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11 September 1979

USSR Report

RESOURCES

(FOUO 22/79)

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USSR REPORT

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ELECTRIC POWER AND POWER EQUIPMENT

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THE KAYSHYADORSKAYA PUMPED-STORAGE ELECTRIC POWER STATION

Moscow GIDROTEKHNICHESKOYE STROITEL'STVO in Russian No 4, Apr 79 pp 2-6

/Article by engineers G. N. Avdeyev and G. A. Sakharova/

/Text/ The construction site for the 1600-megawatt Kayshyadorskaya GAES /pumped-storage electric power station/ was selected in the Lithuanian SSR, on the right bank of the Kaunas GES reservoir, where the topographical engineering, geological and hydrological conditions are more favorable than at other possible location sites for the GAES which were available in the Baltic republics and the Leningrad Oblast.

The Kayshyadorskaya GAES, an engineering project developed by Gidroproyekt /All-Union Planning, Surveying and Scientific Research Institute imeni S. Ya. Zhuk/ will operate in the OES SZ/United North-West Electric Power System/ to help in covering peaks and filling in night-time dips of the electrical load schedule(figure 1), to perform the functions of a frequency and short-term emergency quick lead-in reserve and also of an 800,000 kilovolt ampere synchronous compensator. Of all of the Soviet Union's power systems, the OES SZ has the most uneven schedule of electrical consumption. In recent times the load during the peak hours exceeds the night dip by about 40 percent which causes daily shut-downs at night of the 150, 200 and 300 megawatt TES/thermal electric power plant/ units. In the future this unevenness will increase up to 50 percent. The operation of the power units in the alternating mode has an extremely harmful effect on the condition of the electric power equipment: expenses increase for current and capital repairs, the number of emergency equipment breakdowns grows, its operational life is sharply curtailed, and fuel expenditure connected with the regulating regime of the units increases considerably. Thus, the alternating work mode of the TES units reduces their economy of operation and the dependability of the electric power supply.

The Kayshyadorskaya GAES has been advanced as an immediate construction project in the OES SZ on account of its advantage over the other possible GAES's in the region not only because of natural conditions but also because of its advantageous location in the center of peak electrical loads and for its technical and economic indicators as a whole.

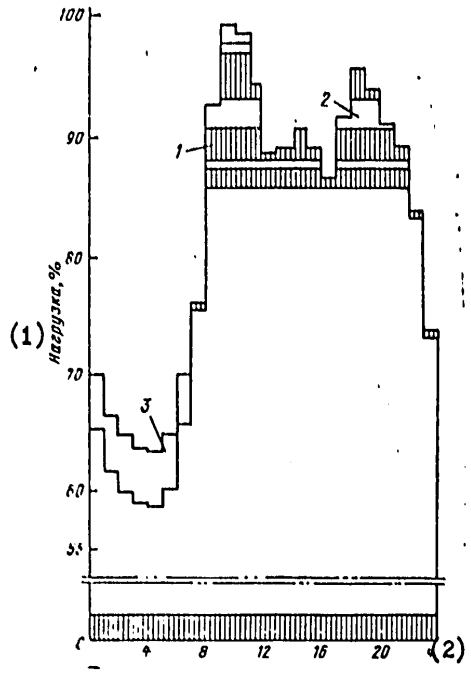

Figure 1. The Participation of the Kayshyadorskaya GAES in Covering the Daily Winter Load Schedule of the North-West OES
1 - GES's in operation and under construction; the Kayshyadorskaya GAES; 2 - Under turbine conditions; 3 - In the pumping mode

Key:
1. Load, in percentages
2. Hours

The installed power of the GAES in the turbine mode is 1,600 megawatts, and it is 1,760 megawatts in the pumping mode. The GAES has been estimated to generate up to 2,400 million kilowatt hours a year in the peak hours and to consume up to 3,300 million kilowatt hours(a plant efficiency factor of 73 percent) during the night-time power system schedule load dips.

The Kayshyadorskaya GAES is an effective electric power construction project. The additional capital investment in the GAES in comparison with alternative ways of developing the OES SZ through the construction of GTE's[gas turbine electric power stations] pays for itself in savings in operational expenditures, fuel savings, an improvement in the operating conditions of the large-scale TES's and especially AES's[atomic electric power stations], a savings in expenses for associated services(guaranteeing the requirements for reactive power and energy, water for the irrigation of adjacent lands, for providing water to the city of Kayshyadoris, etc.).

The savings in operating expenses(without fuel) at the Kayshyadorskaya GAES in comparison with a GTE has been determined to be 9 million rubles because of lesser amortization allowances, capital repairs, a smaller requirement for operational p rsonnel, etc.

A fuel savings of .27 million tons of specific heat has been determined as the difference of fuel expenditures at a GTE and for the charging of a GAES. The expenditure at an alternative GTE for gas-mazut fuel would amount to 1.21 million tons of specific heat or 1,036 million cubic meters of gas per year.

The economic effect of improving the operation of the large TES's and especially the AES's with the introduction of GAES's is determined by the fact that the total increase of yearly expenditures for the electric power system for one kilowatt of power of the GRES, drawn to load regulation, amounts to 3.6 rubles. Including the technically possible level of discharge of GRES units at 40 percent, one kilowatt of pumped GAES power permits the utilization in the constant mode of the operation of 1.67 kilowatts of GRES power. The high maneuverability qualities of the GAES and especially the charging of TES and AES electric power equipment during night dips in load schedule significantly distinguishes the GAES from any other type of peak electric power station. These operating advantages of the GAES show themselves either in the increase in the electric power system of the capacity of atomic stations according to operating conditions, or in increasing the charge of thermal and atomic plants during the period of night-time loading schedule dips of the electric power system, which leads to a cut-back in expenditures for equipment repairs, lessens the emergency and repair down-time of TES's and AES's, and lengthens the service life of the equipment. Economically, these operational advantages are estimated at six rubles per kilowatt of pumped GAES power per year, i.e., ten million rubles per year.

Savings on associated services can amount to around one million rubles a year.

On the whole the one-time capital investments in the Kayshyadorskaya GAES, in comparison with an alternative GTE, will pay for themselves because of yearly expenditure savings during a time period of less than three years.

The Kayshyadorskaya GAES has the following installations:

--an elevated water storage basin without tributary with an aggregate capacity of 46.5 million cubic meters and an available capacity of 37.5 million cubic meters when the depth decrease is 13.5 meters with a tower water scoop for irrigating adjacent lands(Q = 8 cubic meters per second). The basin is built on a morainic elevation, 350 hectares, on a semi-hollow/semi-bank, the length of the dam enclosure is 6,600 meters.

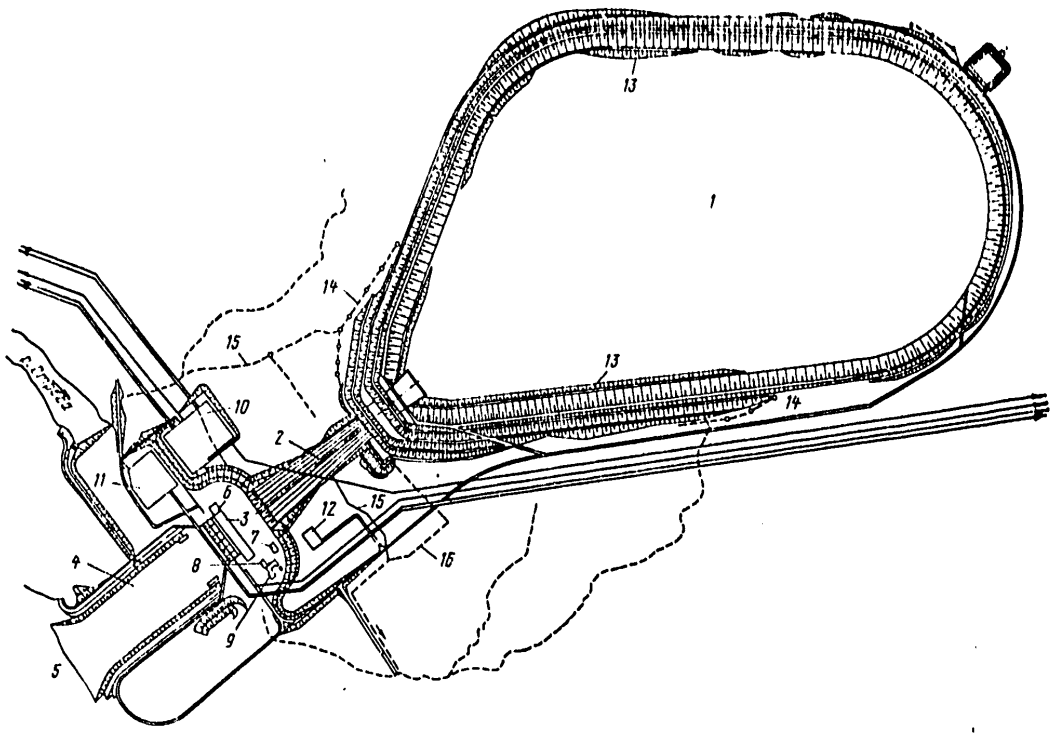

Figure 2. Diagram of the Location of Installations at the Kayshyadorskaya GAES Construction Site

Key:

1. Elevated basin
2. Turbine conduit with water intake
3. GAES engine house
4. Reversible canal
5. Kaunas reservoir
6. Service building
7. Oil plant
8. Transformer workshop
9. Operational yard
10. ORU(outdoor distribution system) - 330 kilowatts
11. ORU - 110 kilowatts
12. Hotel
13. Bracing with 20cm reinforced concrete slabs
14. Vertical drainage
15. Catch drain
16. Drainage water disposal

--a dam-type water intake with eight openings and tunnels 9.5x10 meters and 165 meters long each. The openings have been protected by grillwork from stray articles getting into the pipelines. They have emergency repair gates to quickly cover up the openings and two flush gates for repair work. The throughput of water intake in GAES turbine operations is 1,808 cubic meters per second and 1,512 cubic meters per second in pumping operations.

--reinforced eight-thread concrete pressure pipes, d = 7.5 meters with a 10-millimeter metallic coating. The extent of the thread is 658 meters, made up of sections 40 meters each. The pipe wall thickness is 70 centimeters.

--a GAES building with 330 kilovolt ORU and maintenance-production projects. The building is rectangular in design, 57 x 184 meters, 50 meters high, and consists of two sections for housing eight reversible units. An installation area abuts the building on the left side and there is a maintenance-production wing on the right. The abutment of pipes to the building has been covered by soil. Transformers have been placed on this embankment. The deepening of the rotor axle under the minimum level of the Kaunas reservoir from the condition of non-cavity operation of the hydraulic machinery in the pumping mode amounts to 14.5 meters.

--a 650-meter long reversible canal connects the GAES building with the Kaunas reservoir.

The existing Kaunas reservoir with a volume of 500 million cubic meters, an area of 6.35 square kilometers, and 80 meters long, is used as the GAES down-strean reservoir. When putting the GAES into operation the hydrological condition of the Nyamunas River and reservoir will not change.

The operating schedule of the Kaunas GES, with its small capacity, will be fully subordinated to the operating schedule of the GAES for maintaining the necessary level in the reservoir. During the operation of the GAES at full capacity in the turbine and pumping modes, within the estimated time periods, the maximum fluctuation of the level in the reservoir amounts to 65 centimeters with a water rise rate up to 13 centimeters per hour. The Kayshyadorskaya GAES is estimated to work at full installed capacity in the turbine mode for 5-6 hours during an estimated pressure of 100 meters, and in the pumping mode up to 8 hours with a mean water rise to 105 meters.

The adjustable GAES reversible hydraulic devices are intended to operate in the statistical pressure ranges in the turbine mode from 110.2 to 93.6 meters and, including losses, from 108.0 to 89 meters(estimated according to the capacity-100 meters) and in the pumping mode with a water rise from 114 to 95(the average is 105 meters).

The range of working pressures of the Kayshyadorskaya GAES coincides with the range of working pressures of the Zagorskaya GAES, because they have adopted for these GAES's uniform reversible hydraulic machines manufactured by the Leningrad Metal Plant.

The radial-axle type reversible hydraulic machine has the following parameters: a rotor diameter of 6.3 meters; in the turbine mode a capacity at design pressure of 205 megawatts and an expenditure of 226 cubic meters per second; in the pumping operation a power intake with average pressure of 217 megawatts and water pumping of 189 cubic meters per second, the height of the intake with minimum pressure is 14.8 meters; the hydraulic machine weighs 900 tons, including the 97-ton rotor.

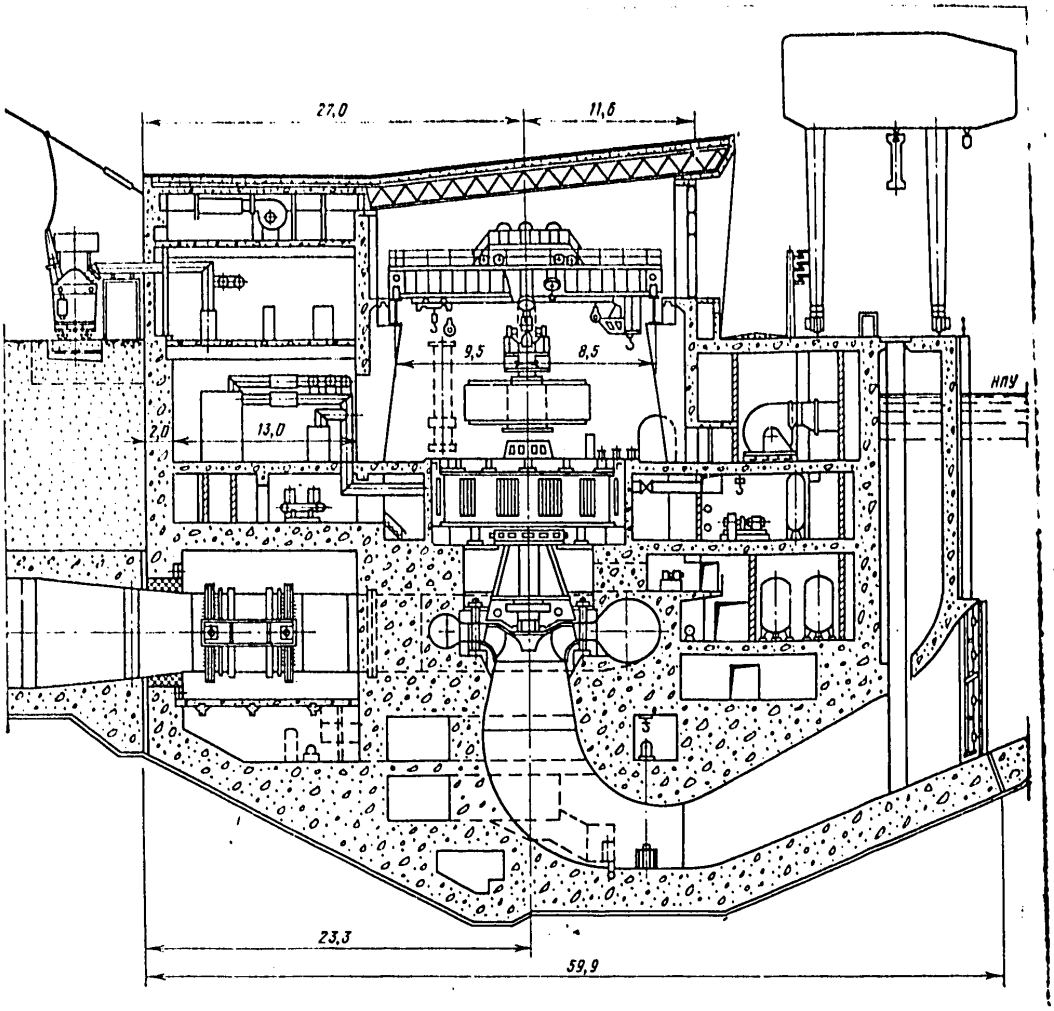

Figure 3. The GAES Engine House. A Cutaway View of the Hydraulic Unit.

Key:
1. NPU [normal backwater level]

The reversible motor generator has a capacity in the turbine mode of 200 megawatts and in the pumping mode of 220 megawatts.

Two methods have been considered for starting up the unit in the motor (pumping) mode: a direct asynchronous one with the full voltage of the network and from a frequency converter. The first method is more preferable. The final version will be adopted by the time the construction is completed.

The connection of the GAES to the electric power system has been stipulated at a voltage of 330 kilovolts over six LEP's/electric power transmission lines/ outgoing to the Lithuanian GRES(Elektrenay), and the cities of Kaunas, Sovetsk, and Shaulyay. A site has been specified for the construction of a 110 kilovolt ORU.

The organization of the GAES operation has been developed by doing research on the mathematical model of GAES work schedules in OES SZ and the drawing up of a ASUTP/automatic control system of production processes/ schematic diagram. The Kayshyadorskaya GAES, as a multi-purpose maneuverable electric power station, must provide with its own work, in the final analysis, the reliability of the electric power supply of the consumer and improve the technical and economic indicators of the GRES's, TETs's, and AES's. Therefore its operating schedule is determined by the power-economic and technical requirements of the OES indicated generating capacities. Hence the maneuverability and reliability of operation of the GAES and its installations as a whole, acquires great importance. These positions are the basic criteria when designing GAES's and OES's. The situation was earlier adopted whereby the GAES is used in turbine or pumping modes under the "usual, normal" operating conditions of the OES generating capacities for covering the daily electric power load schedule; the possibility has been accepted for the simultaneous switching off or starting up of two reversible GAES units. This condition was set during the selection of the type and design of the installations, the conditions of starting up and stops of the reversible units, the picking of auxiliary equipment, etc.

Joint studies of Gidroproyekt with the ODU SZ have shown that with the established GAES work conditions there must be emergency OES situations during which all eight reversible units at the GAES can be simultaneously switched off or on, and also a part of the units can work simultaneously in the pumping mode and part in the turbine mode. These requirements were also taken into consideration during the design of the basic GAES installations.

The number of operational personnel was determined to be 300.

The total area of land set aside for the construction of the GAES is 8.54 square kilometers, including 6.53 square kilometers for permanent use and 2.90 square kilometers of plowed fields. Some 207 individuals from 87 farms are being moved from the area set aside. To compensate for the loss of agriculture they have provided for the creation of irrigated long-term cultivated pastures with dual regulation of soil moisture on a 7.31 square kilometer area. Altogether 88.30 square kilometers of adjacent agricultural lands can be irrigated from the elevated basin of the Kayshyadorskaya GAES. This basin will also be used for the water supply of the city of Kayshyadoris.

The total expense on measures for preparing the construction site is 4.6 million rubles and 2.58 million rubles for restoring agricultural production.

Money has been made available for measures to protect nature, strengthen the coastal area, and compensate for the loss of the fishing industry at a total cost of 3.9 million rubles.

The type of work volumes for the main GAES installations amount to: the removal of 16 million cubic meters of soil, the embankment and earth backing of 16 million square meters, laying of concrete and reinforced concrete--about 800,000 cubic meters using 62,000 tons of equipment, the installation of 9,600 tons of metal structures and machinery, 16,600 tons of metallic pipe coverings, and 17, 250 tons of hydroelectric power equipment.

About three million cubic meters of non-metallic materials including 1.1 million cubic meters of gravel, 90,000 cubic meters of crushed stone, 20,000 cubic meters of brick, and 650,000 cubic meters of sand are required for the construction of the Kayshyadorskaya GAES.

The non-metallic materials for the construction project have been taken from three local open sand and gravel pits, two of which are underwater, situated in the Kaunas reservoir; all of them are within a five-kilometer radius of the GAES installations.

In the installation work, about 70 percent of which is concentrated on the elevated basin, they plan to use mainly excavators in combination with automatic dump trucks. They intend to carry out a part of the excavation work using motor and pull-type scrapers, bulldozers and small excavators, and also type 300-50 dredgers.

For laying concrete in the installations they have provided for crawler-mounted and tower cranes with an input of concrete mixture to them by automatic dump trucks and they have provided for concrete mixer pumps for laying in the reinforced concrete pipes. For preparing the concrete mixture they have created a concrete service with a productivity of 80 cubic meters of commercial concrete an hour(a maximum monthly laying of 33,000 cubic meters), including a concrete plant for four concrete mixers of one cubic meter each, a 1,700-ton cement warehouse, fill warehouses, etc.

The total requirement for basic construction machinery and means of transportation(pieces) amounts to 41 excavators, 14 scrapers, 2 dredgers, 36 bulldozers, 30 tractors, 38 various kinds of cranes, 127 various types of automatic dump trucks, and 42 vehicles with sides.

A complex of subsidiary enterprises has been provided to carry out the construction and installation work: a temporary construction facility at the construction site; at the Lithuanian GRES construction base in the settlement of Elektrenay there is a permanent railroad facility, which after completion of the construction of the Kayshyadorskaya GAES will be used as a

Показатели (1)	Гидроаккумулирующие электростанции (2)			
	Кайшядорская (3)	Загорская (4)	Киевская (5)	Ладингтон (США) (6)
Установленная мощность в генераторном режиме, МВт. (7)	1600	1200	225	1920
Обратимые агрегаты: (8)				
мощность, МВт	200,0	200,0	33,5	320,0
количество	8	6	3	6
Напор (расчетный), м (9)	100,0	100,0	65,0	105,5
Часы работы гаэс (расчетные) в режиме: (10)				
турбинном	5,6	4,0	3,0	8,5
насосном	8,0	6,0	7,4	Недельный режим (19)
Годовая выработка (расчетная), млн. квт·ч (11)	2400	1200	100	5000
Потребление электроэнергии в насосном режиме, млн. квт·ч (12)	3300	1640	160	6820
Расход воды на выработку 1 кВт·ч, м³ (13)	4,16	4,82	5,48	3,46
Верхний бассейн:				
энергетический эквивалент, млн. кВт·ч	9,14	4,18	0,71	19,2
полная емкость, млн. м³ (14)	46,5	29,9	4,6	102,0
полезная емкость, млн. м³	37,5	22,2	3,7	66,5
глубина сработки, м	13,5	9,0	6,0	20,4
Объемы основных работ на 1 кВт:				
выемка (15)	10,0	14,8	37,7	17,2
насыпь	10,0	18,05	49,2	15,3
бетон и железобетон	0,5	0,56	0,32	Нет данных (20)
то же без учета крепления и трубопроводов	0,26	0,33	Нет данных (20)	0,17
Общая стоимость строительства: (16)				
млн. руб.	261,4	217,3	25,8	—
млн. долл.	—	—	—	340
Удельные капиталовложения:				
руб/кВт (17)	144,1	163,0	184,0	—
долл/кВт	—	—	—	175
Срок окупаемости, лет (18)	3,0	5,5	Нет данных (20)	

Key:

1. Indicators
2. GAES's
3. Kayshyadorskaya
4. Zagorskaya
5. Kievskaya
6. Ladington(USA)
7. Installed capacity in the generator mode, in megawatts
8. Reversible units: capacity, in megawatts number
9. Pressure(estimated), in meters

/Key continued on following page/

10. Hours of operation of the GAES (estimated) in:
    turbine mode
    pumping mode
11. Annual output(estimated), in millions of kilowatt hours
12. Consumption of electric power in the pumping mode, in millions of kilowatt hours
13. Expenditure of water to produce one kilowatt hour, in cubic meters
14. Elevated basin:
    electric power equivalent, in millions of kilowatt hours
    aggregate capacity, in millions of cubic meters
    available capacity, in millions of cubic meters
    depth of decrease, in meters
15. Amount of basic work per kilowatt:
    excavation
    embankment
    concrete and reinforced concrete
    the same, not considering reinforcement and pipes
16. Total construction cost:
    millions of rubles
    millions of dollars
17. Specific capital investments:
    rubles per kilowatt
    dollars per kilowatt
18. Investment recovery period, in years
19. Weekly operation
20. No information

permanent construction base of the general contractor and as a permanent repair enterprise of the Lithuanian SSR electric power system. Use is also planned of the production capacities of the combine of production enterprises and the general contractor's base, located in the city of Kaunas, which belong to the USSR Ministry of Power.

A housing settlement for the construction and operational personnel, with a total area of 100,000 square meters, is in the power workers settlement of Elektrenay.

The total length of construction of the Kayshyadorskaya GAES(including the preparatory period) amounts to six years with 3,500 construction personnel. The start of the construction of the Kayshyadorskaya GAES has been stipulated as a national economic plan of the current five-year plan and preparatory work on it has begun.

The technical and economic indicators obtained for the Kayshyadorskaya GAES have been compared with the indicators of the similar GAES's(see the table): Zagorskaya, Kievskaya(USSR) and Ladington(USA) which are similar in composition and arrangement of installations, in natural conditions(climatic, hydrological, topographic, and geological). The Zagorskaya GAES is being built, the Kievskaya was built in 1973, and the Ladington in the years 1969-1974.

Thus, the technical and economic indicators of the Kayshyadorskaya GAES are favorable and show the economic effectiveness of its construction.

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ELECTRIC POWER AND POWER EQUIPMENT

EQUIPMENT FOR PUMPED-STORAGE ELECTRIC POWER STATIONS'

Kiev Seminar

Moscow ENERGOMASHINOSTROYENIYE in Russian No 4, Apr 79 pp 46-47

[Article by Candidate of Technical Sciences Yu. I. Fedulov and engineers L. O. Sheludyakov and S. S. Nikol'skaya]

[Text] The "Basic Trends in the Development of the National Economy of the USSR for the Years 1976-1980," produced by the 25th CPSU Congress, envisions a speeding up of the construction of GAES's [pumped-storage electric power stations] to provide an improvement in the technical and economic work indicators of water power equipment.

The requirement to construct GAES's in the united "Yug" system, which provides electric power to customers of the Ukrainian and Moldavian Republics, a number of RSFSR oblasts, and also the CEMA member countries, came about through a number of basic factors--the almost full utilization of the effective water power potential of rivers and the slow construction of new peak and semi-peak GES's, the further growth in peak and semi-peak loads, the necessity to cover these loads and, in connection with this, to create high-speed drainage canals, and the difficulties in developing economic peak and semi-peak steam and gas-turbine electric power stations.

In 1978 in Kiev at the UkSSR VDNKh "Elektrifikatsiya" pavilion, the republic scientific and technical seminar "Experience in Creating Hydromechanical and Electrical Equipment for Pumped-Storage Electric Power Stations" took place. The seminar was devoted to examining the creation of hydromechanical and electrical equipment for GAES's and the prospects and problems of GAES construction.

The seminar was organized by the Khar'kov Scientific Center of the UkSSR Academy of Sciences, the Scientific Council of the UkSSR Academy of Sciences on Power Engineering Problems, the Institute of Engineering Problems of the UkSSR Academy of Sciences jointly with the UkSSR Ministry of Power and

Electrification, the Institute of Electrodynamics of the UkSSR Academy of Sciences, and the Ukrainian NTO/Scientific and Technical Society/ Board for the Power and Electrical Engineering Industry of the UkSSR VDNKh.

Some 102 people participated in the work of the seminar--staff members of Gosplan UkSSR, the USSR and UkSSR Ministry of Power and Electrification, representatives of scientific institutions, VUZ's, scientific research, planning, and design organizations working in the field of water power, staff from power and electrical engineering equipment producer plants, electric power system workers, representatives of the central and republic NTO Board for the Power and Electrical Engineering Industry.

Two sections worked in accordance with the program of the seminar--hydromechanical GAES equipment and electrical engineering GAES equipment.

Some 43 reports, communications, and speeches open to discussion were heard and considered at meetings and summaries of these reports, communications, and discussion materials were published prior to the beginning of the seminar.

The following basic questions were discussed at the seminar--prospects and problems of GAES construction in the Ukraine and the USSR, GAES's in power complexes, features of designing hydromechanical and electrical engineering equipment for GAES's in the USSR and abroad, problems in starting up and operating powerful GAES units, the design of and operational experience with domestic and foreign reversible units, the exchange of experience in the area of scientific research work on creating hydromechanical and electrical engineering equipment for GAES's, including the creation of equipment for low-pressure GES-GAES's, the use of new methods of theoretical and experimental research on the operation of reversible hydraulic machinery and an increase in the effectiveness of the use of the results of scientific efforts, the coordination of scientific research work in the creation of flow-through parts of reversible hydraulic machinery for various parameters, including for GAES's of the UkSSR, and other questions.

The exhaustion of the economic potential of water power resources in a number of regions of the European part of the country precludes the construction of new GES's. An increase in the production of power by the existing GES's can be achieved by using water storage at the newly constructed GES-GAES's, and also by installing reversible equipment at some of the existing stations. The availability of low-pressure reversible equipment, which is being produced extremely slowly in our country, is required to solve these problems.

About 50 sites have been mentioned where GES-GAES's can be constructed, the first and foremost of them being Dnestrovskaya, Tereblinskaya, Kanevskaya, and Dneproskaya. Data were presented in the report of Yu. A. Yukhnov and Yu. N. Vasil'yev(the Ukrainian department of Gidroproyekt/All-Union Planning, Surveying, and Scientific Research Institute imeni S. Ya. Zhuk/, Khar'kov) on the stations listed.

They examined the design features and parameters of GAES's of a number of foreign countries(the report of L. Ya. Stanislavskiy, Khar'kov Scientific Center). Recommendations were made to utilize this experience in creating powerful GAES's when building domestic GAES's. The necessity to speed up the construction of large-scale GAES's with units of 200 megawatts and higher was emphasized in order to accumulate experience.

In the process of operating the Kiev GAES, the first one in the USSR, as noted in the report of the chief engineer of the Kaskad Srednedneprovskikh GES S. I. Potashnik, a significant amount of experience and the results of a large volume of full-scale research and operational tests were accumulated. The conclusion was that GAES's are efficient and must be introduced into the water power engineering of our country.

The reports of A. A. Sotnikov and I. M. Pylev(of the production association "Leningrad Metal Plany") spoke of extensive research, innovations in design resolution, and schemes for the automatic control of a turbine pump. A complex of project design work, based on the spatial representation of the flow and the energy balance equation, permits the optimization of the flow channel, decreases the number of variants worked out experimentally, and increases the effectiveness of experimental research.

At the Institute of Engineering Problems of the UkSSR Academy of Sciences, Khar'kov(the report of Yu. I. Fedulov), they developed a model of a flow-through part of a reversible hydraulic machine of the radial-axis type for 180-220 meters of pressure which has satisfactory hydrodynamic and economic indicators, corresponding to the level of foreign suggestions for the given pressures. Recommendations were made for the design of rotors at the prescribed pressures.

A basic problem is starting up the reversible units in the engine mode. For the immediate time frame the electrical industry cannot create reliable units with a 300 megawatt capacity, started by direct switching into the network. Therefore the only acceptable method of starting up is to start up from a thyristor frequency converter. Such a device was manufactured at the Khar'kov Electrical Machinery Plant and installed at the Kiev GAES for in-depth studies.

In the closing seminar recommendations which were adopted it was noted that the Kiev GAES, the first one in the country, substantially benefits the power system in covering above-peak loads. The growth of water storage can satisfy the demands not only of electric power but also of water supply and irrigation.

It was pointed out that the amount of research and planning and design work on creating hydromechanical and electrical engineering equipment for future GAES's is still inadequate. Gosplan, the appropriate ministries, and the producer plants must pay attention to the creation of reversible hydraulic machinery and generators, to increase the volume of research and planning-design work in this area, to broaden the experimental facilities of the existing laboratories, and provide the required financing.

New Miniature Steam Generator

Moscow ENERGOMASHINOSTROYENIYE in Russian No 4, Apr 79 inside back cover

[Advertisement]

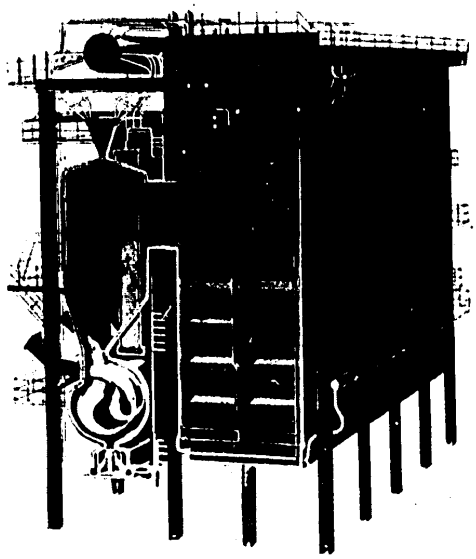
[Text] E-500-140GM-VN GOST 3619-69 (model TGM-444)

The steam generator has one drum, with natural circulation, is single-hull, miniaturized, with a TsKTI [Central Scientific Research, Planning and Design Boiler and Turbine Institute imeni I. I. Polzunov] vortical furnace. It has a three-way configuration of the heating surfaces and has been designed to operate under pressurization. The furnace chamber consists of a horizontal cylindrical chamber and a prismatic cooling chamber.

The steam superheater has been made from screened convectional sections, providing free access for the inspection and repair of each pipe of the heating surface.

There is no cleaning of the heating surfaces due to the operational features of the steam generator's high-force vortical furnace.

The MPG [miniature steam generator] with the TsKTI vortical furnace is an original domestic design, most fully answering the growing requirements of high-parameter and large-capacity electric power stations.



Basic Advantages of the MPG

Small size: there is a decrease of 2-3 times in the space occupied by the MPG mainly because of a height reduction brought about through the use of a high-force vortical furnace.

High design and operational reliability: this is obtained by a reduction of local loadings in the zone of the highest gas temperatures, the uniform warming of the heating surfaces, their constant cleanliness, and the elimination or significant decrease of low-temperature corrosion.

Heating universality: the design of the TsKTI vortical furnace permits the burning of different types of fuel in it and has a high level of unitization of elements for the PG/steam generator/ in a broad range of capacities.

High operational KPD/efficiency factor/: the method of burning and the optimum work conditions of the heating surfaces provide a stable KPD, equal to 94-95 percent for gas and mazut and 92-93 percent for solid fuel.

The possibility of working under pressurization: this helps to eliminate insufficiently reliable and expensive exhaust fans from the gas channel.

The minimum length of the steam mains is 25-40 meters instead of the 80-140 meters for the usual MPG design.

The flow line production of elements can be organized because of their heat and technological universality.

The high-speed installation of the MPG is possible because the heating surfaces are delivered as a small number of volumetric units fully finished at the plant.

The MPG E-500 VN has 30 percent less metal capacity and its dimensions(by volume) are 50 percent less compared with a chamber PG of the same capacity and parameters.

Please direct all questions concerning the purchase or sale of licenses to the All-Union Association "Litsenzintorg" at the address: 113461, Moscow, M-461, 31 Kakhovka St., telephone number 121-05-35.

They have developed in the USSR a new industrial process for manufacturing a wholly-punched, sharply-curved pipe bend(a curved fitting) for high-pressure, large-sized piping by using the punching from rolled or stamp-welded pipe material.

Technical capabilities of the process:

the angle of bending of the pipe, in degrees.....up to 180
the minimally permissible relative thickness of the wall of the material(the relationship of the thickness of the wall to the outer diameter).....0.06

the relative radius of the pipe bend(the relationship of the mean radius of the curvature to the outer diameter).....0.8-2.0
the relative length of the straight-line end section(the relationship of the length of the straight section to the outer diameter of the pipe bend), depending on the radius of the curvature...0.3-0.4
the greatest tapering of the wall on the convex surface in percentage when the angle of bend is up to:
100 degrees..... 6
180 degrees..... 12

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ELECTRIC POWER AND POWER EQUIPMENT

70TH BIRTHDAY OF NIKOLAY ALEKSANDROVICH RZHANITSYN

Moscow GIDROTEKHNICHESKOYE STROITEL'STVO in Russian No 4, Apr 79 p 58

[Text] Professor Nikolay Aleksandrovich Rzhanitsyn, Doctor of Technical Sciences and Honored Scientist and Engineer of the RSFSR, had his 70th birthday in December 1978.

After graduating from a higher engineering and technical school in 1931, Nikolay Aleksandrovich was involved in design work for 10 years and worked on the construction of large-scale hydraulic engineering installations. In the construction of the Moscow canal in the years 1931-37, he carried out complex hydraulic calculations and studies of the canal, as well as studies of the lay-out of the Ivan'kovskiy and Pirogovskiy hydraulic power systems, sluices and pumping stations. In the years 1937-1941 he worked on the construction of the Kuybyshev hydraulic power system, and then in planning management, he carried out laboratory research on the planned installations. From 1941-1945 he was in a special expedition on the Northwestern front, and then the expedition was sent to the Urals to design and construct a hydroelectric power station on the Tura River.

In 1945, after defending his master's dissertation, N. A. Rzhanitsyn was named director of the marine hydrophysical station of the USSR Academy of Sciences where he performed scientific work. In 1947 he moved to scientific work with TsNIIEVT/Central Scientific Research Institute for the Economy and Operation of Water Transportation/ of the RSFSR Ministry of the River Fleet where he was deputy director of the institute for eight years and then managed a division. The main result of the work of this period was the development by the division's collective, under the leadership and with the direct participation of N. A Rzhanitsyn and in collaboration with a number of production organizations, of a new system for improving the navigational conditions of rivers.

Since 1952, parallel with his main work, he has taught at MGU imeni M. V. Lomonosov and then at MISI/Moscow Construction Engineering Institute imeni V. V. Kuybyshev/.

In 1958 he defended his doctoral dissertation "Hydrologic and Morphometric Characteristics of Lowland Rivers." In 1960 he was awarded the title of professor.

In 1962 Nikolay Aleksandrovich was transferred to work at the University of Friendship of the Peoples imeni P. Lumumba and selected for the job of head of the department of Hydraulics and Hydraulic Work.

N. A. Rzhanitsyn is a well-known scholar in the fields of river hydraulics, hydrology, and river-bed processes. His work is concerned with the problems of the theory of river-bed processes, the construction of a river network of unstable motion, and the movement of water through natural channels. He has published 40 works on these questions including four monographs containing new scientific trends in the theory of river network and river-bed processes. Individual treatises of his have been presented at international congresses. He also has four patents for his inventions. During the last ten years he has conducted a large amount of scientific research on the problem of developing the Karakum Canal imeni V. I. Lenin.

N. A. Rzhanitsyn is a member of the academic councils of the department and university, a member of the commission for the protection of resources of the state committee for science and technology under the USSR Council of Ministers, a member of the specialization academic council of the Moscow Hydraulic Development Institute, a member and consultant of the technical council of the RSFSR Ministry of the River Fleet, a member of the International Association of Hydraulic Studies and a member of the Soviet national committee of this association. He is also a consultant to the USSR Ministry of Water Resources, the USSR Ministry of Power, and Gosplan USSR.

His party and public work has been marked by Oktyabr'skiy and Cheremushkinskiy diplomas of the RK/republic committee/ CPSU and entered on the rayon honor roll.

In 1967, for great contributions to the work of preparing highly-skilled specialists for the developing countries and in connection with the 5th birthday of the university, N. A. Rzhanitsyn was awarded the Badge of Honor. In 1974 for distinguished contributions to the development of domestic science and technology and also in connection with the 40th anniversary of his scientific and teaching activities, he was awarded the title of "Honored RSFSR Scientist and Engineer." In 1968, for working out problems on the development of the Karakum Canal and in training national scientific personnel, he was awarded the diploma of the Presidium of the Supreme Soviet of the Turkmen SSR. He was also awarded diplomas of the USSR Ministry of Higher and Secondary Specialized Education, the RSFSR Ministry of the River Fleet, an AUCCTU diploma, and medals.

In noting the 70th birthday of Nikolay Aleksandrovich Rzhanitsyn, the scientific hydraulic engineering community and the editorial staff of the magazine GIDROTEKHNICHESKOYE STROITEL'STVO cordially congratulate him on his glorious jubilee and sincerely wish him good health and further success in developing the science of hydraulic engineering.

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CSO: 1822

FUELS AND RELATED EQUIPMENT

UDC 662.767.004.14.003

GAS SUPPLY SYSTEM UNIFIED

Moscow GAZOVAYA PROMYSHLENNOST': EKONOMIKA GAZOVOY PROMYSHLENNOSTI in Russian No 5, 1979 pp 15-18

[Article by I. G. Barkhudaryan and E. S. Kotanyan, VNIIEgazprom: "Analysis of the Gas Consumption in the Transcaucasus Republics"]

[Text] Natural gas has become a basic form of fuel in the Transcaucasus economic region: one-third of the consumers have their needs satisfied through gas. The major consumers of natural gas are industry as a whole and enterprises of the chemical, metallurgical and building materials industries. It is interesting to analyze the gas consumption that has actually been established by the consumers of the Transcaucasus republics during the last few years (1974-1977).

The proportion of gas consumption by industry individually for the Transcaucasus republics is approximately identical: in the Armenian SSR--76 percent, in the Georgian SSR--78.6 percent and in the Azerbaijan SSR--76.1 percent. This proportion is not maintained, however, if one considers industry without including the power engineering sector, which is the largest gas consumer: in the Armenian SSR--48.1 percent, in the Georgian SSR --56.8 percent and in the Azerbaijan SSR--30.7 percent. This disproportion in gas consumption stems primarily from the fact that a dissimilar amount of gas goes to the share of power engineering. For example, in the Azerbaydzhan SSR power engineering consumes almost half of the gas consumed by the entire republic (45.4%), while in the Armenian SSR it is 28.0 percent and in the Georgian SSR--21.8 percent.

No substantial differences are observed in the indicators for the relative proportion of gas consumed for municipal and everyday service consumers of the Transcaucasus republics. The relative proportion of this category of consumers constitutes 22-25 percent of the gas consumption by all the republics.

The second major gas consumer for the Transcaucasus is the chemical industry, which has developed particularly in Armenia and Azerbaijan (Table 1). In this sector gas is consumed both as a raw material and as fuel. In the Georgian SSR ferrous metallurgy is the second major consumer.

Table 1. Structure of Gas Consumption by the Transcaucasus Republic Industry, in %

Sector of Industry	Arm SSR	Georg SSR	Az SSR
Industry as a whole	100.0	100.0	100.0
Including:			
power engineering	37.0	27.7	59.5
building materials	9.8	14.9	5.9
chemical, petrochemical	23.0	14.5	18.9
nonferrous metallurgy	8.9	--	--
ferrous metallurgy	--	26.1	3.0
food	6.6	5.0	2.0
machine building and electrical equipment	7.1	4.0	6.7
other sectors	7.6	7.8	4.0

In the Armenian SSR, in contrast to the other republics of the Transcaucasus, nonferrous metallurgy has been developed. In this industry about 45-50 percent of the total amount of gas is used in the aluminum and copper-smelting industry, and the remaining portion of the gas is used in other subsectors.

The building materials industry is one of the main sectors of industry in the Transcaucasus republics. This sector is more developed in the Georgian SSR and the Armenian SSR, however. It must be noted that in the building materials industry the percentage of use of gas for nonindustrial needs is high: approximately 80 percent goes to roasting and drying furnaces.

The machine building and electrical equipment sector of industry holds third place in gas consumption in the Azerbaijan SSR. Natural gas is used in machine building mainly in the processes of smelting, heating and forging metal.

The food industry may also be included as a developed sector in the Transcaucasus. It is more developed in the Georgian SSR and Armenian SSR, where the gas consumption is respectively 6.6 and 5.0 percent of the consumption by all of industry. In this sector the proportion of gas used for industrial processes is slightly less than 50 percent.

The rest of the sectors of industry, grouped as others, consume a negligible amount of gas individually, and therefore are not considered in differentiation.

An analysis of the dynamics of the actual gas consumption by basic categories of consumers in the Transcaucasus republics showed that in 1976 some indicators for the industrial sector were reduced. This because, during the winter period, due to the sharp drops in temperature of the outer air and emergency situations at the GTS, many industrial enterprises were converted to reserve types of fuel for the purpose of normal provision of gas for facilities in the municipal and everyday service sector.

Table 2. Values of Coefficients of Seasonal Irregularity in Gas Consumption by the Major Consumers of the Transcaucasus Republics

Consumer	Months											
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Machine building	1.54	1.45	1.37	0.98	0.71	0.64	0.60	0.58	0.63	0.74	1.17	1.59
Chemical industry	0.95	0.82	1.08	1.01	1.07	1.02	0.97	1.02	0.85	1.01	1.07	1.13
Building materials industry	0.88	0.98	1.08	1.01	1.04	0.96	0.93	0.96	0.93	1.02	1.10	1.11
Food industry	1.54	1.38	1.23	0.85	0.62	0.55	0.62	0.61	0.77	0.95	1.26	1.62
Municipal-everyday service sector	1.95	1.70	1.65	0.75	0.42	0.35	0.38	0.37	0.39	0.50	1.44	2.10
On the whole for the national economy	1.03	0.98	1.09	1.04	1.05	0.99	0.88	0.86	0.93	1.00	1.04	1.11

The main portion of the gas consumption, as was shown above, falls to power engineering, but in the last few years a certain reduction in the consumption has been observed. This situation resulted in a reduction in the gas consumption indicators by the entire industry. This had no effect, however, on the growth rates of the republics' national economy (1.05-1.10), since gas consumption in the municipal-everyday service sector is growing.

Restrictions in the consumption of gas by the power engineering sector, particularly in the Armenian SSR and the Georgian SSR, are connected with the fact that the facilities of this sector are converting to reserve fuel (mazut) primarily. This group of consumers should be supplied with gas, however, in the first place, from the standpoint of the efficiency of using gas relative to other types of fuel [1], and in the second place, from the standpoint of environmental protection. The latter is very important for the Transcaucasus republics, particularly Armenia and Georgia, where the facilities of the power engineering sector are located in areas that are close to housing tracts.

The results of the analysis of the actual gas consumption by the sectors of the national economy are used in predicting gas consumption, especially its regime indicators. At the same time there is widescale use of methods of studying the dynamic series in the preceding period with the corresponding processing of the data analyzed. The predictive indicators characterizing the gas consumption conditions were determined by means of the Wald-Persons methods, making it possible to find the values of the adjusted coefficients of the seasonal irregularity by eliminating the growth dynamics and random fluctuations that distort the normal course of the seasonal wave [2].

The algorithm for calculating the coefficients of the seasonal irregularity for gas consumption by the basic categories of consumers was executed on a YeS-1020 computer (Table 2). The indicators of the seasonal irregularity for gas consumption are necessary for a correct solution to the problem of choosing the most economical methods of regulating the irregularity or their optimum combination, particularly in studies to determine the gas volumes for reserve systems.

There must be a further improvement in the structure of gas consumption, based on the economic efficiency of using natural gas, a detailed analysis of the fuel consumption regimes and a better substantiated approach to working out measures for conversion of industrial enterprises to reserve fuel.

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[8144/1710-12151]

FUELS AND RELATED EQUIPMENT

UDC 553.981.2:550.8

SUMMARY RESULTS OF GEOLOGICAL EXPLORATION WORK FOR GAS IN THE USSR IN 1978

Moscow GEOLOGIYA, BURENIYE I RAZRABOTKA GAZOVYKH MESTOROZHDENIY in Russian No 6, 1979 pp 16-27

[Article by N. P. Grishin, Ministry of the Gas Industry, Ye. V. Kudryashov, VNIIEgazprom, I. A. Blinnikov, USSR Ministry of Geology, and A. S. Fokin, Ministry of the Petroleum Industry]

[Text] In 1978--the third year of the 10th Five-Year Plan--intensification of geological prospecting work for gas in the USSR was specified in the north of Tyumenskaya Oblast, in Eastern Siberia, the Yakut ASSR, Arkhangel'skaya Oblast, the Komi ASSR, Central Asia and the Kazakh SSR (the border zones of the Caspian basin).

In addition, new gas deposits were sought and prospected in old gas-extractive regions: in the Ukraine, the Northern Caucasus and the Ural-Volga region.

As the result of the geological prospecting work, the plan for increase in natural gas on the whole for the country was fulfilled by 114 percent.

The main increase (81.8%) was obtained in the regions of the north of Tyumenskaya Oblast. The gas reserves have increased in the Komi ASSR, Central Asia and the Ukrainian SSR.

In 1978, 35 new natural gas deposits were discovered, including 15 in the European part of the USSR and 20 in the Asian part. Of the deposits discovered, 15 are gas, 14--gas condensate, 4--oil and gas, and 2--oil and gas condensate (Table 1).

Two deposits were discovered in the Komi ASSR--the Prilukskoye (gas) and the Yugidskoye (oil and gas); in the Ural-Volga region--four deposits--the Sovkhoznoye and Soldatsko-Stepnovskoye (gas), Mechetkinskoye (gas condensate) and Rodnikovskoye (oil and gas); in Krasnodarskiy Kray two gas condensate deposits were discovered: the Yuzhno-Serdyukovskoye and Novo-Leninodarskoye; in Western Siberia--six: the Antipayutinskoye, Gydanskoye, Ust'-Tasel'skoye, Yuzhno-Samburgskoye, Vostochno-Urengoyskoye (gas condensate) and Toplorskoye (oil and gas condensate). One gas condensate deposit--the Verkhne-Chonskoye

--was discovered in Eastern Siberia and one oil and gas deposit (Kalamandyn) in the Azerbaydzhan SSR. Six new deposits were discovered in the Ukrainian SSR--the Shumskoye (gas), Sementsovskoye, Svetilchnoye, Koshevoyskoye, Ozeryanskoye (gas condensate), Kulichikhinskoye (oil and gas condensate), and in the Kazakh SSR--three deposits: Tamady (gas), Kasimbay (gas condensate) and Zhanazhol (oil and gas). The largest number of deposits were discovered in Central Asia: two in Uzbekistan--the Markovskoye and Zapadnoye Khodzhi (gas condensate), and eight in Turkmeniya--the Keymir (gas condensate), and the rest were gas--the Stikhiynoye, Malayskoye, Shorkel'skoye, Uchadzhinskoye, Seyrabskoye, Vostochno-Tedzhenskoye and Gagarinskoye.*

Table 1

Region	Total	Deposits			
		Gas	Gas condensate	Oil-gas	Oil-gas condensate
USSR	35	15	14	4	2
Including:					
European part	15	4	7	3	1
Asian part	20	11	7	1	1
RSFSR	15	6	6	2	1
Komi ASSR	2	1	-	1	-
Ural-Volga region	4	2	1	1	-
Krasnodarskiy Kray	2	-	2	-	-
Western Siberia	6	3	2	-	1
Eastern Siberia	1	-	1	-	-
Azerbaydzhan SSR	1	-	-	1	-
Ukrainian SSR	6	1	4	1	1
Kazakh SSR (Mangyshlak)	3	1	1	1	-
Turkmen SSR	8	7	1	-	-
Uzbek SSR	2	-	2	-	-

The characteristics of the deposits according to the results of testing the wells discovered first are given in Table 2.

In addition, at the deposits discovered earlier, individual gas beds were discovered that substantially increase the promising nature of their gas-content. In the north of Tyumenskaya Oblast at the Kruzenshternskoye deposit two gas condensate and two gas beds were discovered, confined respectively to the strata TP, TP_{10}, PK_{11} and PK_{12} of the Lower Cretaceous deposits, and at the Bovanenkovskoye deposit--a new gas condensate bed at

* A new exploratory well 12 was sunk at the Gagarinskoy structure of the Turkmengazprom in 1977, as the result of a review of the geological data obtained by the Ministry of the Petroleum Industry when performing research work in the 1960's. This well revealed a productive horizon X in the carbonaceous mass of the Upper Jurassic period, and when tested, an industrial gas flow was obtained.

stratum TP_{II}, which considerably increases the gas and condensate reserve of these deposits. In the Komi ASSR at the Zapadno-Soplyasskoye deposit, the western part of the Pechoro-Kozhvinskiy arch, a gas condensate bed was revealed at the Middle Devonian level. An inflow of gas with condensate was obtained from a range of 4036-4265 meters. The gas yield was 450,000 m^3 a day.

Three beds were found in the Yakut SSR at the Mastakhskoye and Sredne-Tingskoye deposits.

In Permskaya Oblast a gas bed was revealed in the Bobrikovskiy horizon at the Altykovskoye deposit (range 177901782 meters, yield 310,000 m^3/day, diameter 19 mm at the flow regulator).

A gas bed was discovered at the Kalamkaskoye deposit in the Kazakh SSR. Here, upon checking the Aptian deposits at well 10 a spout of gas with a yield of 40,000 m^3/day was obtained at a flow regulator 26 mm in diameter. The horizon to which this bed was confined is still being traced at a number of wells at the deposit.

It should also be noted that in the region of the ultradeep Bikzhal'skaya well, on the Ul'kentob area, when an exploratory well 2 was drilled, with a depth of 5,140 meters, a spout of oil with gas was obtained (60-70 m^3/ /day), from subsalt carbon deposits. This fact again confirms the promising nature of the oil- and gas-bearing capacity of the southeastern rim of the Caspian basin.

In Krasnodarskiy Kray at the Kuznetsovskoye gas deposit, at well 3 with a depth of 4,631 meters, from the subsalt mass of the Upper Jurassic period (Batskiy stage) an ejection of gas with a yield of 8-10 million m^3/day occurred. (visual.) At present the well is giving 350,400,000 m^3/day and 20 tons of condensate.*

Obtaining industrial inflows of gas from the deposits of the Basal horizon of the Lower Cretaceous period (range 1,369-1,375 meters) at the Beysugskoye deposit in Krasnodarskiy Kray is important in principle. The gas yield from these deposits at well 25 was 179,000 m^3/day at a flow regulator 10 mm in diameter.

Gas with a yield of 102,000 m^3/day was obtained through a flow regulator 12 mm in diameter at the Russkiy Khutor deposit (Northern Caucasus) at well 96 from stratum VI of the Maykopskoye deposits (1,640-1,648 meters).

In the Azerbaydzhan SSR at the deposits at Kalamandyn, two gas beds were revealed in the upper part of the productive strata (range 1,311-1,256 meters, yield 69,000 m^3/day, using a flow regulator 7 mm in diameter, range 1,126-1,074 meters, yield 50,000 m^3/day, through a flow regulator 9 mm in diameter).

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* According to the conclusion of a number of authors--white oil.

Table 2.

Deposit	Location	Preliminary estimate of deposits, bill. m^3	Results of testing wells
1	2	3	4
1. Prilukskoye gas condensate	Komi ASSR	3-5	In well 1 from sandstones of the Upper Devonian (Pashinskiy horizon) in a range of 2007-2108 m, a gushing inflow of gas with condensate with a yield of 54,000 m^3/day through a nozzle 12 mm in diameter
2. Yugidskoye oil, gas	Komi ASSR	3-5	In well 52, on testing the deposits of the Middle Devonian Period in a range of 3090-3104 m, oil obtained with a yield of 192 m^3/day, through a nozzle 13 mm in diameter
3. Sovkhoznoye gas	Volgogradskaya Obl., Bugrinsko-Shadzhinskaya zone of salt domes of Caspian basin	not estimated	In well 1 from Triassic deposits (range 2785-2788 m) a gas inflow was obtained with a yield of 17,000 m^3/ /day through a nozzle 8 mm in diameter and from a range of 2772-2767 m--334,000 m^3/ /day using a nozzle 11 mm in diameter.
4. Soldatsko-Stepnovskoye gas	Volgogradskaya Obl., Rim zone of Caspian basin	0.12	In well 1 from Artinskian deposits (range 2647-2652 m) a flow of gas was obtained with a yield of 289,000 m^3/ /day through a nozzle 15 mm in diameter
5. Rodnikovskoye oil, gas	Saratovskaya Obl., within Ilovlinsko-Peskovatskiy swell	not estimated	In well 43 from terrigenous Devonian deposits (strata D_2-y) in range of 3378-3380 m oil spout obtained w. yield of 36 m^3/day, gas--5,000,000 m^3/day, nozzle 6 mm in diam.

1	2	3	4
6. Mechetkinskoye gas condensate	Saratovskaya Obl., southern rim of Markovskaya depression	not estimated	In well 1 from the Upper Devonian deposits (Kynovsko-Pashiyskiy horizon) with a depth of 2602-2658 m, flow of gas with condensate obtained. Well being studied
7. Antipayutinskoye gas	Tyumenskaya Obl., Gydanskiy oil-gas-bearing region	150	In well 1 in the Senoman deposits from a range of 1018-1025 m, a gas flow was obtained with a yield of 240,000 m^3/day through a nozzle 18 mm in diameter
8. Gydanskoye gas	Tyumenskaya Obl., Gydanskiy oil-, gas-bearing region	120	In well 1, when testing Upper Cretaceous deposits (Tonopchinskiy formation) in a range of 1522-1520 m a gas spout was obtained with a yield of 141,800 m^3/day through a nozzle 9 mm in diameter
9. Yuzhno-Samburgskoye gas condensate	Tyumenskaya Obl.	300	In well 154 upon testing stratum B_4-14 (range 3208-3218 m), a gas spout with condensate was obtained with a gas yield of 193,000 m^3/day, through a nozzle 10 mm in diameter
10. Vostochno-Urengoyskoye gas condensate	Tyumenskaya Obl.	150	In well 301 upon testing stratum BU_{16} in a range of 3218-3226 m, a spout of gas with condensate was obtained with a yield of 300,000 m^3/day through a nozzle 10 mm in diameter
11. Toplopskoye oil-gas-condensate	Tyumenskaya Obl.	18	In well 8 upon testing the stratum in a range of 2024-2041 m, a spout of gas was obtained with a yield of 800,000 m^3/day through a nozzle 18 mm in diameter from strata 10_2 and 10_3

1	2	3	4
12. Ust'-Taselskoye gas	Tyumenskaya Obl.	65	In well 2 upon testing stratum 10_3 (range 2738-2743 m) a gas flow was obtained with a yield of 260,000 m^3/day through a pipe 37 mm in diameter
13. Verkhne-Chonskoye gas condensate	On border of Irkutskaya Obl. Yakut SSR	50	In well 122 upon testing the deposits of the lower-Motskiy member (range 1572-1576 m) a spout of gas was obtained with a yield of 300,000 m^3/day, through a nozzle 31 mm in diameter
14. Kalamadyn	Azerbaydzhan SSR, Northwestern part of Nizhne-Kurinskaya basin	not estimated	In well 3 from the upper part of the productive strata (range 1481-1398 m) a gas flow was obtained with a yield of about 70,000 m^3/ /day, through a nozzle 7 mm in diameter, and from a range of 1367-1362 and 1254-1330 m oil and gas were obtained with a yield of 12 m^3/day using a nozzle 5 mm in diameter
15. Sementsovskoye gas condensate	Poltavskaya Obl., in region of Obazovskoye deposit	not estimated	
16. Svetlichnoye gas condensate	Chernigovskaya Obl.	"	In well 1 upon testing the hard coal deposits (horizon C-26) a gas flow was obtained with a yield of 32,000 m^3/day using a nozzle 10 mm in diameter. From a range of 3825-3877 m gas was obtained with a yield of 590,000 m^3/day and condensate --230 m^3/day through a nozzle 14 mm in diameter.

1		2	3	4
18.	Shumskoye gas	Poltavskaya Obl., northern rim part of Dneprovsko-Donetsk basin	5	In well 16 at a range of 4590-4603 m, upon testing the Visean deposits a gas spout was obtained with a yield of 698,000 m^3/day through a nozzle 18 mm in diameter
19.	Ozeryanskoye gas condensate	Chernigovskaya Obl., joining of southern rim and central zones of Dneprovsko-Donetsk basin	1.1	In well 6 at ranges of 4366-4375 m, 4380-4385 m upon testing Lower Visean deposits a gas and condensate flow was obtained with a yield of 22,000 m^3/day through a nozzle 4 mm in diameter
20.	Koshevoyskoye gas condensate	Poltavskaya Obl., central part of Dneprovsko-Donetsk basin	0.8	In well 107 upon testing the Lower Visean deposits (range 5572-5622 m, 5315-5475 m), a gas flow was obtained with a yield of 73,000 m^3/day and 10.9 m^3/day of condensate through a nozzle 6 mm in diameter
21.	Zhanazhol oil-gas condensate	Kazakh SSR, Aktyubinskaya Obl., eastern rim of Caspian basin	not estimated	In well 4 upon testing the Middle Carboniferous deposits (range 2800-2900 m) gas was obtained with a yield of 174,000 m^3/day through a nozzle 14 mm in diameter, and condensate--4.9 m^3/day
22.	Kasimbay gas-condensate	Kazakh SSR, Gur'yevskaya Obl, southeastern rim of Caspian basin	1	In well 1 at a range of 1715-1725 m upon testing Upper Jurassic deposits, a spout of gas was obtained with a yield of 282,000 m^3/day through a nozzle 14 mm in diameter, and of condensate --4.9 m^3/day
23.	Tamdy gas	Kazakh SSR, Mangyshlak penin., within northern slope of Karabogazskiy arch	not estimated	In well 2 upon testing Lower Cretaceous deposits (range 1908-1912 m) gas flow was obtained with a yield of 330,000 m^3/day through a nozzle 25 mm in diameter

1		2	3	4
24.	Uchadzhinskoye gas	Turkmen SSR, Maryyskaya Obl.	40-50	In well 3 upon testing the Lower Cretaceous Karabilskiy sandstones (range 2513-2520 m) a gas flow was obtained with a yield of 1-1.1 million m^3/day through a nozzle 20 mm in diameter
25.	Vostochnyy Tedzhen gas	Turkmen SSR, Maryyskaya Obl.	2	In well 1 from Lower Cretaceous Karabilskiy sandstones (range 3808-3814 m) a gas flow was obtained with a yield of 1.1 million m^3/day through a nozzle 20 mm in diameter
26.	Stikhiynoye gas	Turkmen SSR, Chardzhouskaya Obl.	2	In well 1 upon testing carbonate deposits of the Upper Jurassic (VIII horizon) from a range of 2865-2853 m a gas and water flow was obtained with the gas yield through a nozzle 20 mm in diameter 20,000 m^3/day. Horizons IX and X, and also the Lower Cretaceous I-V according to coring data are described as water-bearing
27.	Malayskoye (gas)	Turkmen SSR, Chardzhouskaya Obl.	25	In well 1 from the Callovian-Oxford deposits (range 3603--3625 m) a gas flow was obtained with a yield of about 600,000 m^3/day through a nozzle 18 mm in diameter
28.	Shorkel', gas	Turkmen SSR, Maryskaya Obl.	10	In well 1 from the Karabil'skiy formation in a range of 3760-3722 m a gas flow was obtained with a yield of 1,100-1,200,000 m^3/day through a nozzle 18 mm in diameter

1	2	3	4
29. Gagarinskoye gas	Turkmen SSR, Chardzhouskaya Obl.	50	In well 12 from limestones of horizon X of the Upper Jurassic period in a range of 3135-3148 m a gas flow was obtained with a yield of 1 million m^3/day through a nozzle 24 mm in diameter. The gas contains H_2S-0.55% vol., CO_2--0.73% vol.
30. Seyrab gas	Turkmen SSR, Maryyskaya Obl.	40-45	In well 2 upon testing Karabil'skiy sandstones of the Lower Cretaceous period (range 2528-2538 m) a gas flow was obtained with a yield of 1.1 million m^3/day through a nozzle with a diameter of 20 mm, and condensate content--traces
31. Keymir gas condensate	Turkmen SSR, Gogran--okaremskiy region	1.5	In well 1 from the lower red deposits of the Pliocene in a range of 2961-2966 m, 2981-2899 m, gas flows were obtained with a yield of 300-350,000 m^3/day and of oil with a yield of 80 m^3/ /day through a nozzle 10 mm in diameter
32. Markovskoye gas condensate	Uzbek SSR, Kashkadar'inskaya Obl.	10	In well 1 of Upper Jurassic limestones (range 2716-2723 m) a gas spout was obtained with a yield of 750,000 m^3/day through a nozzle 20 mm in diameter. The gas contains H_2S--3.5% and CO_2-2.4%, and of condensate--13.5%.
33. Zapadnoye Khozhi, gas condensate	Uzbek SSR, Bukharskaya Obl.	5	In well 1 upon testing the Upper Jurassic carbonaceous deposits (range 2192-2200 m) a gas spout was obtained with a yield of 122,000 m^3/day through a nozzle 8 mm in diameter. The gas contains H_2S, CO_2 and condensate.

1	2	3	4
34. Yuzhno-Serdyukovskoye gas condensate	Krasnodarskiy Kray	not estimated	In well 1 upon testing deposits of the Albian stage in a range of 2705-2720 m a gas flow was obtained with a yield of 14,900 m^3/day using a nozzle 6.3 mm in diameter. The gas contains a small amount of condensate.
35. Novo-Leninodarskoye	Krasnodarskiy Kray	not estimated	In well 2 upon testing the basal horizon of the Lower Cretaceous period (range 2530-2504 m) a gas flow was obtained with a yield of 153,000 m^3/day using a nozzle 8 mm in diameter. The condensate yield was 6.8 m^3/day.

A considerable number of gas beds were revealed at deposits in the Ukraine. A new gas bed in the Tournaisian deposits (well 17) was discovered in Poltavskaya Oblast at the Anastas'yevskoye deposit. From a range of 4800-4815 m the gas yield was 158,000 m^3/day, and the condensate yield--343 m^3/day through a nozzle 16 mm in diameter. At the Churovskoye deposit, by drilling well 25, the gas-bearing area of the carboniferous deposits of the Lower Permian period was considerably expanded. Upon testing the well at ranges of 3320-3340 m, 3154-3170 m and 3040-3060 m, a gas flow was obtained with a yield of 100,000 m^3/day using a nozzle 10 mm in diameter. At the Khar'kovtsevskoye oil deposit (well 10) a new gas bed was revealed at horizon C-20 in a range of 4995-5020 m. The gas yield was 377 and condensate yield 73 m^3/day through a 10 mm nozzle. In Khar'kovskaya Oblast at the Druzhelyubovskoye gas deposit in Middle Carbonaceous deposits (formation C_2^7) a gas bed was discovered (well 8) in ranges of 1767-1776 m and 1744-1755 m with yields of 57,700 and 200,000 m^3/day using a 10 mm nozzle. In the western regions of the Ukraine at the Lukvinskoye oil deposit in the Borislavsko-Pokutskaya zone of the Ciscarpathian foredeep in well 1 a gas bed was discovered in the menilite deposits at ranges of 1030-1065 and 1070-1125 m with yields of 150,000 m^3/day each using a 13 mm nozzle. At the Lelyakovskoye deposit (Chernigovskaya Oblast) a gas bed was discovered in the Visean deposits. The gas yield from a range of 3636-3642 m was 117,000 m^3/day using a nozzle 5 mm in diameter.

In the Uzbek SSR three gas beds were discovered. One--at the deposit at Zapadnyy Barsekel'mes--within the confines of the Ustyurt plateau--upon testing at the parametric well 1 of the Middle Jurassic deposits; from a

range of 2798-2815 m the gas and condensate flow respectively was 74 and 3.6 m^3/day using a 14 mm nozzle. The second was at the deposit at Shurtan in the Bukharo-Khivinskaya oil- and gas-bearing region, as the result of testing at well 17 the carboniferous deposits of the Upper Jurassic period (reef horizon XV). The gas here was obtained from a range of 3514-3520 m (yield 297,000 m^3/day, using a 24 mm nozzle) in the depressed mass of the structure, located 300 m below the contact of the gas-water of the main bed.

At the deposit at Umid there was confirmation of the assumption of a high hypsometric position of the roof of the reef mass at the place where well 9 was sunk, which makes it possible to assume an extension of the boundaries of the reef mass in its western part and an increase in the industrial importance of the deposit.

At the Baryk deposit (Ferganskaya valley) at stratum V of the Paleogene (range 3547-3557 m) well 1 obtained gas with a yield of 300,000 m^3/day using a nozzle 10 mm in diameter.

Gas from paleogenic deposits (strata V, Vi, VII) was obtained at a number of wells at the Northern Karakchikum deposit at ranges of 3576 -3580 m, 3622-3624 m and 3682-3684 m with yields from 10 to 80,000 m^3/day, and of condensate--from 23 to 95 m^3/day.

In Eastern Turkmeniya south of the Donmez deposit at parametric well 25 a spout of gas with a yield of 711,000 m^3/day was obtained using a nozzle 18 mm in diameter from Goterivskiy sandstones (Karabil'skaya formation). Right here on the northern slope of the Dauletabadskoye deposit parametric well 24 and exploratory well 21 were sunk, in the cross section of which the Goterivskiy sandstones are characterized according to field-geophysical data as gas-bearing, which considerably increases the promise for the presence of gas in this region.

A favorable coring of the Cretaceous cross section was also obtained at exploratory well 1 at the Kulachskaya area in the Turkmen SSR.

In Western Turkmeniya gas beds were discovered at the deposits at Barsa-Gel'mes and Erdekli. At the Barsa-Gel'mes deposit gas was obtained in the middle-red deposits from a range of 4969-4964 m with a yield of 72,000 m^3/day through a nozzle 10 mm in diameter, and at Erdekli from an akchagyla (range 2242-2248 m). The gas flow here was greater--149,000 m^3/day using a similar nozzle.

In 1978 calculations were made that substantiated the gas reserve at the Astrakhan gas condensate deposit. According to the condition on 1 April 1978 they are estimated at 802 billion m^3 for category C_1 and C_2, including 56.4 billion m^3 for C_1.

The most important results of 1978 are as follows:

1. Discovery of the Antipayutinskoye and Gydanskoye gas deposits on the Gydanskiy peninsula. These are the first deposits within the limits of the Gydanskiy megaswell. A new direction in exploratory-prospecting work for gas in Tyumenskaya Oblast is involved in their discovery.

2. Obtaining a powerful flow of gas in the Middle Jurassic deposits at the Kuznetsovskoye deposit opens great perspectives (a new prospecting object) for further direction of geological prospecting work in Krasnodarskiy Kray.

3. Revealing new gas beds at the Kurzenshternskoye and Bobanenkovskoye deposits, in addition to increasing the reserves, confirms the perspectives for the presence of gas at the Goteriv-Aptian sedimentary complex on the territory of Yamal.

4. The discovery of gas deposits at Uchadzhi and Seyrab, confined to the large Uchadzhi-Kulachskiy arch with a series of local elevations along the regional Repettian fault gives every basis for counting on the discovery, in this region of Western Turkmeniya, of new gas deposits in both the Lower Cretaceous and the Jurassic deposits.

The discovery of the Gagarinskoye deposit within the limits of the Eastern Uchadzhinskiy arch in the northern part of the Amu Darya syneclise is important in principle.

Therefore, as the result of the geological prospecting work in 1978, true prerequisites have been created for a further increase in the raw material base of the gas industry.

[8144/1712-12151]

FUELS AND RELATED EQUIPMENT

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WHOLESALE INDUSTRIAL PRICES FOR HEATING OIL

Moscow KHIMIYA I TEKHNOLOGIYA TOPLIV I MASEL in Russian No 7, Jul 79 pp 24-27

[Article by B.N. Davydov and L.T. Artyukhova, All-Union Scientific Research Institute of the Petroleum Industry]

[Text] A knowledge of the level and relationship of wholesale prices for the most important types of interchangeable energy-producing fuel -- coal, gas and oil -- is of great value in helping us make rational use of fuel and energy resources. Until recently, the gap between the prices for heating oil and energy-producing coal was being narrowed. For instance (using figures converted to standard fuel), throughout the nation in 1951 the wholesale prices for oil were higher than those for energy-producing coal by an average factor of 1.5. By 1954 this factor had decreased to 1.4, and by 1956 to 1.25. After the wholesale prices were reformed (in 1966-1967), the relationship of the prices at the points of consumption, for the country as a whole, were (in percentages): coal -- 100, gas -- 89, oil -- 102.

Although on the average oil is more expensive than coal under the industry's prevailing wholesale prices, an analysis of the level and relationship of the prices for energy-producing fuel on a territorial basis (Table 1) showed that in most regions of the country (14 out of 19) the wholesale prices for oil are lower than those for coal and range from 66.3 percent of the latter in the Northwestern region to 90.2 percent in the Donetsko-Pridneprovskiy region. Only in the eastern parts of the country (Kazakhstan, the Urals, Siberia, the Far East) do the prices for oil range from 6 percent (the Far Eastern region) to 150.3 percent (Eastern Siberia) higher than coal prices. It is obvious that the indicated relationships of the prices for interchangeable types of fuel contributed to the change in the structure of this country's fuel balance and the

Table 1. Effective Wholesale Prices for Various Energy-Producing Fuels

Район потребления (1)	Оптовые цены, руб.-коп. за т.* (2)			Соотношение оптовых цен, % (6)	
	уголь (3)	газ (4)	мазут (5)	газ (4)	мазут (5)
Северо-Западный (7)	25·84	18·96	17·13	73,3	66,3
Центральный (8)	21·43	17·78	17·13	83,0	79,9
Волго-Вятский (9)	19·99	16·81	17·13	84,1	85,7
Центрально-Черноземный (10)	20·91	15·97	17·13	76,4	81,9
Поволжский (11)	19·51	15·97	17·13	81,8	87,8
Северо-Кавказский (12)	19·49	12·11	17·13	62,1	87,9
Уральский (13)	15·64	13·88	17·13	88,7	109,5
Западно-Сибирский (14)	10·90	9·24	18·22	84,8	167,2
Восточно-Сибирский (15)	7·72	11·76	19·32	152,3	250,3
Дальневосточный (16)	20·98	14·73	22·24	70,2	106,0
Донецко-Приднепровский (17)	19·00	14·05	17·13	73,9	90,2
Юго-Западный (18)	19·53	15·97	17·13	81,8	87,7
Южный (19)	21·99	17·97	17·13	72,6	77,9
Прибалтийский (20)	21·97	18·82	17·13	85,7	78,0
Закавказский (21)	23·55	18·49	17·13	78,5	72,7
Среднеазиатский (22)	20·76	9·68	17·13	46,6	82,5
Казахстанский (23)	13·27	12·60	17·13	95,0	128,1
Белорусская ССР (24)	22·23	17·65	17·13	79,4	77,1
Молдавская ССР (25)	21·11	16·81	17·13	79,6	81,1
СССР (в среднем) (26)	17·03	15·08	17·37	88,5	102,0

* Цены на уголь приняты за 100%. (27)

Key:
1. Consumption region
2. Wholesale prices (rubles and kopecks per ton of standard fuel)
3. Coal
4. Gas
5. Fuel oil
6. Relationship of wholesale prices, %*
7. Northwestern
8. Central
9. Volgo-Vyatskiy
10. Central Black Earth
11. Povolzhskiy
12. North Caucasus
13. Urals
14. Western Siberia
15. Eastern Siberia
16. Far East
17. Donetsko-Pridneprovskiy
18. Southwestern
19. Southern
20. Pre-Baltic
21. Trans-Caucasus
22. Central Asia
23. Kazakhstan
24. Belorussian SSR
25. Moldavian SSR
26. USSR (average)
27. Prices for coal taken as 100 percent.

increase of the share of oil (fuel oil) and gas in it. From 1961 to 1975 alone, the share of these progressive types of fuel in the total amount extracted increased from 39 to 66 percent [1].

A characteristic feature of this period was the extraction of oil and gas in geographically favorable and inhabited regions.

In combination with low transportation costs, this made oil (fuel oil) and gas the most efficient and widely used types of fuel, on the basis of which many progressive branches of the national economy were further developed. During the Ninth Five-Year Plan, sparsely inhabited regions far from the basic consumers in the eastern part of the country become the main oil production centers. This had a negative effect on the economics of the oil extraction industry, which required significant additional capital investments for the organization of oil extraction and its transportation to the European part of the USSR. These trends continue to operate in the 10th Five-Year Plan and will apparently remain in effect in the future.

Thus, oil is becoming an ever more expensive and difficultly available energy source, so the problem of its more rational utilization is now one of primary importance. It can be solved only by a gradual reorientation of the nation's fuel balance toward the primary usage in power engineering of more readily available energy sources (coal, natural gas and atomic energy) instead of fuel oil. At the present time the share of fuel oil in the structure of petroleum products production is still significant, which causes a reduction in the share of light petroleum products (motor fuels) and the raw materials for petrochemistry that are extremely necessary to the national economy. Significant amounts of light petroleum products (primarily fractions of directly distilled diesel fuel and gas oil obtained by catalytic cracking) are used in the production of low-viscosity fuel oil (M-40), which accounts for 55 percent of commercial fuel oil production (Table 2).

The policy of intensifying oil refining can be maintained only by enlarging the selection of light petroleum products and the share of secondary production processes (catalytic cracking, hydrocracking and so on). The raw material for these processes is vacuum gas oil (350-420°C), which is now a component of commercial fuel oil. This is related to the reduction in the resources of fuel oil that is available for the needs of stationary power engineering. The limitation on the use of fuel oil for energy-producing purposes has also predetermined the necessity of changing the wholesale price policy for interchangeable types of fuel and a closer correlation of the prices for coal and fuel oil with respect to both their common level and the territorial profile.

The significant share and comparatively high cost of extracting and transporting coal insure its dominant position in formulating prices for energy-producing fuels and predetermines the establishment of a new and higher price level for fuel oil, the basis of which is the existing prices for coal, which have been raised an average of 30 percent in order to provide the coal

Table 2. Production Structure and Effective Industrial Wholesale Prices for Grades M-40 and M-100 Heating Oil (All-Union State Standard 10585-75)

Мазут (1)	Доля выработки, % (2)	Оптовая цена промышленности (по 1-му поясу), руб.-коп. [2] (3)
Малосернистый (серы не более 0,5%) (4)	10,8	25,06
в том числе М-40 (5)	1,2	25,50
Сернистый (серы не более 2%) (6)	42,8	23,86
в том числе М-40 (5)	31,1	24,00
Высокосернистый (серы не более 3,5%) (7)	46,4	22,74
в том числе М-40 (5)	22,7	23,00
Итого (8)	100,0	23,47 (в среднем) (9)

Key:
1. Fuel oil
2. Share of production, %
3. Wholesale industrial price (for Zone 1), rubles and kopecks [2]
4. Low-sulfur (no more than 0.5 percent sulfur)
5. Including M-40
6. Sulfurous (no more than 2 percent sulfur)
7. High-sulfur (no more than 3.5 percent sulfur)
8. Total
9. Average

industry with the necessary level of profitability over the next 5-7 years. Calculations showed that when the price of unloaded coal (free at shipment station) is raised 30 percent and transportation costs (3.31 rubles per ton of standard fuel as a nationwide average) remain unchanged, the price for coal at the consumption point will increase by 24 percent.

Allowing for an increase of this scope in coal prices for only two economic regions (Western and Eastern Siberia), the effective prices for fuel oil insure a significant (more than 20 percent) excess in comparison with the prices for coal. In these two regions, the effective wholesale prices for fuel oil are also supposed to be maintained in the future. Calculations for five variants of price increases for fuel oil were made for all parts of the country by VNII NP [All-Union Scientific Research Institute of the Petroleum Industry]. The original variant was the first one, in accordance with which and on the basis of equality of a useful calorie in coal and fuel oil, the price for the latter was projected to be 1.5 rubles/ton of standard fuel[1] higher than the price for coal.

[1]For each economic region, the difference in the consumption

Table 3. Proposed Wholesale Prices for Coal and Heating Oil

Район потребления (1)	Проектируемые цены на уголь, руб./т. у. т. (2)	Предлагаемые цены на мазут (руб./т. у. т.) по вариантам (3)				
		1	2	3	4	5
Северо-Западный (4)	31·10	32·60	29·60	32·60	35·86	38·12
Центральный (5)	26·42	25·92	27·92	27·92	30·71	33·50
Волго-Вятский (6)	24·05	25·55	22·55	25·55	28·10	30·66
Центрально-Черноземный (7)	26·07	27·57	27·57	27·57	30·33	33·08
Поволжский (8)	23·55	25·05	25·05	25·05	27·56	30·06
Северо-Кавказский (9)	25·28	26·78	26·78	26·78	29·46	32·14
Уральский (10)	19·06	20·56	20·56	20·56	22·62	24·67
Западно-Сибирский (11)	13·54	18·22	18·22	18·22	18·22	18·22
Восточно-Сибирский (12)	9·40	19·32	18·32	19·32	19·32	19·32
Дальневосточный (13)	25·83	27·33	27·33	32·80	30·05	32·80
Донецко-Приднепровский (14)	24·33	25·83	25·83	31·00	28·41	31·00
Юго-Западный (15)	24·71	27·21	26·21	31·45	28·83	31·45
Южный (16)	27·87	29·37	29·37	35·24	32·31	35·24
Прибалтийский (17)	27·34	28·84	25·84	28·84	31·72	34·61
Закавказский (18)	29·45	30·95	29·95	30·95	34·05	37·14
Среднеазиатский (19)	25·68	27·18	27·18	27·18	29·90	32·62
Казахстанский (20)	16·34	17·84	17·84	17·84	19·62	21·41
Белорусская ССР (21)	27·90	29·40	26·40	29·40	32·34	35·28
Молдавская ССР (22)	26·34	27·84	24·84	27·84	30·62	33·41
СССР (в среднем) (23)	21·16	26·21	25·45	26·84	28·24	31·24
Соотношение цен, % (24)	100,0	123,9	120,3	126,8	133,5	147,6
Общее повышение цен на мазут, % (25)	—	+50,9	+46,5	+54,5	+62,6	+79,9

Key:
1. Consumption region
2. Projected coal prices, rubles/ton of standard fuel
3. Proposed fuel oil prices (rubles/ton of standard fuel), by variants
4. Northwestern
5. Central
13. Far East
14. Donetsko-Pridneprovskiy
15. Southwestern
16. Southern
17. Pre-Baltic
18. Trans-Caucasus
19. Central Asia
20. Kazakhstan

[Key continued on next page]

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cost between coal and fuel oil is provisionally taken as an average value of 1.5 rubles/ton of standard fuel.

Key to Table 3 [continued]:

6. Volgo-Vyatskiy
7. Central Black Earth
8. Povolzhskiy
9. North Caucasus
10. Urals
11. Western Siberia
12. Eastern Siberia
21. Belorussian SSR
22. Moldavian SSR
23. USSR (average)
24. Relationship, %
25. Total increase in fuel oil prices, %

The other variants for formulating fuel oil prices differ from the first one as follows: in the second variant, the prices for it are projected to be 1.5 rubles/ton less than coal prices in the regions with high fuel oil consumption (Northwestern, Volgo-Vyatskiy, Pre-Baltic, Trans-Caucasus, and Belorussian and Moldavian SSR's); in the third, fuel oil prices are projected to be 20 percent higher than coal prices in those regions where the coal extraction industry has been developed (Far East, Donetsko-Pridneprovskiy, Southwest, South, and Kazakhstan); in the fourth and fifth variants, the wholesale prices for fuel oil were set higher than those for coal by 10 and 20 percent, respectively, for the purpose of creating prohibitive moments in the use of fuel oil. The levels of the proposed fuel oil prices are shown in Table 3, from which it is obvious that when the prices are increased in each economic region in accordance with the five variants under discussion, the total increase (in comparison with the existing level) will be a minimum of 46.5 percent (second variant) and a maximum of 79.9 percent (fifth variant) for the country as a whole.

Of the variants under discussion, the most preferable one is the fourth, in which -- in contrast to the first three -- the fuel oil prices in all the economic regions are of a prohibitive nature and, at the same time, the total increase in the fuel oil prices is must less than in the fifth variant. According to the fourth variant, the total increase in fuel oil prices throughout the country will be 63 percent. In connection with this, the relationship between the proposed prices for coal and fuel oil in the consumption regions will be 100: 133.5 (see Table 3).

However, even after the determination of the level of the wholesale prices for fuel oil in each economic region in accordance with the fourth variant, the improvement in these prices cannot be regarded as completed until the number of price zones for fuel oil has been determined. In view of the necessity of matching their levels, the question of territorial differentiation of prices for interchangeable types of fuel is of no little importance if the following circumstances are taken into consideration.

Table 4. Recommended Zonal Wholesale Prices for Heating Oil

Пояс (1)	Экономический район (2)	Доля потребления мазута, % (3)	Оптовые цены, руб.-коп. (4)		
			расчетные за т. у. т. (5)	предлагаемые	
				за т. у. т. (7)	за т (6) (8)
II	Западно-Сибирский (9)	3,9	18-22	18-00	24-50
	Восточно-Сибирский, Казахстанский (10)	4,5	19-50	19-50	26-50
III	Уральский (11)	8,4	22-62	22-50	31-00
IV	Поволжский (12)	21,0	27-56	27-50	34-50
V	Волго-Вятский, Донецко-Приднепровский, Юго-Западный (13)	12,8	28-45	28-50	39-00
VI	Северо-Кавказский, Среднеазиатский (14)	6,3	29-66	29-50	40-60
VII	Центральный, Центрально-Черноземный, Дальневосточный, Молдавская ССР (15)	18,2	30-60	30-50	42-00
VIII	Прибалтийский, Южный, Белорусская ССР (16)	12,2	32-10	32-00	44-00
IX	Закавказский (17)	5,6	34-05	34-00	46-50
X	Северо-Западный (18)	7,1	35-86	36-00	49-00

Key:
1. Zone
2. Economic regions
3. Share of oil consumption, %
4. Wholesale prices, rubles and kopecks
5. Calculated, per ton of standard fuel
6. Proposed
7. Per ton of standard fuel
8. Per ton
9. Western Siberia
10. Eastern Siberia, Kazakhstan
11. Urals
12. Povolzhskiy
13. Volgo-Vyatskiy, Donetsko-Pridneprovskiy, Southwest
14. North Caucasus, Central Asia
15. Central, Central Black Earth, Far East, Moldavian
16. Pre-Baltic, South, Belorussian SSR
17. Trans-Caucasus
18. Northwest

The wholesale prices for coal have been established as free on rails at the shipment station; consequently, the transportation expenses for shipping coal are paid by the consumer in addition to the price, in view of which the wholesale prices for coal are essentially unique for each consumption region, with their

level ranging from 7.72 to 25.84 rubles/ton of standard fuel (see Table 1). At the same time, the wholesale industrial prices for fuel oil are established as free on rails at the receiving station (that is, allowing for the expense of transporting it) and are differentiated with respect to three zones, with 85, 12 and 3 percent, respectively of the total amount of fuel oil realized in each of them. In connection with this, the gap between the wholesale prices for fuel oil in the second and first zone, which reflects the average transportation expense for delivery of the fuel oil to the consumer, is 3 rubles/ton, while between the third and second zones it is 4 rubles/ton; that is, the maximum territorial differentiation in the prices is 7 rubles/ton.

It is obvious that matching the fuel oil prices and those for coal, while preserving the payment of transportation costs for the latter, requires a more differentiated zonal division of the fuel oil prices. With this goal in mind, regions with proposed fuel oil prices that are approximately the same are grouped into one price zone. When the difference in individual prices by regions is no more than 1 ruble/ton of standard fuel, 10 such zones are determined when the recommended fourth variant for formulating fuel oil prices is used. The average price level has been calculated for each zone (Table 4, allowing for rounding off and the conversion to tons of standard fuel). Here, also, we see the distribution of the economic regions by zones and the share of each zone in fuel oil consumption.

In the new zonal division, the lowest price level for fuel oil (Zone 1) is in the Western Siberian region, while the highest is in the Northwest. In the existing price list the difference between the minimum and maximum zonal prices is 7 rubles/ton, while if the proposed differentiation is made, it will be 24.5 rubles/ton. Fuel oil consumption within the separate price zones will also be much more uniform than before.

The proposed increase in the overall level of wholesale industrial prices for heating oil and their more detailed differentiation should limit the use of fuel oil as an energy-producing fuel. This will create the prerequisites for intensifying oil refining and increase the output of motor fuels and raw materials for petrochemistry; that is, for the better qualified utilization of oil, which is an extremely valuable raw material, the reserves of which are limited. The next stage in improving the wholesale industrial prices for heating oil should be their differentiation according to the fuel oil's basic qualitative characteristics (sulfur content, viscosity and so on), which have the gre test effect on the economics of fuel oil consumption.

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FUELS AND RELATED EQUIPMENT

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ECONOMY OF FUEL AND ENERGY RESOURCES

Moscow KOZHEVENNO-OBUVNAYA PROMYSHLENNOST' in Russian No 6, Jun 79 pp 33-35

[Article by Yu.F. Mel'nikov, chief, Power Engineering and Mechanics Administration, USSR Minlegprom]

[Text] The intensive expansion of production capacities makes increased demands on the development and improvement of the technical state and operation of energy management in enterprises.

In 1978, the tanning and shoe industry's enterprises did a great deal of work to improve the technical state of their basic production equipment, raise the technical level of their energy management operations, and implement a regime of economy of fuel and energy resources.

For example, in 1978 the tanning and shoe enterprises of RSFSR Minlegprom [Ministry of Light Industry] replaced and modernized 14 boilers and connected 2 enterprises to regional heating networks and 3 to gas networks. The power supply system was remodeled at five enterprises that were then converted to operation on a higher voltage. Measures were implemented that also improved the technical state of other installations and equipment that were part of the enterprises' energy management operations.

The realization of this work had an immediate effect on increasing the efficiency and reliability of the basic production equipment, particularly when they were operated under winter conditions.

In 1978 a great deal of attention was given to implementing measures for the organization of a regime of economy of fuel and energy resources. The problem of "Monitoring the Use of Electricity Limits," which also covered a number of other

problems in the branch's automated control system, was solved and the solution was put to use for the first time. The solution of this problem made it possible to improve the planning process and insure operational control over the use of the limits of the electricity allocated for the enterprises' needs.

During the course of the organization and development of socialist competition for economy and thriftiness in the consumption of material, raw material, fuel and energy, and other resources in the collectives of the tanning and shoe enterprises, the workers and engineering and technical personnel made many rationalization suggestions for the improvement of the enterprises' energy management operations and economy in the use of fuel, heat and electricity. For instance, at the Ostashkov Tanning Plant of the Kalininskaya Oblast Tanning Production Association, 10 rationalization suggestions with a total annual economic effect of 32,200 rubles were submitted, while at the Tanning and Shoe Combine imeni V.I. Lenin there were 48 rationalization suggestions with a total effect of 54,500 rubles, at the Leningrad Skorokhod Shoe Production Association imeni Ya.A. Kalinin there were 43 suggestions with a total effect of 37,600 rubles, and at the Tanning and Shoe Combine imeni Komintern there were 42 rationalization suggestions with a total effect of 16,100 rubles. Other examples could also be given.

In 1978, on the initiative of RSFSR Minlegprom, the Presidium of the Central Committee of the Textile and Light Industry Workers' Trade Union and the Presidium of the Scientific and Technical Society's Central Administration, a public competitive review for the best organization of work on energy management operations and the rational use of energy resources at light industry enterprises in the RSFSR.

During the course of the review, attention was turned to the implementation of the plans of organizational and technical measures for economy in fuel and thermal and electrical energy, the state of energy management with respect to observance of the requirements of Gosgortekhnadzor's [RSFSR State Committee of the Council of Ministers for Supervision of Industrial Safety and for Mining Inspection] and Gosenergonadzor's [State Inspection for Industrial Power Engineering and for Power Engineering Supervision] "Rules" and "Norms," the realization of projects established by planned preventive maintenance schedules, and the state of energy managements according to such indicators as the accident and traumatism rates.

A total of 45 production associations and eneterprises participated in this competitive review.

According to the results of the competitive review, the enterprises that had achieved the best results were awarded cash prizes. Among those who received cash prizes were collectives from the following organizations: Skorokhod Shoe Production Association imeni Ya.A. Kalinin, Tanning and Shoe Combine imeni V.I. Lenin, Tanning and Shoe Combine imeni Komintern, and the Novosibirsk Tanning and Shoe Production Association, among others.

The implementation of the organizational and technical measures and the performance of a great deal of work on mobilizing the collectives of RSFSR Minlegprom's tanning and shoe enterprises made it possible to achieve the following savings in 1978: conventional fuel -- 4,329 tons; thermal energy -- 119,331 gigacalories; electricity -- 14.426 million kilowatt-hours.

Analogous work was done by the tanning and shoe enterprises of the Ministries of Light Industry in the Ukrainian and Belorussian SSR's and other republic ministries.

However, at some tanning and shoe enterprises there are many unsolved problems that are causing definite concern in relation to the implementation of projects for further increasing the reliability of energy managments, including questions relating to the preparedness of enterprises for operating under winter conditions, as well as the development of socialist competition for the rational and economic use of fuel and energy resources. Inspections conducted in 1978 by the State Inspections of USSR Gossnab, the USSR Ministry of Power and Electrification, departmental energy inspectorates, and other monitoring agencies established that there were inadequacies in the work on these problems.

For example, we can present several shortcomings in basic indicators that were discovered.

Boilers:
boilers and auxiliary boiler equipment are operated without authorization by Gosgortekhnadzor's agencies;
boilers and auxiliary boiler equipment are operated with serious defects (in safety devices, automatic safety equipment, monitoring devices, and so on);
poor feed water preparation and nonobservance of the water regime for boiler installations;
boiler location does not correspond to the requirements of the effective "Rules" and "Norms."

Electrical engineering equipment:
an unsatisfactory technical state for transformers that are also operated under loads exceeding the allowable limit;

the use of nonstandard fuse links to protect electrical equipment;
an unsatisfactory technical state of distributing devices;
violation of the preventive testing periods for electrical engineering equipment;
noncorrespondence of electric motors and starting devices to the parameters of the environment in production areas;
an unsatisfactory state of electrical networks.

Compressor stations:
violation of the examination periods for compressor installations;
an unsatisfactory technical state or the complete absence of safety devices;
violation of the regime or absence of monitoring of compressor lubrication;
siting of compressor stations in violation of the requirements of the "Rules" and "Norms";
absence of protection against accidents.

It should be mentioned that shortcomings are inherent not only for the equipment listed above, but also for ventilating, insulating and other equipment. These shortcomings include: violation of the planned preventive maintenance schedules, lack of proper technical documentation (instructions, manuals, actuating plans, and so on), the admission of people not authorized to service energy management equipment, violation of the periods for certifying maintenance personnel, incomplete staffs, and so forth.

In evaluating the regime of fuel and energy resource economy, the monitoring agencies mentioned that despite the existence of definite successes in this matter, at a number of enterprises in the tanning and shoe industry there are serious shortcomings that can be summarized as follows:
the plans of organizational and technical measures for economy of fuel and energy resources that have been worked out do not correspond to the established quotas for saving fuel, heat and electricity. These measures do not take into consideration questions related to improving the technology and increasing the efficiency of utilization of production and other equipment. Questions concerning the organization and improvement of energy resource accounting have been ignored;
the enterprises have organized the standardization of energy resources per unit of production output rather poorly. The specific norms for the consumption of energy resources do not help enterprise collectives mobilize to look for reserves for economy in each kilogram of fuel, each gigacalorie of thermal energy, and each kilowatt-hour of electricity;

in the enterprises there are direct losses of energy resources as the result of incomplete utilization and the presence of defects in the operating and power machinery, shortcomings in the organization of warehouse management, and so forth.

In order to organization the preparations of the enterprises and insure their stable operation under the conditions to be encountered during the 1979-1980 winter, it is necessary to direct the efforts of the enterprises' collectives to the solution of the following two basic problems.

The first and primary one is the problem of implementing the complex of measures aimed at putting the basic production equipment in the proper technical state and insuring its reliability.

The following should be provided for:
the completion of projects for the technical re-equipment of energy managments, including the replacement of obsolete and the modernization of existing boilers, electrical engineering, ventilation and other installations and equipment;
the introduction of automated equipment to control the energy systems of enterprises. The performance of work to connect the heat and gas systems of enterprises to regional heat and gas mains. The improvement of the technical state of thermal, water conduit, heating, and sewage networks and cable and aerial electric power transmission lines;
the implementation of a complex of projects to improve the technical state of buildings and structures important to the production process. When this work is done, special attention should be given to repairing load-bearing and enclosing structures, roofs, door and window openings, and air and heat screens;
the timely realization of funds for fuel and the creation of stable fuel reserves;
the organization of clearcut planning and monitoring of the utilization of the limits of allocated electricity;
insuring the preparation of solid fuel warehouses and storage capacities for liquid fuels to receive and store them, the preparation of loading and unloading devices and machinery and temporary enclosures and devices for the preliminary heating of fuel oil, and the preparation of railway and other access routes. Idle time above the established norms is not to be allowed for railroad cars and motor vehicles being unloaded on railway lines or in unloading areas. The completeness of the unloading of tank cars and freight cars is to be monitored rigorously;
the dissemination and introduction, wherever possible, of progressive experience for improving the technical state of and operating energy management systems in enterprises;

increasing the responsibility of maintenance personnel for the technical state and operation of energy management systems in enterprises.

The second -- and no less important -- problem is the implementation of a regime of economy of fuel and energy resources. In this work, the heaviest weight falls on projects to eliminate direct losses of heat, fuel and electricity that are caused by insufficient loading of the production equipment, poor maintenance of this equipment, and the existence of defective production output, which entails additional expenditures of fuel and energy resources, as well as the unsatisfactory state of the engineering networks and energy management equipment, which result in the leaking of heat, steam, hot and cold water, and so on.

Work done to see that the energy and production equipment is operated in accordance with the requirements of the pertinent regulations, as well as the organization of a system of accounting for the use of and the setting of norms for fuel and energy resources in accordance with the production output, is of great value in implementing a regime of economy of these resources.

The problems indicated cannot be solved without widespread mobilization of labor collectives for the implementation of an entire complex of projects to insure the reliable and uninterrupted operation of power and operating machinery and the fulfillment of established assignments for economy of fuel and energy resources.

An atmosphere with an intolerant attitude toward the facts of poor management in this matter must be created in every labor collective.

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