with a view to producing optimal solutions, especially for subsequent KATEK facilities.

The Design of Coal Storages and Schemes for Mechanizing Them

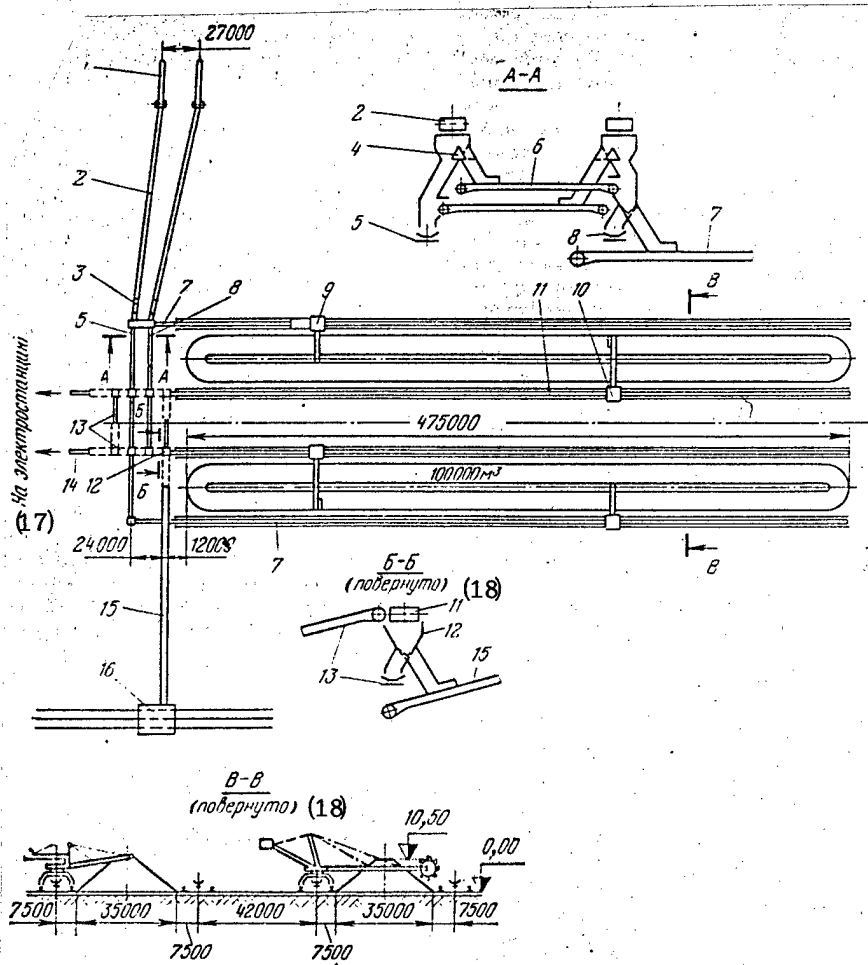
The Kansk-Achinsk Coal Basin's brown coal is marked by high volatility in regard to oxidation and spontaneous combustion. Having a high operating moisture content (up to 38 percent), these coals tend to freeze at low air temperatures. During storage they disintegrate, forming a large number of small fractions, which are especially susceptible to oxidation. From the point of view of reducing the hazard of spontaneous combustion and the freezing of these coals, and also with a view to protecting the environment, it would be more desirable, it would seem, to store them in covered warehouses. However, taking into account the enormous amount of Kansk-Achinsk coal that is mined and the fact that storing the coal in enclosed warehouses would require large capital investment for their erection (the specific capital for closed silo-type storage is about 100 rubles per 1 million m³ of capacity). Moreover, as experience in the operation of thermal power stations indicates, the coal dust of brown coals possesses high explosibility.

From the economic point of view, and also taking account of the peculiarities of Kansk-Achinsk coal, storage for KATEK facilities should be open piles of coal (figure 6). Coal is delivered from the strip mines to storage by belt conveyors and

Figure 6. Coal Storage Supplied with "Takraf" Association (GDR) Equipment.

Key:

1. Trunk-line belt conveyor, $Q = 5,000$ tons/hr.
2. Inclined belt conveyor, $Q = 5,000$ tons/hr.
3. Conveyor scales.
4. Device for regulating intensity of streams.
5. Belt conveyor, $Q = 6,600$ tons/hr.
6. Loading belt conveyor, $Q = 6,600$ tons/hr.
7. Distributing belt conveyor ($Q = 6,600$ tons/hr).
8. Belt conveyor, $Q = 4,000$ tons/hr.
9. Pile layer.
10. Rotary loader.
11. Collecting belt conveyor, $Q = 4,000$ tons/hr.
12. Distributing hopper, two-position.
13. Belt conveyor, loading, $Q = 4,000$ tons/hr.
14. Belt trunk-line conveyor, $Q = 4,000$ tons/hr.
15. Inclined belt conveyor, $Q = 4,000$ tons/hr.
16. Loading point.



17. To the electric-power station.
18. Rotated.

pile-formers with a productivity of up to 6,000 tons/hr. The coal from the buffer storage piles is loaded onto belt conveyors by rotary loaders with a productivity of 4,000 tons per hour.

When the quality of stored coal must be blended, the coal should be placed in piles in layers and loading performed by special blending machines. UkrNIIproyekt has developed engineering tasks for producing blending and reloading equipment for coal in series. The question of manufacturing this equipment must be resolved.

The Institute of Fuel Minerals must update research associated with the development of recommendations for preserving coal in open storage.

Ways to Raise the Efficiency of Operational Solutions at Future Strip Mines

The main coal reserves of the Kansk-Achinsk Coal Basin are confined to gently sloping (3-5 degree) seams of 40-60 meter thickness. As mining proceeds along the dip of the seam, the overall thickness of the overburden rock being worked and the

width of the strip mine's operating zone will constantly increase. The proportion of the lower stripping benches that can be worked with the transporting and piling system (where they are 40-50 meters thick) will be reduced from 100 percent in the first 8-10 years of operation to 15-25 percent at the time of cleanup of the strip mine's "take."

In order to create adequate coal reserves for winter with operation of the transporting and piling system and, given the existing parameters of the heaping machines, the length of the strip-mine coal trench (at a strip mine of 55-60 million tons' productivity) is 9-10 km. In this case, the total length of the conveyor lines for each of the later advancing stripping benches will be 20-25 km. The intensity of working the "take" and of restoration of the stripping, mining and heaping slopes will be low, since the annual advance of the work front is only 80-100 meters. With full conveyorization of overburden-rock transporting, the work front and the total length of the conveyor lines can be reduced 2-fold to 3-fold, and the coal reserves needed for winter will have been readied, thanks to the anticipatory stripping work performed.

Use of the transport system also creates favorable conditions for the execution of an effective operating maneuver when the mine face encounters hard inclusions. Therefore, when selecting an excavating system, it must be based not just on providing temporary advances (during the first 5-10 years of strip-mine operation) for the transporting and heaping systems, but also on an evaluation of the overall effectiveness of working the "take."

From these standpoints, the adoption of the transporting and heaping system for the first phase of Berezhovskiy Strip Mine No 1 is more likely an exception, one occasioned by the relatively slow increase in the overburden rock's thickness (it does not exceed 30 meters) in this portion of the "take" in the first 15 years of operation. In connection with what has been said, the creation of highly productive and reliable continuous-action machinery complexes for the excavation's transport system must be speeded up.

In order to increase the proportion of the transporting and heaping systems in the overall stripping-operations volume, equipment complexes that will enable overburden rock 60-80 meters thick to be worked must be used. In this case the advance benches will be cut only during the 20-25th year of strip-mine operation, and the increase in costs for developing them (because of the increase in length of the front) in the overall expenditure of the strip mine will be felt in lesser degree. In this case, it is desirable to specify that the machinery complexes being created have a potential for further development, taking into consideration growth in overburden rock thickness as working of the section proceeds. Such complexes (the transporting and heaping bridge with chain excavators on rail undercarriage) are excavating overburden rock up to 60 meters thick in the GDR. An undesirable factor from the point of view of climatic and soil conditions of the KATEK fields is the necessity for maintenance and a large amount of shifting of railroad tracks. Machinery complexes must be created that do not require a rail foundation and will enable block working of the overburden rock. These questions should be solved by USSR Minugleprom institutes, jointly with appropriate USSR Mintyazhmash organizations.

Under the traditional schemes for stripping and working the "take" along the seam's dip, the use of transporter systems, especially where an optimal (reduced)

length of work front is adopted, will lead to an intensification of mining and to an increase in the current stripping coefficients that are more rapid than under other systems. The later introduction of adjacent sections, that is, the working of the "take" simultaneously by several narrow strips along the dip, will enable prevention of an increase of the strip mine's average current stripping coefficients but will lead to complexities that are associated with the simultaneous working of adjacent "takes" (the leaving of border coal pillars, complications in shifting overburden rock in space that has been excavated, larger amounts of overburden rock reexcavated at the borders, and so on).

A scheme worked out by UkrNIIproyekt for the combined working of a "take" is a successful solution to the problem of searching for methods for making effective use of transport systems under the conditions being examined. Under this scheme, mining work is performed in two directions: a narrow (1.5-2.5 km wide) strip along the dip, with flanking placement of an exit trench, which prepares an open side for the later introduction into operation of strips 1-1.5 km wide along the strike.

The scheme has the following merits: a substantial reduction of the overall length of the stripping conveyors and the average distance for transporting all the stripped rock to the heaps (1.5-2 km); a reduction of the amounts of mine development work and simplification of the preparation for new sections (or strips); an increase in the concentration and intensity of mine operations; enablement of the complete independence of stripping and mining operations and the possibility of creating large stripped coal reserves, using highly productive heaping equipment of relatively small working dimensions; an enablement of precise organization of and reduction of the time spent in shifting conveyor lines (work front advance is on the order of 350-400 meters per year); and a reduction in the frequency of shifting the conveyor lines with the use of mine-face reloaders.

In order to raise the reliability and effectiveness of technological schemes with the combined procedure for working "takes," it is desirable to create lighter two-support bridge-type conveyor loaders with a loading height on the order of 30-35 meters and a productivity of 5,250-12,500 m³/hr.

The combined procedure for excavation merits serious attention and detailed scientific and design study. In particular, such a variant operation of the technological scheme must be examined in detail in the preliminary design for the second phase of Berezovskiy Strip Mine No 1, taking into consideration especially the necessity to speed up its construction and introduction into operation.

One of the important prerequisites for increasing the reliability and effectiveness of strip-mining work is elimination of the need to place the machinery on the soil of the seam, since the presence of internal heaps of great height on an inclined foundation can lead both to the pollution of the work area and to complication in shifting the conveyor lines, and to the occurrence of collapses of the heaped rock and to selective underflooding during torrential rains. This will be especially telling for transporting and heaping systems, given the restricted sizes of the lower working area. The laying of a conveyor line along the hanging wall of the lower bench and the transfer of coal to this horizon by interbench reloader or rotary excavator with top loading, can be a partial solution of this problem. For full solution, excavators with bottom digging, particularly chain excavators, must be used. An amalgamation of excavating and transporting equipment at one operating site would help also to raise the overall reliability of the technological schemes.

It should be noted that, by virtue of the limited nature of the production capacity of machinebuilding plants and also the still existing unjustifiably skeptical attitude toward these machines, discussions still go on in regard to the question of using chain excavators, although the engineering tasks for their manufacture were worked out long ago. The creation and introduction of highly effective chain excavators will help in performing successfully the required amounts of mine development work.

With the creation of new equipment for future strip mines, a choice of optimal relationships in the height of the benches and the productivity of the excavating machines must be insured. Actually, given the prescribed productivity and reduced height of the bench, it is easier to create rotary excavators of more rigid design and with less specific metal intensiveness (per 1 m³ of productivity). However, when such machines work overburden rock of great thickness, the number of transport horizons is increased and the overall economy of the excavating system being applied is reduced considerably. The operation of rotary excavators with transfers (along interbench crossovers) is complicated organizationally, and, as a rule, requires the use of specialized interbench reloaders, which also reduce the economy of the given technology. In this regard, full-rotation chain excavators, the use of which enables the working of a bench 50-60 meters high (with top and bottom excavation) at one transporter horizon, which is especially important where there are transporter systems, distinguish themselves to advantage.

The specifics of production ties of future strip mines with the consumers requires a detailed and, in most cases, individual evaluation of the degree of permissible and rational unevenness of mining operations. The answer to this question, as analysis of the design of the final phase of Berezovskiy Strip Mine No 1 indicated, can be given only with an integrated approach to determination of the number, standard sizes and magnitudes of the productivity reserves of mining machines, their operating regime, length of operating front and the number of mining benches, the schemes for and organization of stripping work, type and location of the customers and the terms for and degree of unevenness of their receipt of coal, the opportunity, necessity and rational placement for the creation of buffer coal storages, their types, cost of erection and servicing, and so on. Thus, this is a rather complicated problem, and there is still no methodology for a general solution to it in the works of the industry's institutes. Work done by UkrNIIproyekt should be viewed only as the first steps in this direction. In order to master all aspects of this problem, it is necessary to unite the forces of scientific institutes (UkrNIIproyekt, TsNIEIugol' [Central Scientific-Research Institute for the Economics of and Scientific and Technical Information for the Coal Industry], VNIIUugol' [not further identified], VNIIOSugol' [not further identified], and IGI [Institute for Mineral Fuels], design institutes (Sibgiproshakht [Siberian State Institute for the Design of Mines] and Vostsibgiproshakht [East Siberian State Institute for the Design of Mines]) of USSR Minugleprom, and appropriate institutes of USSR Minenergo [Ministry of Power and Electrification] and USSR MPS. Only in this case can a more integrated solution of the question be found that is more effective from the national-economy point of view.

Conclusions

1. The basis of future development of KATEK's fuel section is the wide use of flowline technology for stripping and mining work, based upon the use of high capacity continuous-action machines. The difficulties associated with climatic and

mine-engineering conditions for excavation are of an objective nature, and all the measures necessary for overcoming them should be adopted. Primarily, questions of the preliminary detection of hard inclusions and the preparation thereof for excavation and transporting by continuous-action machines should be resolved, as well as questions of dealing with sticking rock. USSR Minugleprom institutes, with the help of USSR Academy of Sciences institutes, must expand deep theoretical and experimental research on these questions and obtain their final solution.

2. The decisive factors in successful operation of KATEK strip mines are the creation and timely delivery by USSR Mintyazhmash enterprises of highly productive and reliable complexes of continuous-action machines that have been designed to take into account the specifics of operating under the severe conditions of the Kansk-Achinsk Coal Basin. In so doing, it is necessary to push the development and creation of rotary complexes with a productivity of 12,500 m³/hr, and also of chain machines, primarily for mining work.

3. USSR Mintyazhmash and USSR Gosplan must solve as quickly as possible the question of manufacturing auxiliary equipment, without which the reliable and productive work of large machinery complexes is impossible.

4. It is necessary to insure the adequate financing and development of construction work for the timely introduction of a repair base into operation.

5. USSR Minugleprom scientific-research and design institutes should consider the deficiencies of the first designs and provide for a deeper and more integrated justification for an optimization of the parameters of the technological schemes for excavating at strip mines, and an evaluation of their reliability, unevenness in the delivery of coal, the necessary productivity reserves of machines, and requirements for the creation of buffer storages in the strip mine-customer system.

6. The parameters and utilization effectiveness of schemes for the full conveyerization of transporting stripped rock must be analyzed more deeply, and, in particular, the technology of a combined procedure for working the "take," relative to the second phase of Berezovskiy Strip Mine No 1, must be worked out in detail. It is time to promote exploratory studies on the creation of transporting and heaping complexes of machines for the working of overburden rock that is 60-80 meters thick.

7. The question about the necessity for creating buffer coal storages within the strip mine-customer system and the capacity of such storages should be solved on the basis of integrated studies by USSR Minugleprom, USSR Minenergo and USSR MPS institutes. The conduct of this research must be organized in the near future.

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FUELS

CONFERENCE NAMES STEPS TO INCREASE COAL-INDUSTRY LABOR PRODUCTIVITY

Moscow UGOL' in Russian No 7, Jul 82 pp 13-16

[Article: "Raising Labor Productivity Is a Most Important task of the Industry's Workers"]

[Text] "Provide for an increase in the amount of mining and processing of coal basically through a rise in labor productivity."
(From the Basic Directions for Economic and Social Development of the USSR During 1981-1985 and During the Period up to 1990)

In April 1982 the All-Union Practical-Science Conference on Growth of Labor Productivity in the Coal Industry in Light of 26th CPSU Congress Decisions was held at Donetsk.

Taking part in the conference's work were supervisory workers of USSR Minugleprom and UkSSR Minugleprom, party and trade-union workers, supervisors of production associations, underground mines, strip mines, coal machinebuilding plants, preparation plants, advanced production workers, and staff workers of scientific-research, design, and design-development organizations of the industry and of training institutes.

Reports were rendered by USSR Minister of Coal Industry B. F. Bratchenko, UkSSR Minister of Coal Industry N. K. Grin'ko, chairman of the Central Committee of the Trade Union of Coal Industry Workers, M. A. Srebnyy, First Deputy USSR Ministers of Coal Industry V. V. Belyy, V. D. Nikitin and M. I. Shchadov, Deputy USSR Ministers of Coal Industry V. P. Gerasimov, F. F. Kuzyukov and G. I. Nuzhdikhin, Academician V. V. Rzhevskiy and corresponding member of the AN SSSR [USSR Academy of Sciences] A. V. Dokukin.

The conference's seven sections discussed the tasks of raising labor productivity at underground and strip mines and questions of savings, the organization and planning of production, improvement in the quality and a reduction in the labor intensiveness of the repair of mining machinery and equipment, increased labor productivity at preparation plants, and improvement of quality and a rise in the technical level of the equipment produced at coal machinebuilding plants.

The reports and addresses noted that 26th CPSU Congress decisions assigned coal-industry workers important tasks--to increase the amount of coal mined in 1985 to 770-800 million tons, and to insure growth in mining basically by raising labor productivity.

In light of the indicated tasks, special decrees by the CPSU Central Committee and USSR Council of Ministers, "On Measures for Accelerating the Reequipping of USSR Ministry of Coal Industry Underground Mines," "On Additional Measures for Speeding up Development of Coal Mining by the Surface Method in 1981-1990," and "On Raising Wages and Salary Rates and Improving Organization of the Wages of Blue-Collar and White-Collar Workers of the Coal (and Shale) Industry and of Mine Construction," have special significance. The decrees contemplated a set of effective measures aimed at improving the operation of the coal industry and at further increasing the mining of coal and increasing production effectiveness.

During the 10th Five-Year Plan coal mining increased throughout USSR Minugleprom by 242 million tons over the 9th Five-Year Plan, and 13.3 million tons of coal were mined above the annual plans. In 1980, 709.3 million tons of coal were mined, 14.7 million tons more than in 1975. The preparation plants processed 1.4 billion tons of coal, 127 million tons more than during the 9th Five-Year Plan. During the five-year period capacity for mining 89 million tons of coal and for preparing 29.2 million tons were put into operation.

Reequipping of the industry continued: the level of coal mining by longwall mining machines rose from 52.5 percent in 1975 to 67.4 percent in 1980, and the conduct of preparatory excavations by tunneling cutter-loaders rose from 30.2 to 38.1 percent; at strip coal mines the share of coal mining with the use of rotary excavators reached 42 percent, versus 31.9 percent in 1975.

The area of use of progressive methods for stripping and the preparation of underground and strip mine "takes" and of rational systems for excavating was expanded. Progressive methods for preparing coal were introduced, the level of which was 89.6 percent in 1980, versus 86.3 percent in 1975.

OF's [preparation plants] in 1980 produced 20.7 million tons of products that had been awarded the Emblem of Quality, versus 4.1 million tons in 1975.

Coal machinebuilding plants greatly increased the output of the main underground mining equipment: longwall mining machines 1.5-fold and tunneling cutter-loaders 1.2-fold. The serial production of more than 100 new machines and sets of equipment for underground and surface mining methods was mastered.

The industry developed and introduced measures for improving the economic mechanism, production planning and management, organization, the setting of norms and pay. Advanced experience was disseminated systematically. Standard-practice and instructional documents on the improvement of planning, cost accounting and economic incentives were worked out and refined at all levels of management of the industry's management. Measures were executed for raising and improving the pay of workers of the coal (and shale) industry and of underground-mine construction, introducing progressive norms and standards, and expanding the use of the brigade form of organization and wages, especially for work being done under the time payment system. The transfer of the industry's workers to the new terms for pay in the country's main coal basins was completed.

At the same time, there were deficiencies in coal industry work during the 10th Five-Year Plan. Coal mining throughout USSR Minugleprom increased by only 2.1 percent. The average monthly labor productivity per worker engaged in mining fell

during the 10th Five-Year Plan from 73.7 to 69.1 tons per month, and in 1981 to 67 tons per month, or by 9.1 percent. At underground mines, labor productivity was reduced from 53.8 tons per month in 1975 to 44 tons per month in 1981, or by 18 percent. The labor intensiveness of underground coal mining increased for all production processes. For development work, despite an increase in the number of high-speed brigades, the average pace for tunneling did not increase and labor productivity fell.

One of the factors that restrains labor productivity growth is a worsening of conditions in underground mines because of the lack of preparation of new horizons. The dispersion of mining operations and the length of support tunneling per 1,000 tons of mining was increased.

At strip mines labor productivity per worked engaged in coal mining rose from 425.7 tons per month in 1975 to 441.3 tons per month in 1981. At the same time, there are reserves here for improving this indicator, mainly by raising the utilization coefficient of mining and transporting equipment.

There are also substantial unused reserves for raising labor productivity at other enterprises of the industry--preparation plants and other plants, and also in capital construction.

One of the important tasks set by the 26th CPSU Congress was a steady reduction in all branches of the number of workers engaged in manual labor. About half of all workers in the coal industry are still engaged in unmechanized operations--in the reinforcement of tunnels and the repair thereof, the delivery of materials and equipment, the repair and servicing of track, auxiliary work, and loading and unloading.

Scientists and engineers should make substantial contributions toward solving the problems of raising labor productivity. Within the industry, 37 scientific-research and design-development institutes, the experimental base of which is represented by 29 test plants and other subunits, are operating. However, the creation and introduction of integrated mechanized equipment for the mining of coal from thin and steep seams, cutter-loaders for tunneling through hard rock, and means for the mechanization and automation of auxiliary processes are being accomplished slowly. Matters must be so arranged that all the achievements of practical science will find daily use in the shortest possible time so that effective scientific and engineering solutions may cope successfully with the influence of mine-geology factors.

The All-Union Branch Practical-Science Conference noted that the main tasks for coal industry workers during the 11th Five-Year Plan are, besides increasing coal mining, to raise labor productivity at each work place and section and each enterprise, organization and association. This will be a pledge of successful development of the industry.

The All-Union Branch Practical-Science Conference adopted a number of recommendations for insuring a rise in labor productivity in the coal industry during the 11th Five-Year Plan.

In the Area of Mechanization and Improvement of Underground Coal-Mining Technology

On the basis of the improvement of technology and the use of new, highly productive equipment, provide for:

For Breakage-Face Operations:

a rise in the level of concentration of mining work by increasing the rate of advance and the length of mine faces, a reduction in the time spent working on and in the length of mine-support excavation, and growth in the workload per breakage face, seam, wing and underground mine;

an accelerated conversion to progressive operating schemes. Increase to 80 percent the share of progressive systems for developing coal fields by 1985;

the development of mining operations in accordance with master schemes for cutting underground mine "takes" during the period up to 1990, after paying special attention to a reduction in stages for the transporting of coal and auxiliary materials and to improvement in the ventilation of mine workings;

a rise of up to 75 percent in the level of integrated mechanization, mainly by introducing complexes where mine-geology conditions are complicated;

the supplying of up to 70 percent of the total number of breakage faces with longwall mining machines of a high engineering level;

an improvement in the use of longwall mining machines, thanks primarily to the precise execution of mine-face operating regimes, improvement of the organization of work and of production, and improvement of the time spent on assembly, disassembly, repair and renovation work at existing longwalls;

the conversion to mine-face operations with integrated mechanization and conjugate supports;

the introduction by 1985 of the method of strengthening unstable rock with chemical cementing compounds and anchors with chemical fixation at no fewer than 300 breakage faces; and

the accelerated creation and serial production of means for the remote and automated control of breakage-face longwall mining machines, primarily for thin and steep seams;

For Development Operations:

a rise in the pace of mine tunneling, thanks mainly to the use of highly productive heavy-type tunneling machines, the mastery of cutter-loaders for tunneling an area with a cross-section of up to 35 m² through rock with a hardness factor of $f = 6-9$, including rocks at seams with an explosion hazard, the integrated use of the main tunneling equipment in combination with support layers, telescoping conveyors, and monorail ways and surface roads;

An increase by 1985 to 43 percent in the level of mine tunneling performed by tunneling cutter-loaders and a reduction in manual labor expenditure; and

a rise in the stability of mine tunneling by the chemical consolidation of rock, the wide use of screw anchors, also with chemical reinforcement, and the use of progressive designs of yielding metal supports with bolt-free angles.

For Underground Transport

a rise of up to 30 percent in the level of conveyorization for the transporting of coal along horizontal drifts and of up to 70 percent along sectional mine workings;

a further improvement in the mechanization of loading, unloading and transport operations for hauling auxiliary loads in packaging and containers; and

an expansion in the use of electric locomotives with a drawbar weight of 14-28 tons and of small cars with bottom unloading, and the introduction of track-repair trains, track-cleaning machinery and other means of mechanization;

For the Surface Activities of Underground Mines

simplification of the operating schemes for transporting coal and rock;

completion by 1985 of the organization of a grid of large central flat rock dumps; and

improvement of underground mine storage by means of integrated mechanization and automation of the means for transshipping freight in packages and containers.

In the Area of Surface Coal Mining

Raise the technical level and concentration of production at strip mines, expand the use of continuous-action machinery, bring the share of coal mining by rotary excavators up to 47 percent in 1985, develop a transport-free and a transport-and-heaping system of excavation;

increase the capacity of enterprises for mining and preparing coal by the construction, rebuilding and reequipping of strip mines and preparation plants;

introduce into operation capacity for mining 68.6 million tons of coal at strip mines during 1981-1985, and begin the construction and rebuilding of strip mines with a total capacity of 61 million tons of coal per year;

introduce new high-capacity mining and transporting equipment and increase its productivity by improving the organization of production and work; and

speed up the series production of means for mechanizing labor-intensive auxiliary operations, improve the supplying of technical equipment to repair bases, and reduce the proportion of use of manual labor.

In the Area of Savings and the Organization and Planning of Production

In all subbranches of the industry that are under USSR Minugleprom, intensify the work to search for and realize reserves for labor productivity growth, aim economic work at raising the degree to which production is equipped with machinery, make

better use of material and labor resources, and intensify research and development on measures for raising labor productivity, for which purpose:

continue work to improve the economic mechanism in the industry, further improve planning in the area of intensifying the role of 5-year plans, and raise the level of substantiation and achievement of a full balancing and mutual coordination of long-range and current plans, make wide use of the specific-program method of planning, of introduction of a system of scientifically substantiated norms and standards, and of expansion of the use of electronic computer equipment;

intensify the work by each enterprise, organization, and association (or combine) to implement the measures of an integrated program for cutting the use of manual labor and reducing the proportion of workers who work manually and plan tasks for reducing the use of manual and of heavy manual labor during the 11th Five-Year Plan;

intensify economic incentives for production and improve the system for planning, financing and incentives for purposes of creating, mastering the production of and introducing new machinery. Take measures to speed up implementation of a complex of measures for improving the economic mechanism, taking into account the work experience of the coal industry and other branches of the national economy;

improve the management of the industry, and raise the role and responsibility of workers of associations and underground and strip mines for the quality of the engineering solutions adopted, the substantiation of plans that are established, and the observance of plan discipline at all management levels;

concentrate attention on the introduction of standard designs for the scientific organization of work at workplaces, sections and departments and of integrated plans for NOT [scientific organization of work] for the enterprise as a whole;

provide support for the systematic introduction of collective forms for organization and wages and, by the end of the 11th Five-Year Plan, cover the overwhelming number of workers with them;

improve the organization of socialist competition and of methods for evaluating the labor contribution of competitors, and use more fully the opportunities of competition and dissemination of advanced experience for supporting a higher level of labor productivity;

raise the role of norm-setting in support of the fulfillment of plan tasks for labor productivity growth, increase the number of worker trades for which norm-setting tasks are established, use more widely progressive forms for setting norms that are based upon the use of collective aggregate norms and provide for the introduction of technically substantiated norms for tunneling and of standards for worker manning by the deadlines set by USSR Minugleprom;

provide for the substantiated use of forms and systems of wages, the introduction of progressive systems for awarding bonuses, the more effective use of the right of enterprises in the area of establishing markups for wage rates and salaries for highly skilled workers for vocational mastery and for high qualifications of engineers, technicians and white-collar workers, stimulation of an acceleration in labor productivity growth, and an increase in the output of products with the fewest workers; and

intensify monitoring over the expenditure of monetary resources for wages, and expand research in the area of setting norms for work and wages.

In the Area of Technical Servicing and Repair of Equipment

Improve the use of machinery by improving technical servicing and repair, raising its reliability, and observing the standards for using the equipment, for which purpose:

continue work on further improving the performance and centralization of repair operations, and the specialization of repair enterprises, on raising the quality and reliability of equipment that has been repaired, and on introducing progressive technology for the restoration of worn parts and the repair of machinery. Complete in 1983 the creation of departments (or sections) for the restoration of worn parts;

speed up the creation within the industry of an enterprise that will manufacture technological and nonstandard equipment for the purpose of establishing a centralized supply to the industry of flowlines and of lines with integrated mechanization, and departments and sections that will make overhauls;

develop integrated programs for the further mechanization of mechanical-assembly, welding, casting and forging production and of loading and unloading operations, and reduce manual labor in repair work;

proceed to execute a whole complex of operations for the assembly, disassembly, repair and tune-up of equipment by the forces of specialized underground-mine erection administrations, continue to study questions of the effectiveness of strengthening mechanized supports and other equipment at the SShMU [specialized underground erection administration] and of operating its underground mines under rental terms, expand the specialization and centralization of work on technical servicing and current repair of equipment by the forces of factory technical-servicing subunits of coal machinebuilding plants, specialized setting-up and underground erection administrations of production associations, and repair and setting-up brigades of enterprises; and

improve organization of the technical servicing of equipment, extend practical assistance in the functioning of the PPR [planned preventive maintenance] system, introduce by the end of 1985 a specific-purpose integrated Zapchastugol' [not further identified] system for the supply and use of spare parts, and arrange for the serial output of an adequate amount of diagnostic equipment and special tools.

In the Area of Coal Preparation

In order to obtain the maximum increase in coal-preparation volume, it is necessary:

to assimilate the design capacity of plants put into operation in recent years;

to reduce systematically the labor intensiveness of operations at preparation plants, based upon the fulfillment of integrated plans to mechanize auxiliary operations and to eliminate heavy manual labor;

to organize at VPO Soyuzugleavtomatika [All-Union Production Association for Automation of the Coal Industry] plants the production of means for automation and instruments for monitoring coal quality for OF's [preparation plants];

to organize in the Donets, Kuznetsk and Karaganda Coal Basins, in the setting-up administrations of VPO Soyuzugleavtomatika, sections for the tie-in, erection, setting-up and servicing of equipment for automating OF's;

to improve the organization of work and production, to strengthen technological and labor discipline, to improve personnel training, and to raise the quality of the work of operating personnel, using moral and material incentives. Develop socialist competition and disseminate advanced experience widely.

In the Area of Improving Organization of the Construction and Rebuilding of Coal-Industry Enterprises

In order to provide for the timely mastery of the work volume for the construction and rebuilding of facilities for mining and preparing coal and of coal machinebuilding enterprises, and for the timely introduction of facilities due for early startup, together with housing and facilities for social and cultural purposes, it is necessary:

to improve, during the design process, engineering solutions that are aimed at reducing labor intensiveness sharply and at raising the level of industrialization of the work of building facilities at the surface of the underground coal mine and other operating enterprises of the industry;

to use more widely the modular method for assembling equipment, to bring the level of fully prefabricated construction in 1985 up to the 30-percent level, to use more widely tunneling complexes for penetrating shafts and to bring the proportion of high-speed mine excavation up to 25 percent of the total amount;

to raise the mechanization level of operations and to provide for a reduction in 1985 of the amounts of work done manually by improving the use of machinery, providing underground-mine construction organizations with small-scale mechanization equipment and power tools (up to 50 units per 100 workers) and expanding deliveries of containerized and packaged freight, and so on; and

to improve the economic mechanism in underground-mine construction, to use the contract method for construction more widely, and to improve the material incentive system for reducing standard construction time.

In the Area of Coal Machinebuilding

Expand the output of new types of underground-mine equipment, satisfy more completely the requirements of enterprises that mine and process coal and of construction organizations for progressive, highly productive machinery, for which purpose:

raise the technical level of production by introducing automatic lines and lines with integrated mechanization, with the use of numerically controlled machine tools, robots, and special and ganged equipment, the introduction of integrated mechanization of castings production, an increase in the output of blanks and

parts by the methods of precision closed-impression die forging and of casting under pressure, and the introduction of small-scale mechanization during assembling, loading, unloading and storage operations; take the necessary measures to provide plants with high-quality, uniform rolled metal; and intensify claims work at plants in regard to the acceptance of metal;

raise the degree of unification of parts of the machines produced and provide for continuity of design;

raise systematically the work effectiveness of the technological services of plants and institutes;

improve output quality and bring the proportion of products in the highest quality category up to 30 percent, insure the mastery of new, highly productive machinery, the improvement of industrial processes for the production thereof, and the introduction of an integrated system for controlling product quality at all plants, and, as a result, reduce labor expenditures and the accident rate substantially during the operating process; and

improve the economic mechanism in coal machinebuilding, and provide incentives for the development and output of new, highly productive machinery and for an improvement in its quality and in the labor productivity of machinebuilding plant workers.

The conference recommended that a strengthening of ideological work, active participation of workers in improving production work and a raising of their skill levels and their economic and technical knowledge, be considered the most important factors for labor productivity growth in the industry.

Successful solution of the tasks that have been set will promote the advancing development of the coal industry and achievement of the labor productivity growth tasks that are contemplated.

From the Editorial Board

In considering the importance of raising labor productivity in order to increase the effectiveness of the industry's work, the journal's editorial board proposes to publicize systematically various aspects of this problem and to make room for information about ways to solve it and about advanced experience gained in this area.

The editorial board invites specialists of coal-industry enterprises and organizations, as well as brigade leaders and workers and all production innovators, to take an active part in the discussion of this urgent problem.

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PIPELINES

PIPELAYING UNDERWAY ON BED OF KAMA RIVER

Moscow PRAVDA in Russian 1 Sep 82 p 1

/Article by A. Avdeyev, Sarapul, Udmurtskaya ASSR: "On the Bed of the Kama"

/Text Yesterday pipelaying work got underway on the bed of the Kama River on the Urengoy-Pomary-Uzhgorod export pipeline.

For the construction workers who are building the gas mainline from Urengoy to Uzhgorod nature has not spared any difficulties. The builders face the mud of the Tyumen' swamps, the Ural mountainous slopes, and endless rivers. There are 561 water barriers shown on the map of the area. The crossings over the most difficult of these barriers have been assigned to especially highly trained specialists.

Often these specialists are called "under water workers". And this is true: they build under water and the All-Union Association is called the Soyuzpodvodtruboprovodstroy /All-Union Underwater Pipeline Construction Association. The Nadym, Ob', Kama, Volga, Don and Dnestr -- 40 kilometers of large diameter pipe must be laid on the beds of these large rivers.

The deputy chief of this association, V. Mal'tsev, reports, "to do this it is necessary to remove from beneath the water some nine million cubic meters of earth. For example, in crossing the Volga River the depth of the trench will reach 16 meters."

We spoke with Vladimir Sergeyevich Mal'tsev on the shore of the Kama River, not far from the city of Sarapul, where the sector of the specialized administration of the underwater technical work is located. The mobile housing facilities have been made into a settlement with all conveniences and recreation facilities. The construction workers have not come here for just one or two months. During the current five-year plan they must lay six kilometer-long pipeline sections on the bed of the Kama River. Two of these sections are for the transcontinental Urengoy to Western Europe pipeline. Why are there two sections? The answer is for reliability.

The underwater construction workers assert that each water crossing is unlike any other. There are no identical rivers and working conditions always vary. But it is precisely this lack of sameness in tasks that makes the specialists what they are. A lot of experience and good equipment make it possible for them to pick up the pace of pipelaying from year to year. This same Mal'tsev, who in his time has worked on the mainline connecting the oil fields of Sakhalin with the continent, says, "we now have at our disposal the most powerful explosive charges, the 'Yamal' and the 'Samotlor', which have a yield of thousands of cubic meters of earth per hour. The 'Podvodnik-1' explosive charge is capable of making a trench in even a rocky bottom."

The "Podvodnik" crew prepared to move their operations base to the Belaya River as soon as they completed the Kama section. The crew chief of this organization, S. Baryshev, and his crew participated in the work on several river crossings for oil and gas pipelines. And in almost all cases the report on work completion began with the words "ahead of schedule".

While laying the trench on the Kama River bed, preparatory work on the shore is coming to an end. Here we find I. Usenko's brigade welding pipes in two-meter sections, insulating them and setting the footings - in other words they are using the wooden measuring rods to ensure that the insulation is not damaged by the iron weights. The weights are necessary - they prevent the pipe from floating when it is filled with gas.

During and following work on the trench, the work quality is checked by V. Serbin, the senior man here and a diver first class, and his assistants at the station.

Preparations for starting work are coming to an end. They carry the cable across the Kama by hand. Isn't this a lot and aren't the construction workers "playing it safe"? Here are three figures for you to consider: a section of pipe weighs 400 tons and there are three such sections for a total weight of more than 1,200 tons! No, if you please, the cable does not appear to be too thick. The first section starts slowly. It is almost impossible for the naked eye to detect its moving into the water. More than 24 hours will pass before the two shorelines of the river are joined together by the new gas mainline. But it is already known that the Kama River crossing will be completed six months ahead of schedule.

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PIPELAYING IN SARAPUL SECTOR

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 4 Sep 82 p. 1

/Article by A. Reshetov, UDMURTSKAYA PRAVDA correspondent, Sarapul:
"Urengoy - Uzhgorod: A Throw Across the Kama"/

/Text/ The two strands of the Urengoy to Uzhgorod export pipeline, the four Urengoy to the Center pipelines and another two reserve strands cross one of the largest water barriers - the Kama River. The construction workers on the Sarapul sector, who work for the sixth Leningrad Specialized Administration for Underwater-Technical Work, have achieved their first victory. They have completed laying of the first siphon of the pipeline on the bed of the Kama River. The 630-meter steel length of pipe, weighing more than 1,200 tons, was extended across the river in 20 work hours.

Leningrad specialists recently arrived at the picturesque shore of the river. They have settled into a village comprised of mobile housing units. As soon as the first 20 railroad carloads of the West German manufactured 1,220 mm pipe was delivered to Sarapul, local workers unloaded them within several hours and delivered them to the opposite shore to the welding stand.

Yuriy Babushko and Yuriy Kozlov went to work. Until late in the evening the vegetation along the shoreline was lit up by the sparks of the electrowelding equipment.

At the same time that the welding was being done on the sections of pipe, the "Kamskiy-212" and "Podvodnik-1" explosive charges were being used. They had started to lay the trench along the river bed.

It was especially difficult to deliver the "Podvodnik" that was to clear the way on the right shoreline in the rocky soil of the pre-Urals spurs.

An experimental insulating combine of Leningrad manufacture was delivered to the construction site - in one pass it cleans the pipes that have been welded into a length to a shine and wraps them with a very durable, wide insulating coating.

After testing the first 300-meter shoulder of the siphon, V. Yegorov, a machine operator and one of the most senior Soviet gas pipeline workers, puts the combine into operation after regulating it. The second shoulder of the siphon, after also being checked for a pressure of one hundred atmospheres, is insulated by Vladimir Dmitriyevich within half a day.

He commented, "it is an excellent piece of machinery. It has a high output and quality as well."

The securing of the insulating layer of the two-ton weighting rings, which protect the siphon insulation during the towing operation, proceeded just as rapidly. After all the siphon will have to remain on the river bed for many decades.

The pipeline builders had previously laid the "Northern Lights" gas pipeline over a distance of some 2,800 kilometers. They crossed rivers, lakes, canals and reservoirs. They had brought their ships to the Kama. They delivered the 150-ton winch, which was manufactured in Moscow, on schedule.

The crossing of the water barrier was set for Monday, 30 August. On the day before, they let out the cable in thickness by hand from the right shore, where the winch was secured, to the left shore; the cable was fastened at midpoint on a pontoon. Diver V. Serbin observed the underwater trench.

"Over a period of more than 10 years I have observed siphon crossings on the Sylva, Severnaya Dvina, Daugava, Oka, Vychegda, Vyma, and Sukhona rivers - I am not counting the small rivers," V. Serbin told me, apparently to explain why he was chosen for this job.

Vladimir Dmitriyevich Yegorov, the operator of the insulating combine, has even more experience. But now he is in another role. He and Nikolay Fedorovich Belusov have been tasked with controlling the winch, which will take the lion's share of the load.

It is 1000 hours local time. The chief engineer of the administration, Vitaliy Petrovich Sereda, who is on the left shore at the radio, where both shoulders of the siphon have been extended, gives out the command: "Commence extending the cable."

The shoulder of the siphon was seized by five pipeline layers and a bulldozer held on firmly to the end section. A rocket is launched. At once the engines of an entire column of machinery started up, which are capable of lifting and carrying 400 tons of load.

The chief engineer transmits the command to the winch operators to provide the load.

The pipeline layers, having slightly raised the steel pipe length, began to pull it into the river. When the siphon head was even with the beacon which shows the ships movement of the river, the pulling stopped, as called for in the schedule. And once again the ships moved on the river. The construction workers immediately began to secure the weighted rings.

On Tuesday it took only 30 minutes for the shoulder to be placed in the river. There were only a few meters remaining on the shore. And once again Babushko and Kozlov the welders were there. Fragments were strewn on both sides of the pipes. They welded the second shoulder of the siphon.

Babushko announced, "I will do the interior seam!" And bending down, he began to work on the pipe.

The dark fall night had already set in when an x-ray was taken of the welded splice. Dawn had scarcely arrived when the entire collective assembled. Some of the workers began to insulate the welded section while others began to prepare the equipment for pulling the siphon a bit further. Following the connection, the siphon now weighed more than 1,200 tons.

The pulling got underway. In only 12 minutes the siphon was in place. They made some adjustments and secured the equipment, but the section of the siphon that was in the river was covered in slime. The winch cable did not hold - and broke. Diver V. Serbin descended to the 12-meter point. The replacement of the cable was begun. Yesterday at 1000 hours, as planned, they again began to pull the siphon. They brought in auxiliary equipment. The total rated capacity of all engines exceeded 2,200 horse power. Within the first two and half hours the siphon was moved only four meters. At last it was completed. Within 20 hours the first and longest siphon of the export pipeline was in place. A "Kamskiy-513" explosive charge was brought to the area of the pipelaying operation. It began to clear a trench on the river bed for the second siphon of the export gas pipeline.

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GLAVSIBTRUBOPROVODSTROY CHIEF REPORT

Moscow TRUD in Russian 14 Aug 82 p 2

/Article by N. Kurbatov, chief of Glabsibtruboprovodstroy /Main Administration of the Siberian Pipeline Construction Trust, Tyumen':
"The Path of Courage: Urengoy-Uzhgorod Pipeline Builders Pick Up the Pace"/

/Text The pace of construction on the Western Siberia to the Center pipelines even astounds the specialists. In a little over a year a mainline will be completed which can provide customers with tens of billions of cubic meters of natural gas every year. But the requirements of the nation and the potential of the Tyumen' north's deposits are such that even this pace of construction is inadequate. In the 11th Five-Year Plan six powerful "blue fuel" arteries will be built.

We Siberians are laying the crucial sections of these mainlines: from Urengoy to the Urals - which in a construction sense are the most difficult and complicated. We stand at the source of the powerful river of gas and for this reason we must complete our section two to three months more quickly than the other subelements of the USSR Ministry of Construction of Petroleum and Gas Industry Enterprises that are engaged in the construction of the gas transport systems. This is necessary so that our neighbors be able to test their sections of the steel strand on a timely basis. The Siberians have always coped with this task. The Urengoy to Gryazovets and Urengoy to Petrovsk gas pipelines were built some three months ahead of schedule. And the Urengoy to Novopskov pipeline project is ahead of schedule.

These victories do not come easily and are the result of courageous, at times heroic work of many thousands of pipeline builders and our numerous subcontractors.

The main problem facing the builders of the Western Siberia gas pipeline today is overcoming the seasonality of the work, or at least minimizing the impact of weather. Due to the severe natural conditions such as permafrost, swamps and hundreds of rivers, the majority of the work in laying the mainlines must be done during the winter. The polar tundra only gives us six months for intensive construction work.

This summer we plan to build 150 kilometers of the linear portion of the gas pipelines from Urengoy to Novopskov and from Urengoy to Uzhgorod. This is two and a half times more than was done last summer. For this reason this year's navigation on the small rivers of the north was accomplished more efficiently. These rivers can carry cargoes for the construction of compressor stations and the pipelines only in the spring. On the Kazym River, the right tributary of the Ob' River, for example, was transported 30 kilometers of pipe and construction materials and equipment during this short period of time. These goods were delivered to the area of the future "Verkhnekazymskaya" compressor station. This was a lot of work.

This summer the main administration's subelements are working on a wide front to install and test crane assemblies on the Urengoy to Novopskov pipeline; the crane equipment for the Uzhgorod pipeline is being assembled at stationary bases.

Extending the amount of time available for work by even a week provides an enormous economic gain and is the key to speeding up the work. For this reason equipment is even now being prepared and ways are being devised for freezing the ice on the many river crossings of the north. Artificial ice bridges can support a load of up to 100 tons.

A target program for the more efficient use of equipment has been developed and is now being implemented. Two equally important work directions have been selected to accomplish this. First, the repair base is being reinforced. A new plant in Tyumen', for example, which will be put into operation, will not only restore ordinary series-produced equipment, but will also manufacture special machines and the means for small mechanization.

Everyone knows that in the extreme conditions of the north machines wear out faster than in the central region of the Soviet Union. Every year or two their productivity, and consequently, the salaries of the machine operators drop off substantially. He who operates new equipment has the advantage. Until this time the conditions of pay did not take this into consideration. Today within the main administration they have come up with a pay system for machine operators and repairmen which considers the service life of machines.

Pace and quality. As more and more pipelines are laid the requirements for quality of work become more rigid. Accidents on the gas pipelines are not tolerated. Every pipeline worker understands this. Dozens of leading brigades - those of B. Diduk, V. Volkov, N. Kotenev, V. Madenov, A. Perekhrest and V. Martynov - are working with their own personal mark of quality, if it can be expressed in this way; no waste occurs in their work.

Within the main administration a system has been devised and is now functioning for monitoring work quality - the system is all-embracing and strict. X-rays are used to monitor each welded seam. This is not required by state standard, but this is the path we are taking.

A target program for reliability (yes, again a target program, by which we work) also requires constant cooperation with our customers from the USSR Ministry of the Gas Industry. Along with the operators a group has been created to examine the designs. They also specify who is responsible for quality at all sections of work, according to a periodic check of the completed sections of the mainlines.

Much has been done but much remains to be done. Here are some figures. In the 11th Five-Year Plan we must lay more than 7,000 kilometers of various diameter mainlines, primarily 1,420 mm pipe. For comparison, in the 10th Five-Year Plan some 4,000 kilometers of pipelines were built. During the five-year plan some 28 compressor stations must be built. The total volume of work has grown to almost one billion rubles per year.

Today our main goal is to construct the Urengoy to Uzhgorod export pipeline in 1983 ahead of schedule. In our northern section it is this mainline that is the most complicated of the six we are to lay during the 11th Five-Year Plan. The gas pipeline passes through a new corridor, in which there are more natural barriers than we have ever encountered. It is enough to say that the construction workers must overcome more than 200 kilometers of tundra, nearly 150 kilometers of permafrost, more than 100 rivers and a multitude of swamps.

It is essential that before the upcoming winter we build the support bases and housing units with the full set of production and social and services facilities. Work is proceeding at full tilt.

Unfortunately, at present we have encountered several difficulties, which are slowing preparations for the building season. The suppliers are dragging their feet. Enterprises of the USSR Ministry of the Construction of Heavy Industry Enterprises must manufacture and ship to Glavsibtruboprovodstroy 97,000 reinforced concrete weighting compounds; but over the past six months we have received only 26,000 cubic meters. It is entirely likely that, if they make the effort, the suppliers will fulfill the shipping plan by the end of the year. But this will not help the main administration for if we do not receive the compounds before 1 October 1982, before the end of river navigation, we will not be able to transport them to the north.

More than 100,000 cubic meters of weights must be manufactured by the main administration using its own resources in its summer yards. In the third quarter on a target basis we were allocated 53,000 tons of cement. A month passed and we had received only 8,000 tons. And such cement plants as the Estonian plant Punane-Kunda, Sebyakovskiy, Bryanskiy and Magnitogorskiy combines have not shipped us a single ton.

The laying of gas transport systems from Siberia to the European section of the Soviet Union has been called the central construction project of the five-year plan. A coordinating council has been established under the All-Union Central Trade Union Council for socialist competition among contractors on the "workers' relay race" principle.

The machine builders, transport workers, and designers are participating in the competition. We call upon the working enterprises of the USSR Ministry of Construction of Heavy Industry Enterprises and the cement industry to participate in the competition for the ahead-of-schedule delivery of the construction materials that we need so badly today. In turn we promise to complete our sections of the Urengoy to Novopskov and Urengoy to Uzhgorod pipelines ahead of schedule.

The discriminating measures of the administration of the USA, which is headed by President Reagan, are intended to slow the construction of the gas mainlines and the compressor stations. But we the builders know that these measures are not a decisive factor for the time periods for completing the gas pipelines. All projects will be built within the established time period and ahead of schedule.

The pipeline brigades, the manufacturing flow-lines and all working main administrations are resolved to complete laying the norther section of the Urengoy to Uzhgorod gas pipeline ahead of schedule. And this will be done!

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JULY PIPELINE CONSTRUCTION REPORT

Moscow EKONOMICHESKAYA GAZETA in Russian No 33, Aug 82 p 3

/Article by E. Matveyev: "All-Union Competition: In the Rhythm of the Plan"/

/Text/ The builders of the Urengoy to Uzhgorod pipeline are successfully fulfilling the assignment.

The most important construction project of the five-year plan. According to the 11th Five-Year Plan several major mainline gas pipelines, which originate in the Urengoy gas fields, are to be put into operation. The Urengoy to Petrovsk section of the mainline was completed at the start of this year. The linear portion of the Urengoy to Novoskov gas pipeline was completed ahead of schedule. Work has commenced on the Urengoy to Uzhgorod export pipeline. In the Perm' section of the Urengoy to Uzhgorod pipeline the builders of the 2nd specialized installation administration of the Novosibirsktruboprovodstroy /Novosibirsk pipeline construction trust/ have pledged to complete pipelaying within their section, a distance of 75 kilometers, by 25 December 1982.

The export gas pipeline extends from Urengoy to Pomary to Uzhgorod. Not so long ago it was just a line drawn on a map showing the actual layout of this gigantic construction project. We will remind you of the basic dimensions of this pipeline mainline. Its length is nearly 4,500 kilometers; it crosses the territory of 24 autonomous republics and oblasts of the RSFSR and the Ukrainian SSR. The gas will be transmitted at a working pressure of 75 atmospheres through a 1,420 mm pipe. Some 41 compressor stations will be built along the mainline.

Work on the pipeline is getting underway under a great deal of pressure on the part of the construction organizations and machine building enterprises and the gas industry, which are participating in the construction of facilities for the new gas transport system. This enthusiasm is caused by the joint decree of the CPSU Central Committee and the USSR Council of Ministers, which approved the initiative of the leading collectives responsible for the timely completion of

the Urengoy to Uzhgorod mainline, in spite of the discriminating actions taken by the administration of the USA. Dozens of plants are manufacturing assemblies, shut-off fittings, monitoring and measuring devices, automated equipment and other equipment for the compressor stations. The delivery of assembled equipment for the compressor stations is to be completed no later than the second or third quarters of 1983. It is with this in mind that work on filling orders for the construction project has been thoroughly organized. The plan requires that the construction of the entire linear portion of the pipeline be completed by the end of the next year and that its first segment be handed over for operation by the same time. Construction workers of the USSR Ministry for the Construction of Oil and Gas Industry Enterprises, in solving this task, are making use of the experience that they gained in the high-speed construction of powerful pipeline arteries. They are also improving their methods for organizing work and they are making use of the latest, highly efficient engineering innovations. Local party organizations are organizing a socialist competition among the workers on the pipeline for the exemplary fulfillment of all assignments.

All of this is producing results. Significant changes have taken place on the construction project during July. Along the Urengoy to Uzhgorod pipeline, as stipulated in the draft plan for the organization of work, all 56 comprehensive technological flow-lines, engaged in the construction of the linear portion of the gas pipeline, are getting to work. They were transferred here from the Urengoy to Novopskov mainline, where they completed their work ahead of schedule. The collectives that were freed up moved to new locations to the sections that they were assigned. The vehicles, mechanisms and other construction equipment were also moved to the new site.

The collectives of 32 technological flow-lines had started on welding work by the first of August; eight flow-line operations are doing the insulation, pipelaying and backfilling.

For the construction of the gas pipeline they have already received more than 2,500 kilometers of pipe. Most of the pipe came from West Germany, Italy and Japan. By this time more than 400 kilometers of the pipeline have been welded, including 250 kilometers during the month of July. The pace of work on the linear portion of the pipeline is picking up with the passing of each day. Thus, while by 1 July 50 kilometers of finished pipeline had been laid, by 1 August this figure had increased to 197 kilometers. A large number of construction workers have begun to make the route of the pipeline inhabitable and are setting up a way of life. Housing areas are going up. And work on the first ten compressor stations has started.

Hermetic seal tests on the 650-meter pipeline have been completed; this section extends along the bed of the Kama River, which is one of the largest water barriers on the line. At the same time the Kama River crossing workers have used explosive charges to complete the passage of the trench along the bottom of the river. In so doing, they have created a reliable channel for the steel artery.

The section of the mainline, where the Tatnefteprovodstroy collective /Tatar Petroleum Pipeline Construction Trust⁷ is working, proceeds from the Volga to the Vyatka River, a distance of 230 kilometers. Here they must lay the pipeline across 15 large and small rivers. The Tatnefteprovodstroy Trust, having completed their assigned work on the Urengoy to Novopskov mainline, has transferred its technological flow-line operation, headed up by Hero of Socialist Labor I. Shaykhutdinov, to a new construction project.

The July assignment for the construction of the export gas pipeline has been met successfully. The pledges that were made are being supported by practical deeds.

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GENERAL

ELECTRIC POWER AS A FACTOR IN DISTRIBUTING INDUSTRIAL PRODUCTION

Moscow PLANOVOYE KHOZYAYSTVO in Russian No 3, Mar 82 pp 56-62

[Article by V. Ryl'skiy, candidate of economic sciences, department chief of the Council for the Study of Productive Resources attached to GOSPLAN USSR: "Electric Power a Decisive Factor in Locating Industrial Production"]

[Text] Efficient development of the country's fuel and electric power complex plays an important role in the solution of major long-term national economic problems.

The role of the electric power industry and of electrification was substantiated theoretically in the GOELRO [State Commission for the Electrification of Russia] plan adopted by the 8th All-Russian Congress of Soviets. The plan reflects the principal technical and economic directions for the development of productive resources, in conjunction with the country's industrialization involving efficient location of both industrial production and the power system, in accordance with the material and manpower resources of the individual regions.

Already during the first years of the Soviet state, the party defined the basic role of the electric power industry within the general system of developing and locating the country's productive resources, and it outlined a program for economic growth based on electrification. It was noted in the GOELRO plan that "to draft a plan for the electrification of Russia means providing a red guiding thread for all creative economic activity, building the scaffolding for the realization of a unified state plan for the national economy."*

Lenin's principles for the territorial development of productive resources, and the objectives of electrification substantiated by him are based on an analysis of the technical, economic and natural factors in their interaction, and they retain their basic importance even in the present stage of development.

The 26th CPSU Congress reemphasized the role of the fuel and electric power complex in raising the effectiveness of social production and in the solution of social problems as well. The congress focused attention on the unavoidability of pursuing a strict policy of energy conservation, of reducing the consumption volume of refined fuels, and of accelerating the development of nuclear power generation.

*"Plan elektrifikatsii RSFSR" (Plan for the Electrification of the RSFSR), Moscow, Gospolitizdat, 1955, p 32.

By 1985 the output of electric power in the Soviet Union is to reach 1550-1600 billion kilowatt-hours, and within this the share of nuclear power plants is to increase to 15 percent. As a separate large-scale problem, work is expected to unfold on producing synthetic fuel based on low-grade Siberian coal deposits and on intensifying petroleum refining.

The program for developing the fuel and electric power complex bears a clearly regional imprint. The bulk of the increases in the output of petroleum, natural gas and coal is to be supplied by the eastern regions; nuclear power will play an ever greater role in supplying the European regions with electricity.

The attention that the 26th CPSU Congress devoted to the fuel and electric power complex is explained by the complicated and contradictory conditions of the latter's development. The geographic noncoincidence of the centers of consumption and of the centers of extracting energy resources, and the stricter requirements regarding the structure of the sources of energy are making themselves felt increasingly.

The factors of fuel and electric power belong among the constantly functioning factors, and their effect intensifies in the solution of the problems of locating intensive industries at an accelerated rate in the eastern part of the country has already resulted in that the eastern regions at present are producing a significant proportion of the output of nonferrous metallurgy and a number of other industrial sectors.

But in spite of this, the share of the country's eastern part in the gross output of industry is increasing at rates that, in our opinion, are inadequate if we take into consideration the favorable prerequisites here for the development of the fuel and electric power complex. For example, at the end of the current five-year plan when the eastern regions are to supply the bulk of the total output fuel, their share in the total consumption of fuel resources will be less than 28 percent.

The long-term regional parameters that are taking shape in the development of the economy's branches are not in accord with the existing prerequisites for the development of productive resources in the individual regions. Thus, in spite of the policy, which should be implemented consistently, of locating in Siberia industries that have a high energy intensity and a low labor intensity, the demand for manpower is growing at rates that are causing a growing deficit of this zone's manpower balance, which means that the costs of attracting, retaining and settling the manpower are increasing.

Even if no new energy-intensive industries are located in the European regions, the problem of supplying customers with electric power in this zone through the end of the 20th century is regarded as one of the most complicated problems of forming the fuel and electric power complex. At present as well as long term, about two-thirds of the electricity and fuel produced in the country will be consumed here.

The rapid growth rates of electric power consumption in the European regions of the Soviet Union result in a sharp rise of the volume of sources of energy that must be transported here and also necessitate a large-scale program for the

construction of nuclear power plants. In the period 1971-1980 alone, deliveries of petroleum to the European regions increased more than 15-fold; deliveries of natural gas, fivefold; while deliveries of coal increased less than two-fold.

At the emerging location of productive resources and main fuel bases, this approach to supplying the European regions with energy, coupled with the development of nuclear power plants, is the only practically feasible one. But it should be borne in mind that the country's fuel and electric power complex incurs additional transportation costs that each year amount to many billions of rubles.

It seems expedient to analyze the directions and sectoral structure of the growing demand for energy in the European regions. According to our estimates, for example, nonferrous metallurgy and the chemical industry will account for 17.3 percent of total energy consumption in the near future; and ferrous metallurgy and engineering, for 41.8 percent. These figures indicate that here the bulk of the increase in energy consumption will be in industries that are not energy intensive (although the situation in terms of their location is not entirely favorable), and at enterprises whose specific energy intensity is relatively low but whose absolute energy consumption is considerable in view of the scale of their production. This applies first of all to ferrous metallurgy and engineering that account at present, and will account also long term, for more than 40 percent of the total consumption of boiler and furnace fuel in the European regions. So far as the sectors of nonferrous metallurgy are concerned, their share of total energy consumption in the European regions is already now relatively low and cannot be regarded as the basic cause of the growing deficit of the fuel and electric power balance [budget in physical terms].

Despite the persistent trend of the chemical and petroleum refining industries' shift eastward, the share of these sectors within the total energy consumption in the European regions is about 13 to 14 percent. The high consumption of energy in these sectors is explained by the fact that in 1971-1980 the bulk of the increase in the output of chemicals and petrochemicals was achieved through the modernization and expansion of existing enterprises in the European regions. With the accelerated construction of chemical and petrochemical complexes in Siberia, long term we can expect changes in the territorial proportions of energy consumption in the mentioned sectors, in favor of the eastern part of the Soviet Union.

In our opinion, the present location of metallurgical and engineering production is not justified in terms of energy costs. In 1975, ferrous metallurgy in the European regions accounted for more than 87 percent of the total energy consumption within this sector. The situation basically did not change in 1980, and no significant changes can be expected even in the next decade. At the same time the growing demand for metallurgical and engineering products in the eastern part of the Soviet Union is being supplied to a large extent from the European regions. The concentration of metallurgical and engineering production in the European regions is one of the basic causes of the growing deficit in these regions' fuel and electric power balance and, in our opinion, it is also a factor that seriously impedes the development of productive resources in the eastern part of the Soviet Union.

It is typical that in the European part of the Soviet Union the bulk of the increase in energy consumption, including the aforementioned sectors, is located in the western and central regions where sources of energy are particularly expensive (Table 1). Most of the nuclear power plants being built in the Soviet Union are being placed in operation here, to supply the increasing demand for energy.

Table 1. Annual Growth Rates of the Consumption of Electric Power, Heat and Fuel for Direct Combustion, by Regions of the European Part of the Soviet Union (in Percent)

A - Industry jointly; B - Of which the surveyed industries (ferrous metallurgy, engineering, and building materials industry)

	1975		1980		1975-1980	
	A	B	A	B	A	B
Northern and central regions of the European USSR	28.15	23.40	29.15	24.33	36.33	30.70
Southern part of European USSR	40.60	46.00	46.20	39.70	40.30	47.35
Of which Ukrainian SSR	27.70	34.40	33.50	41.90	28.80	27.20

At the same time the role of nuclear power plants in reducing the consumption of sources of energy will be small over a longer period of time. The fuel saved by generating electricity in nuclear power plants in the European regions of the Soviet Union increased under the 10th Five-Year Plan from 8 million tons of standard fuel equivalent in 1975 to 25 million tons in 1980. During this same period the importation of fuel from the eastern regions into this zone increased by more than 300 million tons of standard fuel equivalent. Even with the accelerated construction of nuclear power plants, their share of the European regions' fuel and electric power balance will not exceed, according to the author's estimate, 5 to 7 percent by the end of the current five-year plan, and at the current trends in the location of social production the share of long-haul fuel may be around 50 percent in supplying the energy demand of these regions.

The evolving situation can be explained by the fact that over a fairly long period the nuclear power plants basically will be generating only electricity. However, the proportion of sources of energy used to generate electricity does not exceed at present the total volume of boiler and furnace fuel consumed. The rest of the fuel is used to generate heat (about 30 percent) in industry, construction and in the sector of municipal and consumer services. It may be estimated that for every ton of standard fuel equivalent used to generate electricity, 3 tons are consumed for generating thermal energy, in transportation, agriculture, and in the sector of municipal and consumer services. Thus the development of nuclear power generation to the cogeneration of heat and power (which will be feasible only at the end of this century) will reduce very slowly the European regions' dependence on fuel deliveries from the eastern zone.

Under the developing conditions the most specific direction for gradually changing the proportions of energy consumption is to perfect the territorial proportions of the development of social production, by moving to the eastern parts of the Soviet Union not only the enterprises that are energy intensive, but also

the ones whose energy requirement is only average. The fact that most of the industrially developed regions in the European part of the Soviet Union are beginning to experience water shortages lends support to this proposition. Specialists at present are studying in detail the feasibility of a costly program for diverting a proportion of the flow of the northern rivers into the Volga basin. Here a rise in the rates of developing industrial production is limited also by ecological factors and by the growing real difficulties in supplying manpower for the industrial enterprises. As the density of industrial development increases in the eastern regions and this territory becomes saturated with facilities comprising the social infrastructure, construction costs will decline and, consequently, the effectiveness will increase of locating here a number of capital-intensive and moderately labor-intensive industries.

The possible changes in the purposefulness and the impact of the prerequisites for, and the factors of, social production's development should be reflected in the methodological instructions for assessing the effectiveness of the location of industries. In particular, in the conditions for the intensification of production more attention must be devoted to the role that electrification plays in the rise of labor productivity and the reduction of labor intensity.

In analyzing solutions associated with substantiating the directions for perfecting the territorial proportions in the location of industries, the fact claims attention that the degree of the power industry's influence is practically always assessed on the basis of the electric power component's magnitude within the total additional costs of producing the specific type of output, i.e., on the basis of the cost of electricity. However, the sectoral computations in a number of instances disregard the regional prerequisites for electrification that reduces the expenditure of direct labor and permits a reallocation of manpower among the individual spheres of production; the lower costs of the social infrastructure as a direct function of the lower labor intensity; the improvement of working and living conditions; the abatement of environmental pollution, etc.

It can be said that up to now the degree of the electric power industry's influence on perfecting the territorial proportions in the location of industries, and on forming a rational structure of social production in the regions, has been evaluated from a sectoral viewpoint. In most cases the intersectoral effect of raising the level of technology and improving product quality, and the social and economic consequences of electrification are not taken into account.

Most of the complex problems associated with expanding the sphere of electric power consumption and assessing the impact of electrification on the effectiveness of social production in a region are not being studied adequately. And in a number of instances this leads to conflicts of interest between the development of a specific industrial sector and of the national economy on the given territory.

A rise in the level of the electrification of production and auxiliary processes should be regarded as one of the most important conditions in pursuing

a policy of saving labor and raising the effectiveness of production. This proposition, which reflects one of the characteristics of the national economy's long-range development, is of basic importance for accelerating industrial development in the regions of Siberia that are short of manpower. Here, more so than in any other region of the country, the use of electricity in most power and technological processes in industry is already now more economical than the use of other sources of energy (of petroleum products and natural gas in particular). In terms of the equivalent of one ton of standard fuel, electricity costs about two-thirds as much as natural gas in central Siberia (while in the European regions the ratio is the exact opposite).

Siberia's industrial potential is characterized already now by the highest availability of electrical equipment and highest electrical intensity, and consequently by a lower labor intensity. Basically this can be attributed to the fact that the proportion of energy-intensive industries located here is high. According to our computations, in 1980 the availability of electrical equipment per worker was 2.3 times higher than on average for industry in the Soviet Union, and the electrical intensity of industrial production was 2.1 times higher.

But at the same time, most manufacturing industries in Siberia (light industry, and the food, chemical and lumber industries) have the same availability of electrical equipment per worker as the average for Soviet industry. In view of the manpower shortages in the given regions, this indicates considerable reserves in pursuing a labor-saving policy based on a sharp expansion of the sphere of electric power's applications.

Emphasizing the national economic expediency and necessity of production's wide-scale electrification, practically all specialists note the complexity of its realization, from the viewpoint of organizing the output of the necessary volume of new equipment that has acceptable economic indicators, and also from the viewpoint of increasing the economic effectiveness of using electricity as compared with the other sources of energy.

The differences between regions in terms of energy costs and the availability of manpower favor to the largest possible extent a differentiated approach to the electrification of individual processes on a regional scale.

Under the present conditions when the party is pursuing a consistent policy of raising wages and the zonal ratios of electric power generation are relatively stable, it will be of interest to compare the development of the ratio of the cost per kilowatt-hour to the wages per man-hour (Table 2) in the Soviet Union as a whole and in the individual economic regions.

Even at the relatively high cost of electromechanical equipment and machinery needed to replace a blue-collar worker in auxiliary production (up to and over 5,000 rubles), specialized organizations estimate that the effectiveness of the electrical mechanization of auxiliary production is sufficiently high (the payoff period is estimated at 0.7 year). The ratios of electricity generating costs to annual average wages shown in Table 2 lead to the conclusion that the economic expediency of reducing the labor intensity of production varies in a territorial breakdown: the low generating costs and high wages

Table 2. Changes of the Ratio of Generating Cost per Kilowatt-Hour to Wage Costs per Man-Hour

	USSR average		Siberian average	
	1975	1980	1975	1980
Cost of electricity delivered to customer, kopeks/kWh	1.3	1.3	0.8	0.8
Annual average wage cost (based on 1800 hrs/year), kopeks/man-hour	97	114	136	159
Ratio of cost/kWh to wage cost per man-hour, percent	1.34	1.14	0.59	0.50
Quantity of electricity equivalent to annual average labor cost per man-hour, kWh	135	171	300	360

costs make a given process practically twice as effective in the regions of Siberia than in the European part of the Soviet Union. Many economists confirm these results. For example, Professor Ye. S. Rusanov estimates that electrical mechanization of manual labor in Siberia is 1.4 times more effective than in the European regions. In the computations the considerable differences between zones in the costs of attracting, retaining and settling workers were not taken into consideration. (The costs of moving a worker from the central regions to Siberia amount to several thousand rubles.) Inclusion of the additional costs under this item of expenditure makes electrification in the regions of Siberia even more effective.

As noted earlier, in the practice of economic computations the sectoral approach prevails, under which the expediency of using electric power is determined by the ratios of the costs of using different sources of energy and types of equipment in a specific production process. In our opinion, the effectiveness of the electrification of production processes should be determined not only at the sectoral level, but also at the intersectoral and interregional levels. This enables one not only to substantiate the expediency of increasing the level of electrification for specific production processes, but also to determine the territorial priorities in perfecting the technological and technical equipment of production, with due consideration for the regional prerequisites for accelerating technical progress, the possibilities of concentrating production capacities, and other factors.

The regions of the Soviet Union differ sharply in terms of the costs and use of energy and the availability of manpower, and hence also in terms of the costs of attracting, retaining and settling workers; in the conditions for the technical organization of production (the levels of concentration, specialization, etc.); in the level of the social and production infrastructure; in the state of the environment, etc. Specifically these differences determine the feasibility of "zoning" the location of new machinery and technology, with due consideration for the impact of the entire set of factors and conditions of a technical, economic and social nature.

Naturally the practice of determining the source of energy to be used, and the sectoral approach to assessing the technical and technological reequipping of

industries make it more difficult to implement a set of measures for raising the effectiveness of production when resources intended for a variety of uses are limited; they also hamper implementation of an energy-conservation policy and are not conducive to improving the proportions in the location of industries.

The advanced proposition to take more fully into account the regional prerequisites for electrification as a factor in perfecting the territorial proportions of the development of production cannot be fully realized within the framework of sectoral development programs, since this task concerns a number of intersectoral and interregional programs. The existence of law-conforming relationships between the level of production's electrification and its technical base, the growth of labor productivity and the implementation of a labor-saving policy, demands the expansion of intersectoral planning and the elaboration of a set of overall indicators with which it is possible to assess the national economic effectiveness of the measures to be adopted.

A realistic basis for extensive electrification of production and everyday processes in the eastern part of the Soviet Union, and in Siberia in particular, are the resource prerequisites for creating a powerful and highly economical electric power base. In forming the fuel and electric power complex in the eastern regions of the Soviet Union, three basic centers can be distinguished: western Siberia where the bulk of the increase in the output of petroleum and natural gas is concentrated; eastern Siberia that is developing on the basis of mining the steam coal in the Kansk-Achinsk coal basin and of harnessing the hydroelectric power of the rivers in the Angara-Yenisey basin; and north Kazakhstan on the basis of the Ekibastuz deposits of steam coal. The power system management of Central Asia utilizes the hydroelectric potential of the rivers of Tajikistan and Kirghizia, and also the petroleum and natural gas resources of Uzbekistan and Turkmenistan.

The western Siberian, eastern Siberian and north Kazakhstan fuel and electric power bases have become the foundation for the formation of the largest territorial production complexes in the Soviet Union. Western Siberia specializes in petroleum and natural gas production, the chemical and petrochemical industries, natural gas processing, and the lumber industry. The system of Angara-Yenisey complexes have energy-intensive specialization in nonferrous and ferrous metallurgy, petrochemicals, petroleum refining, and the lumber industry. The Pavlodar-Ekibastuz complex is likewise energy intensive.

Specifically these fuel and electric power regions are to supply energy for customers in the European zone of the Soviet Union. The northern part of western Siberia is to produce 385 to 395 million tons of petroleum and 330 to 370 billion cubic meters of natural gas in 1985, and a significant proportion of this output is to be transported to the European regions of the Soviet Union. Under the 11th Five-Year Plan, construction will continue of the 1500-kV Ekibastuz-Center direct-current transmission line, over which the Ekibastuz state regional power plants will supply up to 40 billion kWh of electricity.

If developed at an accelerated rate, the fuel and electric power complex of eastern Siberia will supply with electricity not only the Angara-Yenisey industrial complexes, but also the zone of the Baykal-Amur trunk line, western Siberia and Central Asia.

In the long run it will be possible to supply electricity to the European regions over extra-high voltage transmission lines. Extensive work is in progress on the preparation of Kansk-Achinsk steam coal, to ensure its high effectiveness even when it is transported over long hauls (up to the European regions).

When the electric power centers within the system of the listed complexes are fully developed, the combined total generating capacity of their thermal power plants could exceed 100 to 120 kW. This will permit supplying the national economy in the eastern regions with over 700 billion kWh of the cheapest electricity in the Soviet Union. (In 1980, the total output of electricity in the eastern regions was less than 400 billion kWh.)

The Kansk-Achinsk fuel and electric power complex (KATEK) is to be the largest in central Siberia in terms of the parameters of its development. In the zone of the Kansk-Achinsk coal basin, the potential reserves of which are estimated at 247 billion tons, it will be possible to build 10 to 12 condensing electric power plants with a combined generating capacity of 90 million kW. The fuel and electric power resources are earmarked for use in the Siberian zone, to ensure a reliable electric power base for the expansion of industrial production in this zone; for the supply of fuel and electric power outside Siberia, primarily to the European zone; and for developing the technological conversion of coal into energy.

In spite of the extremely favorable resource prerequisites, the role of the state regional power plants within the Kansk-Achinsk fuel and electric power complex is relatively small in the fuel and electric power balance of Siberia. The hydroelectric power plants of the Angara-Yenisey basin play a much greater role; their installed generating capacity now exceeds 50 percent of the combined total base-load generating capacity in central Siberia. The industrial complex that is being formed here will require a large quantity of base-load electricity that can be generated only in the powerful condensing power plants of the Kansk-Achinsk fuel and electric power complex. It must also be taken into consideration that the Kansk-Achinsk complex is the basic reserve coal basin of the Soviet Union.

Considering the long construction time of the facilities of the fuel and electric power complex and the region-forming role of the Kansk-Achinsk complex, it is necessary to accelerate already in the next few years the installation of the strip mines and electric power plants, after establishing a sound relationship between the growth rates of Angara-Yenisey cascade's hydroelectric power plants and of the powdered-coal-fired state regional power plants. It is also necessary to accelerate the preparation of this coal, the technological conversion of coal into energy, and the creation in central Siberia on this basis of enterprises for the production of synthetic petroleum, synthetic engine fuel, and feedstock for the chemical industry.

The arguments presented above lead to the conclusion that--despite the considerable successes in developing the fuel and electric power complex of the Soviet Union--there are prerequisites for further increasing the effectiveness of its operation, by consistently moving to the east the consumers of fuel and electric power. The growth of electric power consumption in the east can be

ensured by locating here not only the energy-intensive industries, but also the manufacturing enterprises of average energy intensity whose labor intensity must be reduced by implementing the labor-saving policy that is reflected in higher levels of electrification, and of the automation and mechanization of all production processes.

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