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USSR Report

ENERGY

(FOUO 9/80)

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ELECTRIC POWER

ELECTRIC POWER INDUSTRY PROGRESS REPORTED

Moscow ELEKTROTEKHNIKA in Russian No 4, Apr 80 pp 2-5

[Excerpts from the article by A. I. Mayorets, First Deputy Minister of the Electrical Equipment Industry, submitted 13 Feb 80]

[Excerpts] At the present time, the YeES [Unified Power System] of the Soviet Union is already pr'ducing over 90% of the total electric power produced by all electric power stations of the USSR. The territory of the YeES covers about 80% of the country's populated areas. Electrical networks of the YeES have stretched from the eastern boundary of Chitinskaya Oblast to the western boundary of the USSR. Networks of the USSR YeES are connected with the networks of power systems of the socialist CEMA member countries. The distance between the extreme points of the USSR YeES along the continuous chain of main communication lines is about 7000 km. The main system-forming networks of the YeES at the present time are lines of 330, 500, and 750 kV.

This stage in the development of the electrical equipment industry is connected with the historical resolutions of the 25th CPSU Congress in which it was given exceptionally great attention. In the report of the CPSU Central Committee, the electrical equipment industry was mentioned among the four branches of machine building which have a special responsibility for providing modern machines and equipment to all spheres of the national economy.

Fulfilling the resolutions of the 25th Party Congress, the electrical equipment industry has been increasing considerably the output of products during the Tenth Five-Year Plan in comparison with the preceding five-year plan. The national economy is receiving more than 6000 new advanced types of electrical equipment with a total economic effect of about seven billion rubles. More than 45% of the products put out by this industry will be in the highest quality catigory.

One of the examples of the creation of effective complexes is the development and production of special-purpose electrical equipment for the 750 kV electric power transmission line Vinitsa (USSR) -- Al'bertirsha (Hungarian People's Republic) which is of great importance for the development of electrification in the CEMA member-countries. Comrade L. I. Brezhnev, Chairman of the Presidium of the USSR Supreme Soviet, congratulated the workers of construction, installation, operation, planning and design organizations machine-building enterprises, and all participants of the construction of this line on their remarkable achievement. A number of organizations and workers of the industry were awarded orders and medals of the Soviet Union for their significant individual contribution to the creation of the electrical equipment for the 750 kV Vinitsa -- Al'bertirsha LEP [electric power transmission line].

The atomic power industry is developing very rapidly: the output of electric power at AES during this year alone will increase by 33%. The electrical equipment industry is contributing greatly to the raising of the productivity of atomic electric power stations by producing a large complex of special technical equipment: 1500 rpm turbogenerators with capacities of 500 and 1000 MW, electrical motors for pumps, special automation and protection systems, cables enduring high temperatures and pressures, and highly reliable continuous feed units. Such complexes have been delivered to the Leningrad and Chernobyl' AES and will be delivered to other atomic electric power stations which are under construction in the Soviet Union and in a number of foreign countries.

Technical improvement of electrical equipment and complexes and the improvement of their quality characteristics include great reserves for the growth of the effectiveness of the entire national production. Growth of unit capacities and voltages, the raising of the technical level, quality and operational reliability of products, and the creation of the fundamentally new types of equipment remain to be the main tendencies in the scientific and technical progress of electrical engineering.

The effectiveness of the production of electric energy depends directly on the unit power and reliability of the power unitswhose final elements are turbogenerators or hydrogenerators. Today, 200 and 300 MW generators are replaced by series of machines of 500 and 800 MW. In comparison with 300 MW generators, each 800 MW unit reduces capital investments into the power industry by 1.2 million rubles, releases 150 people of the service personnel, and saves more than 36,000 tons of reference fuel annually.

An important technical achievement of the Tenth Five-Year Plan was the creation by the Leningrad production electrical machine building association "Elektrosila" imeni S. M. Kirov of a 1200 MW turbogenerator for the Kostromskaya GRES (this is the largest machine with a rotation frequency of 3000 rpm), as well as 640 MW hydrogenerators for the Sayano-Shuchenskaya GES.

The Soviet electric machine building industry is faced with great tasks of the fulfillment of a complex program for the creation of a unified standard series of turbogenerators with capacities of up to 800 MW, 3000 rpm, posessing a high degree of reliability and efficiency, as well as requiring a lower specific material consumption. This program is being realized within the framework of the Interelektro, and its early completion will be a substantial contribution to the development of the electrical power industry of socialist countries.

In order to develop the considerable hydroresources of Siberia and the Far East, it is necessary to create hydrogenerators with capacities of 1000 MW and higher.

Designs of bipolar turbogenerators with capacities of 1600 and 2000 MW and quadripolar turbogenerators of 1500, 2000, and 2500 MW are being developed. All these machines have to be put into production in the next 15-20 years. Further increase of the power of such machines is connected with the use of more effective methods of cooling utilizing the superconductivity effect in the field windings. Theoretical and experimental studies in this direction made it possible to produce an experimental industrial turbogenerator with a capacity of 20 MV·A using a superconducting field winding. At the present time, preparations are in progress for developing a bipolar generator with a capacity of 300 MW.

The use of controlled thermonuclear fusion for producing electricity is of interest. Thermonuclear fusion is a practically unlimited source of energy which eliminates radiation and chemical pollution of the environment. Power equipment of reactors consists, basically, of electrical units produced by the electrical equipment industry.

The steady growth of the unit capacity of thermal, hydraulic, and atomic electric power stations, construction of blocks for electric power stations, as well as scheduled and emergency transfers of large amounts of power between power systems make it necessary to increase the carrying capacity of electric power transmission lines.

The electrical equipment industry has developed and produced pilot specimens of a complex of electrical equipment for experimental industrial alternating current transmission line of 1150 kV between Itat and Novokuznetsk which is the first link between Siberia, Kazakhstan and the Ural area. The next goal is to create a more advanced complex of electrical equipment for 1150 kV with a lower level of insulation. It is necessary to develop a protection system against internal overvoltages ensuring their limitation to a value of 1.5-1.6 U_f. The size of the equipment of such a complex will be smaller, which will substantially lower the cost of electrical installations.

At the November (1979) Plenum of the CPSU Central Committee, Comrade L. I. Brezhnev mentioned the necessity of accelerating the development of the Ekibastuz, Kansk-Achinsk, and Kuznetsk fuel and energy complexes and of the construction of the appropriate direct-current 1500 kV electric power transmission lines, primarily the Ekibastuz-Center line.

The electrical equipment industry developed and produced specimens of all types of equipment for the voltage class of ±400 and ±750 kV as early as in 1976.

In order to increase the technical and economic indexes of the Ekibastuz-Center electric power transmission lines, it will be necessary to modernize and develop some new types of equipment: high-voltage thyristor rectifier, conversion transformers, direct-current dischargers, elegas cells, and others. The complex which is being developed has no analogues in the world's practice, exceeding foreign equipment with respect to its parameters.

Industrial development of electrical equipment complexes of 1150 kV for alternating current and 1500 kV for direct current, and later for higher voltages will make it possible to transfer huge streams of inexpensive electric power from Siberia and Kazakhstan to the European part of our country and will improve the reliability and economy of the Unified Power System of the Soviet Union in its joint operation with the power systems of the CEMA member countries.

The growing power needs and the increase in the capacities of the electric power transmission lines make it necessary to searth for new technical solutions for power transmission: development of promising types of cable lines (gas filled cables, cables with direct water cooling of current-conducting cores, superconducting and cryoresistant cables). Superconducting and cryoresistant cable will be used primarily for deep leads into large industrial centers.

For electrical installations, it is necessary to set up the production of highly economical elegas KRU [complete power switching units] for 110 and 220 kv and to develop elegas KRU for 1150 kV.

It is necessary to stress again that V. I. Lenin understood electrification to mean not only the construction of electric power stations and networks, but also as extensive penetration of electricity into all spheres of physical production and everyday life.

In the electrification of industry, transportation, and agriculture, V. I. Lenin saw the basis of the growth of labor productivity and the most important means for the intensification of production and radical improvement of the lives of the working people.

In Lenin's legacy on electrification, a special role is given to the electric drive as a means which "ensures most reliably any speed and automatic connection of mechanical operations at the largest work area."

The modern electric drive is a complicated system of electromechanical devices, as well as means of automatic control based on the latest achievements in the area of electric machine building, semiconductor power devices, and elements of weak-current electronics and microelectronics.

At the present time, new series of asynchronous and synchronous electric motors, as well as direct-current machines have been or are being developed. The introduction of these series reduces the weight of machines considerably and improves their power indexes.

Successes in the area of semiconductor technology are responsible for the industrial introduction of controlled electric-machine-gating systems. Transistor and, partially, thyristor converters have been introduced for drives with a power of up to tens of kilowatts.

For more powerful electric drives, it is necessary to develop and produce transistors for a current of hundreds of amperes and voltages of hundreds of volts. For drives of an average and high power (100-25,000 kW and higher), it is necessary to create thyristors for currents of 4000-5000 A and voltages of 3-10 kV.

One of the most important goals of the electric equipment industry is to ensure a high technical level of electric drives, which is a guarantee of a high productivity of machines and mechanisms.

Technological progress was responsible for the high rate of the introduction of electrothermal processes in many sectors of the national economy. The percentage of electric-furnace steel in the world's total output and the use of thermally processed steel in the machine-building industry are increasing considerably (3.5 times); metallurgical electric furnaces are growing in size (to a capacity of 1000 MV·A and higher). The main task is to accomplish the complex program of the reconstruction of the operating electric steel-melting furnaces. Steel-melting furnaces of 200-250 MV·A with a capacity of 800 tons are in the stage of development. Extremely important and promising is the work on the development of powerful electron-beam units for melting large ingots of steel of up to 100 tons, as well as electron-beam units for melting refractory and highly pure metals and for applying coatings.

The high and ever growing freight intensity on electrified railroad lines and the growth of the rolling stock and the speed of traffic make it necessary to set up series production of direct-current electric locomotives VL-14 and alternating current locomotives VL-84 with a capacity of over 7500 kW as soon as possible, as well as to create new types of electrical equipment. It is promising to use asynchronous and valve traction motors fed from frequency converters, to reduce the sizes and weights of semiconductor electric power equipment, etc.

Later on, we should expect the introduction of linear electric traction motors and magnetic or aerial suspension of the rolling stock for high-speed railroad transportation (several hundred kilometers an hour).

The electrical equipment industry is contributing greatly to the development of the electrification of agriculture and strengthening its material and technical base. Here, we cannot help but be amazed at V. I. Lenin's brillant insight, who stressed more than once the idea that "introduction of electrical equipment in agriculture will mean a gigantic victory of large-scale production" [L,3].

During the Eleventh Five-Year Plan, it is planned to increase considerably the electric power consumption in rural areas in comparison with 1980. In the next few years, about one million kilometers of electric power transmission lines will be built, effective measures will be implemented for accelerating overall mechanization of production processes in plant growing and animal husbandry. The country's agriculture will receive reliable electrical equipment designed on the basis of the latest achievements of science and technology which will considerably increase the effectiveness of agricultural production.

One of the most important problems facing the electrical equipment industry is the realization of a complex program on the creation and introduction into the national economy of electric vibration technique which makes it possible to increase considerably labor productivity in various sectors of the national economy.

Electrical equipment should be introduced more widely in medicine. It is necessary to develop and produce various electrical devices for the diagnoses and treatment of diseases and various artificial organs for life support of man.

The electrical equipment industry has a particularly responsible role in solving socioeconomic problems. Electrification of everyday life and the development of domestic electrical appliances are viewed today as an effective base for improving the well being and cultural level of people. Electrical appliances are an element of a complex problem of electrification of everyday life in which many various interrelated problems are involved: energy, architectural-housing, sociodemographic, economical, medical, hygienic, and many other problems. It is necessady to consider the effects of all these various factors.

In this direction, it is necessary to conduct intensive studies whose results are needed in industry for long-range planning of the output of certain models of appliances.

It is necessary to give attention to the importance of the development of work in the area of illumination engineering both for domestic purposes and for the national economy as a whole.

Complex electrical devices and complexes created at the level of the best domestic and world achievements clearly reflect the tendencies of the modern development of technology -- combination of semiconductor power devices, computer technology, and elements of electronic automation. The following can serve as examples for this: complex thyristor electric drives introduced in various sectors of industry, excitation systems of generators, control systems, adjustment systems, systems of protection and automation of direct-current transmission, automated safety systems of power systems, and others.

At the present time, single-crystal microprocessors with broader possibilities for controlling functions have been developed and continue to develop intensively. Controlling computers, microprocessors, and other microelectronic means are integral parts of electromechanical complexes. Such complexes using control computers are being widely introduced into nuclear power engineering, metallurgy, the chemical industry, metal processing, fundamental physical studies, space research, etc. Much has been done since the time when V. I. Lenin proposed the idea of the electrification of our country, but still much has to be done. The potentialities of electrification are limitless.

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ELECTRIC POWER

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REASONS FOR CONDENSEN TUBE FAILURE IN T-30-90-1 TURBINE

Moscow PROMYSHLENNAYA ENERGETIKA in Russian No 2, Feb 80 pp 25-26

[Article by Ye. I. Stepanov, Ya. M. Bergart and I. N. Kalmychkov, engineers at the Ukrenergochermet technical repair station]

[Text] The T-30-90-1 turbines at the TETs-3 of the "Krivorozhstal'" plant imeni V. I. Lenin are equipped with KP-2000 surface condensers (two-pass), made from LO-70-1 brass. Considerable amounts of cooling water appeared in the condenser of one of the steam turbines 16 months after it was put into operation. During the inspection of cut-out samples of the condenser tubes, traces of corrosion in the form of reddish flakes from 1 to 5 mm in diameter were discovered on the tubes' outer surfaces (on the cooling-water side). There were open cracks in some places. The nature of the damage indicates so-called secondary dezincification of the brass [1,2].

Noticeable corrosion damage was not observed on the inner surfaces of the tubes (on the steam and condensate side). The condition of the tube sheets and the internal surface of the condenser body was satisfactory. Scale deposits were not found. Over a short period of time 1000 tubes (out of 6410) were plugged in order to prevent the intrusion of cooling water into the condensate. The condenser, in fact, broke down long before the end of its standard service life (20 years) [2].

In determining the reasons for the breakdown of the condenser tubes, attention was directed to the basic factors influencing the intensification of the corrosion rate. The cooling of the steam in the condenser is accomplished with fresh water according to a circulating water-supply scheme. In the table are cited quality indicators for the circulating and make-up water during the period of time of the turbine's operation up to the breakdown of the condenser tubes. As can be seen, the salt content of the circulating water amounted to, on the average, 448 mg/kg (the norm for LO-70-1 is up to 1500 mg/kg). The content of nitrates, ammonia and other impurities are also within the limits of acceptable standards, while the pH value is higher than the norm [3]. The calculated velocity of the water in the condenser does not exceed the maximum permissible rate [1,2].

During a metallurgical analysis it was established that the metal of the tubes is of a fine-grained structure--it had not been heat-treated. From [1] it is known that brass tubes with a fine-grained microstructure are subject to secondary-type dezincification, while coarse-grained brass is subject to general surface dezincification. In the first case, the tubes may break down as early as the first year of operation, while in the second case the service life amounts to 4 to 8 years.

1 Вода	2 Солесодержание, мг/кг	3 Щелочность по фенолфталеину, мг-экв/кг	4 Щелочность общая, мг-экв/кг	5 Жесткость, мг-экв/кг	6 Содержание, мг/кг							14 Окисляемость, мг/кг O_2	15 pH
					7 соединений железа	8 соединений меди	9 силикатов	10 нитритов	11 аммиака	12 хлоридов	13 взвешенных веществ		
16 Циркуляционная	448/566	0,25/0,5	3,3/4,0	5,2/6,5	0,5/0,88	0,24/0,56	10,8/13,1	0,014/0,020	0,28/0,33	75/119	20/30	11,7/15,7	8,5/8,7
17 Добавочная	284/320	—	2,4/2,7	3,6/3,9	0,28/0,70	0,076/0,12	7,5/9,1	0,046/0,018	0,25/0,33	34/60	—	7,8/9,6	—

18 Примечание. В числителе приведены средние значения показателей, в знаменателе — максимальные.

Table 1

(1) - Water; (2) - Salt content, mg/kg; (3) - Alkalinity according to phenolphthalein, mg-equiv/kg; (4) - Overall alkalinity, mg-equiv/kg; (5) - Hardness, mg-equiv/kg; (6) - Content, mg/kg; (7) - Iron compounds; (8) - Copper compounds; (9) - Silicates; (10) - Nitrites; (11) - Ammonia; (12) - Chlorides; (13) - Suspended substances; (14) - Oxidibility, mg/kg O_2; (15) - pH; (16) - Circulation; (17) - Add-water; (18) - Note. Average values for the indicators are cited in the numerators, maximum values in the denominators.

Apparently, the presence of a fine-grained structure in the tubes' metal is one of the reasons for their premature failure. As is well known, the protective layer formed on the metal's surface when the water is treated with phosphates [4] has a considerable effect on the metal's corrosion resistance. However, the microphosphate softening treatment of the circulating water envisioned in the design was not carried out.

There are two more similar turbines in operation with KP-2000 condensers, in which the same circulating water as in the case under investigation is used for cooling the steam. Six of the brass tubes in one of the condensers were plugged, while there were no damaged tubes in the other. Both turbines ran without being stopped for repairs and without going on stand-by. At the same time, the turbine with the non-operative condenser was in repair or on stand-by 60 percent of its operational time.

During the turbine's down-time the condenser chamber was flushed with the circulating water. There was no flow-through of water in the tubes. This kind of conservation apparently contributed to the acceleration of corrosion of the metal in the condenser tubes (standing corrosion). The process by which corrosion takes place in this case can be presented in the following manner. The finely dispersed suspended substances in the circulating water, including microparticles of aluminum, iron, manganese and other metallic compounds, settled out on the bottom of the tubes due to their own mass and the absence of moving fluids. They formed microcouples with the zinc (included in the L0-70-1 alloy), which led to the formation of corrosion sources. This proposition is confirmed, in part, by the fact that the majority of copper flakes are found (approximately in a 12:1 ratio) in the lower portions of the damaged tubes, that is, in the places where the finely dispersed slurry particles are most likely to settle. In connection with this the following solution was adopted: when the turbines are stopped for repairs or are on stand-by for a period of up to 10 days a stream of cooling water is to be run through the condenser tubes; when stopped for a greater length of time the condenser must be emptied.

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ELECTRIC POWER

UPDATE ON NEW EQUIPMENT INTENDED FOR POWER PRODUCTION FACILITIES

Moscow ENERGOMASHINOSTROYENIYE in Russian No 4, Apr 80 pp 2-4

[Article by V. P. Goloviznin, deputy chief of technical administration for Minenergomash: "Soviet Power Equipment Construction--The Basis for the Development of Power Engineering in Our Country"]

[Text] The many thousands of workers in the power equipment construction collective together with all our country's workers greet the 110th anniversary of the birth of Vladimir Il'ich Lenin, creator of the Communist Party and the world's first socialist State, with new successes in the struggle to put into practice a program for the construction of communism. Workers in the industry fervently take up the call of the CPSU Central Committee to turn the concluding year of the 10th Five-Year Plan into a year of vital Leninist labor.

V. I. Lenin went down in the history of mankind as a brilliant thinker and a follower of Marx and Engels. He developed their revolutionary teaching and led Russia's proletariat to the victorious October Revolution. He is the creator of the science that deals with the methods of building socialism and communism, the science of the revolutionary party, the science of the national liberation movement and the science that deals with the principles of peaceful coexistence between States and various social strata.

The name of V. I. Lenin is associated with the vigorous development of the electrification of our country. Through his initiative and under his direct leadership the first State plan for the electrification of Russia was developed--the GOELRO plan, which was successfully completed. In 1922 the first stage of the Kashira GRES was put into operation. The Volkhov GES was placed into service in 1926, and as early as 1932 the output of all Russia's electric power stations amounted to 4.68 billion kW. Lenin's GOELRO plan and plans for the further intensive development of power engineering in our country required the accelerated growth of domestic power equipment construction, a pioneer in which is the production association "Leningrad Metal Plant." It was at the Petersburg Metal Plant that the first steam turbines in Russia with outputs of 50-1,250 kW were manufactured. In 1924 at the Leningrad Metal Plant the production of 55 and 370 kW capacity domestic hydroelectric turbines was begun.

Owing to the constant attention and concern of the Party and the government, power equipment construction has become a progressive industry. The equipment manufactured by plants in the industry is characterized by a high unit output, high quality and high reliability. It is on a level with the best examples in the world according to their technical and economic indicators. During the 10th Five-Year Plan the power equipment builders achieved definite success in the execution of the tasks outlined in the decisions of the 25th CPSU Congress. In 1979, 275 articles were produced in the industry which earned the State seal of quality.

The quality and technical level of the power equipment produced is evidenced by the fact that a growing number of articles and developments in domestic power equipment construction are finding recognition on the international market. The portion of the industry's machines that are exported amounts to about 30 percent. The export of technology and the results of scientific research and experimental design projects is accomplished in the form of licences and "know-how". In many countries in recent years, including Japan, West Germany, Italy and Finland, technical documentation for the manufacture of power equipment has been sold.

In 1978 the enterprises in the industry produced the basic equipment for a unique 1,200 MW power unit. This equipment--the K-1200-240 single-shaft turbine and a 3,950 t/h single-stage boiler--is built to supercritical steam parameters. The 1,200 MW capacity single-shaft steam turbine built by the production association "Leningrad Metal Plant" possesses initial steam parameters of 240 kgf/cm^2, 540/540°C. There is no similar turbine in worldwide turbine construction. The commercial production of equipment for power units with unit capacities of 200, 300, 500 and 800 MW intended for thermal electric power plants has continued.

The combined heat and power-supply turbines produced by the turbine construction plants, judging by their unit capacity levels, the basis characteristics of the thermal systems, the initial steam parameters, the thermal economy and their design solutions, correspond to the technical level of foreign turbine units, while the T-250/300-240-2 surpasses its foreign counterparts.

The turbine construction plants have produced unique hydroturbines for domestic and foreign hydroelectric stations, including the second hydroturbine with a removable axial-flow impeller and a nominal output of 650 MW for the Sayano-Shushenskaya GES; the third hydroturbine with the first permanent impeller; prototypes of axial-flow hydroturbines of the Site-1 GES (Canada); and rotating-vane hydroturbines for the Sobradino GES (Brazil) as well as the Nizhnekamskaya and Kegums GES's. The production of hydroturbines for the Nurek, Ingurskaya, Maktakvak (Canada), Zeyskaya, Purnari (Greece) and other GES's is continuing.

During the 10th Five-Year Plan the power equipment construction indust y is vigorously increasing capacities and mastering the production of equipment for atomic power plants. The manufacture and delivery of equipment for atomic power plants with VVER-440 and RBMK-1000 reactors is being carried out, while the delivery of equipment for prototype units with VVER-1000 and BN-600 reactors has been concluded. At a number of industry enterprises the development of production of gas-turbine power installations is continuing.

The production association "Leningrad Metal Plant" has produced several gas-turbine power installations with a unit capacity of 100,000 kW.

The production association "Nevskiy Plant" and the scientific-industrial union of the Central Scientific Research and Design Institute of Boilers and Turbines imeni I. I. Polzunov (TsKTI) have begun testing a prototype of a basement-less modular-design automated gas-turbine installation, type GTN-25, intended for gasline pumping stations. The plant has carried out the modernization of the GTK-10 units and is realizing commercial production of these units with an increased degree of modularity. Compressor equipment of various designations is being manufactured, including equipment for the large-tonnage production of ammonia and ferrous metals.

The production association "Turbomotor Plant" together with the production association of the TsKTI is conducting tests of a basement-less modular gas-pumping prototype unit of the GTN-16 type. The GT-35-770-2 gas power installations which are to be used under the conditions encountered in the far North as well as in the PGU-250 units are being manufactured by the production association "Kharkov Turbine Plant." The development of the type GT-45-850 gas-turbine units for steam-gas cycle installations is also continuing. The production association "Turbomotor Plant" has manufactured 2,400 hp diesel prototypes as well as lots of six- and eight-cylinder diesel engines for heavy dump trucks.

According to design solutions and the basic technical and economic indicators, the boilers produced by plants in the industry for 500, 800 and 1,200 MW power units correspond to the level of the world's best examples and exceed that level according to some of the individual indicators. The boilers which are produced in single-body configurations with gas-proof all-welded water walls operate under pressurization.

The efficiency of domestic boilers when burning gas or liquid fuels is 0.5 to 1.0 percent higher than similar foreign designs. When the differences in working pressures of the environment are taken into account, the unit metal content of the boilers is approximately 10 percent less. In addition to this, the domestic boilers have better dimension indicators.

The solution to the questions posed concerning the increase in the technical level of production, its efficiency and the quality of the products manufactured is being realized through the introducton of progressive methods, the perfection of the production structure, an improvement in the utilization of fixed capital, the application of computer technology, the development of the productive capacities that have been put into service, etc. An entire complex of progressive technological processes and equipment has been introduced in the industry.

At the "Energomashspetsstal'" plant in Kramatorsk a 6,000 ton hydraulic forge has been put into service. It is equipped with a manipulator and a special forge crane and will operate as an automated forge complex. A similar forge complex will be put into service in 1980 at the "Izhorskiy Plant" production association imeni A. A. Zhdanov.

During the manufacture of reactor housings, steam generators, containers for the emergency shut-down and radiation shield system (SAOZ) and VVER volumetric compensators, high-productive flux and submerged-arc welding is employed. A two-pass method of metal deposition with a ribbon electrode is being used instead of the previously applied method of deposition in five or six passes.

In the production association "Izhorskiy Plant" the country's largest sumerged-arc and vacuum-arc smelting furnaces are being employed, which make it possible to smelt metal for forge ingots weighing up to 60 tons. Refining apparatus from the ASEA firm in Switzerland is also being used. At the "Energomashspetsstal'" plant in Kramatorsk a vacuum-induction smelting furnace (VIP) with crucible volumes of 7.5, 15 and 30 tons has been put into operation. Construction has begun on a batch-process submerged-arc processing installation designed to obtain forge ingots of up to 200 tons in weight.

The production association "Izhorskiy Plant" together with the scientific-industrial union of the Central Scientific Research Institute of Machine Construction Technology (TsNIITmash) has introduced a production process for pressing out manifolds on the rim of the manifold zone in the VVER-1000 reactor body. The development of a commercial process for stamping steam generator manifolds is also being carried out. Work is continuing on the creation and introduction of automatic enterprise control and automatic production-process control systems (ASUP and ASUTP's). An industry center for the automation of production processes has been organized.

By the resolution of the CPSU Central Committee and the USSR Council of Ministers "On the Further Development of Machine Construction in the Years 1978-1980," Minenergomash and the other ministries have had the following tasks planned for them: the creation and production development of new machines, equipment, instruments and mechanization and automation facilities; an increase in the relative share of products in the higher-quality categories; a decrease in the weight of manufactured machines and a reduction in the expenditure of metal; the realization of measures directed at increasing the service life of the primary machinery and equipment by a factor of 1.5 to 2 in comparison with 1975.

The Communist Party has set the task of increasing the efficiency of social production in any way possible, that is, the task of obtaining the maximum possible socially beneficial results with the least expenditure of labor and material resources. It is a question of reinforcing the plan, production and labor disciplines in each part of the operation. The attainment of high efficiency demands that the entire industry rise to a level of intensive development as a chief prerequisite for the accelerated growth of labor productivity. In this case, a determining role is played by the refitting of industry on the basis of progressive methods and an improvement in labor organization.

In order to maintain the planned constant supply of power production equipment to the economy, it is necessary to increase the production output of high-quality semi-finished products, steam turbines, fittings, turbine pipes and heat-exchange equipment. The production association "Izhorskiy Plant" must complete construction of projects for the complex of 6,000 and 12,000-ton forges as well as complete the modernization of electric smelting and sheet-rolling mills with the "5000" mill. The production association at "Energomashspetsstal'" in Kramatorsk must complete the construction of a forging and pressing mill with a 45,000-ton press complex intended for the production of large-diameter seamless tubing. They must also finish the construction of the final-dressing and heat-treatment building as well as the structural steel welding shop.

Taking into account the power production industry's requirement for steam turbines in atomic power plants, measures for the development of production capacities at the "Kharkov Turbine Plant" production association will be adopted in accordance with the resolution of the USSR Council of Ministers. During the 11th Five-Year Plan the production association collective "Turbomotor Plant" will be faced with the task of organizing the production of steam turbines for atomic TETs's. In addition to this, it will be necessary to create new production capacity in the production association "Red Boilermaker" for the manufacture of heat-exchange equipment.

In order to increase the output of turbine pipes and fittings it will be necessary to carry out a number of measures intended to develop the production of power equipment fittings for domestic use at the Chekhov and Belogorodskiy power equipment construction plants. This will include completing construction of a special building at the Belogorodskiy plant and outfitting it completely with unique production-process equipment.

The greatest tasks before the workers in the industry are in the area of constructing reactor, turbine and other types of atomic equipment, including: equipment for earthquake-proof commercial AES's with the VVER-1000 reactor and steam turbines with an output of 1 million kW that operate at 1,500 and 3,000 rpm; equipment for commercial AES's with the RBMK-1500 water and graphite-modulated channel reactor; equipment for prototype and commercial district heating atomic power plants; and equipment for chemical atomic power plants with helium coolant and spherical fuel elements. The development of vertical steam generators for saturated and superheated steam in AES units with the VVER-1000 reactor must be completed.

Associated with power engineering's shift from gas and fuel oil to solid fuel there is a sharp rise in the demand for coal-pulverizing equipment. Under these conditions, the construction of a coal-pulverizing equipment shop at the Syzran' turbine construction plant is of great significance.

Within the ministry system intensive work is being conducted on the creation of steam and steam-gas units, boilers and auxiliary boiler equipment for the burning of Kansko-Achinsk, Ekibastuz, Kuznets and other coals as well as by-product gas from the refining process. Coal-fired equipment with unit capacities of 200,000 to 800,000 kW are being built, as well as by-product gas units with up to 1.2 million kW capacities.

One promising direction for the utilization of eastern coal deposits is the creation of powerful (up to 1 million kW) steam-gas installations with intercycle coal gasification. The first stage in solving this problem is the construction of a 250 MW installation. The basic tasks of the scientific research, design and production collectives in the area of boiler construction are:

1. The conclusion of development of the technical documentation and the organization of commercial production of boilers with a steam-producing capacity of 2,650 t/h for 800 MW power units fired by Kansko-Achinsk and Kuznets coal; the production of VPG-600 high-pressure steam generators for PGU-250 steam-gas installations; the production of a 420 t/h boiler with a "cold vortex; the production of a small vertical-chamber boiler for the burning of gas and fuel oil as well as a production run of waste-heat boilers and generating boilers.

2. The performance of start-up, adjustment and testing operations on the boiler for the 1.2 million kW unit installed at the Kostroma GRES, as well as on the first small-scale 500 t/h boiler fired by Kansko-Achinsk coal, on the UPG-60/160 steam generator for pumping steam into oil-bearing underground strata and on the SRK-1400 soda regenerative boiler, the manufacture of which will be concluded this year according to plans for production and the introduction of new techniques.

3. The execution of a number of operations for the construction of a small-scale vortical boiler for the 800 MW unit fired by Kansko-Achinsk coal and for the construction of a 420 t/h fluidized-bed boiler.

4. The completion of work on the standardization of combustion apparatus, intended for the organization of their centralized manufacture. The transition to a new series of boilers, type DE and KE, intended for industrial power production.

It is necessary to develop and organize the production of 4 and 6.5 Gcal/h generating boilers and designs for preheating apparatus, etc.

In the area of turbine construction it will be necessary in the near future:

1. To carry out a great number of scientific research, design and production operations for the construction of peak and semi-peak equipment, including 500 MW steam turbines that operate at 130 kgf/cm^2; 150-200 MW gas-turbine installations with gas temperatures of up to 1100°C and higher ahead of the turbine; and high-efficiency hydroturbines for pumped-hydroelectric storage plants and, primarily, for the Leningrad GAES and the GAES of the Souther Ukranian power complex.

2. To build reliable 16,000-25,000 kW gas-pumping units in modular configuration, including 25 MW units that operate at 120 kgf/cm^2.

3. To raise the technical level of gas-turbine installations employed on main gaslines and at chemical industry enterprises associated with the production of ammonia and dilute nitric acid.

In connection with the tasks listed above, there are many problems in the in the machine assembly industry that must be solved by our metallurgists, metals physicists, flaw inspectors and production engineers.

The resolution of the CPSU Central Committee and the USSR Council of Ministers "On Improving Planning and Strengthening the Influence of the Economic Mechanism on Increasing Production Efficiency and Work Quality" has, on the whole, put before the Ministry and the industry new tasks in the area of improving the control of scientific and technical progress. Chief among these are the tasks of raising the level of planning for the development of science and technology and creating a stable and more flexible system which will insure: the planning of scientific and technical developments on the basis of projected orders; the continuity in carrying out the work "from conception to introduction;" and the efficient utilization of material, manpower and financial resources in the industry.

Particular attention must be directed to the development of measures designed to strengthen the role of the five-year plans and annual plans for the development of science and technology as the chief forms of planning the industry's scientific and technical progress. Also necessary is the further improvement of the existing system of economic and material stimulation of the developers of the new technology. This must be done in order to increase their interest in reducing the time needed to create the objects of this new technology, as well as to raise the technical level of their developments and to aid them in mastering the commercial production of especially important and highly efficient types of machines and equipment used in the assimilation of new, progressive methods.

Power equipment construction is the technical basis for the progress of Soviet power engineering. Workers in the industry will insure the execution of those tasks put forth by the 25th CPSU Congress concerning the future growth of productive capacities at our country's electric power stations and the improvement in the quality, reliability and efficiency of power equipment.

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ELECTRIC POWER

CONSTRUCTION, LAYOUT OF 'ATOMMASH' PLANT DESCRIBED

Moscow ENERGOMASHINOSTROYENIYE in Russian No 4, Apr 80 pp 5-7

[Article by V. G. Pershin, deputy minister of power equipment construction and chief director of the Volgodonsk production association for the construction of atomic power equipment: "'Atommash'--A Key Construction Project in the 10th Five-Year Plan"]

[Text] Speaking at the November (1979) Plenum of the CPSU Central Committee, L. I. Brezhnev named the 'Atommash' plant as one of the three large-scale economic projects whose productive capacities had been placed into service during the first four years of the 10th Five-Year Plan. In "Basic Directions for the Development of the Economy of the USSR in the Years 1976-1980," adopted by the 25th CPSU Congress, provisions are made for the further development of atomic power in our country. Thus, atomic power plant output should increase by more than 13 million kW by 1980. By 1985 the total output should increase several times over.

The rates of growth planned for the atomic power industry make great demands on the power equipment construction industry regarding the provision of complete equipment to atomic power plants. To a considerable degree, the solution to this problem rests on the 'Atommash' atomic power equipment construction plant now being built in Volgodonsk. This is the first enterprise in the USSR designed specifically for the mass production of atomic power plant equipment. When fully developed, its production output will amount to 8 million kW of complete power equipment for atomic power stations. The plant will be built in two stages, each of which will have an output of 4 million kW of AES equipment.

Thanks to the persistent work of the builders, installation workers and operators, all of whom were actively assisted by the many machine construction and equipment supply enterprises in our country, the first production complex (with an output of 3 million kW of AES equipment) was put into service in 1978. In December 1979 the State Commission signed a bill that allowed another 1 million kW of productive capacity to be put into service. Thus, the 'Atommash' plant's productive capacities have been placed into operation in such a way that the following four assemblies of

VVER-1000 reactor-building equipment may be produced annually: the reactor housing, the steam generator, the water tank for the emergency shut-down and shielding system (SAOZ) and the volumetric compensator.

While developing the design of the plant, specialists from the design institutes painstakingly researched the technical and economic conditions determining the choice of a construction site for such an enterprise. The city of Volgodonsk in Rostovskaya oblast was selected due to the nearness of the Donets coal basin's metallurgical base and the feasibility of transporting the finished products to the primary consumers by water across the Tsimlyansk reservoir and along the Volga-Don ship channel. During the designing of the plant the latest achievements of science and technology were not the only factors considered. Also taken into consideration were the possibility of developing atomic power production along the line of further improvement in the unit capacity of atomic power installations as well as the construction of atomic power plants with fast breeder reactors.

The "Atommash" plant is an industrial complex where atomic power plant equipment goes through the complete production-process cycle of manufacture--from the processing of raw stock to the finished item in a given state of installation readiness. "Atommash's" uniqueness consists of the fact that, for the first time, production-line techniques insuring the progressive motion of parts and assemblies from one operation to the next are being employed in the production of power plant reactor equipment.

Another essential feature of the new plant is the inherent blend of specialization and universality in the production sections and shops regarding the equipment being used. In the future this will make it possible to alter the design of AES equipment within broad limits.

The intensification of specialization in the individual shops and sections will make it possible to utilize more fully the production-process equipment, apply mass-production processes and create mechanized mass-production lines equipped with modern high-output machinery coupled to a broad system of transportation facilities. In the largest building (No 1), the production of oversize items of pearlitic steel is concentrated: reactor bodies, covers, upper units, steam generators, volumetric compensators, water tanks for the SAOZ, superheaters and steamtraps, apparatus for handling the in-building equipment (OPVKU) and the handling machinery. In this building all the major large assemblies and parts go through the complete manufacturing cycle, including all production conversions (stamping, welding, machining, heat treating, checking, testing, painting, greasing and packaging).

Production is based on the specialized continuous-flow manufacture of assemblies and structures that are united by the general nature of the processing they must undergo and the similar nature of the production-process equipment being used on them, that is, assemblies and structures that are technologically similar. The building consists of 10 floors, three of which are 42 m wide and have a maximum height (up to the crane rails) of 30 m. Unique electric overhead traveling cranes with a lifting capacity of up to 1,200 t are being installed. On the remaining seven floors which are 30 m wide and 20 m high (to the crane rails), electric overhead cranes of up to 400 t capacity are being installed. In this same building a 15,000 t press has been installed in order to manufacture billets for the equipment bases in the reactor building.

Taking into account the large dimensions and great weights of the parts and assemblies being manufactured, the building is equipped with unique metal-cutting and welding machinery which makes it possible to produce assemblies of up to 1,000 t in weight. More than 20 percent of the overall number of metal-cutting devices are numerically programmed and controlled machine tools. For the quality control and treating of pipes, provisions have been made for the mechanized and automated continuous-flow lines that will accomplish degreasing, cleaning, treating and the ultrasonic and hydraulic checks. A production-line process is envisioned for facing the inner surfaces of the first-circuit units with an anticorrosion layer of stainless steel.

For the manufacture of small parts and individual assembled units, building No 1 forms a cooperative with building No 2, where the manufacture of control and shielding systems (SUZ's) is concentrated. These are the most precise and important atomic equipment assemblies. Building No 2 consists of several machine shops in which the complete processing cycle for the parts is carried out on mechanized and automated continuous-flow lines. Here the organization of integrated systems for processing individual groups of parts (rotating-body parts, reactor-body parts, pinions, sprockets, etc.) has found broad application.

In building No 2 the complex system of organizing small-scale manufacturing, which has been adopted for "Atommash," is based on the following major principles: increasing the series production by the unification, standardization and classification of parts; the application of mass methods for processing the parts; the creation of sections for the group processing of one particular type of part as well as mixed-batch group-processing lines; the mechanization and automation of the transportation, storage and distribution operations on the basis of the creation of clear-cut transportation and storage systems; and the creation of a clear-cut system of controlling small-scale manufacturing through the application of mechanized and automated production control. In the manufacture of SUZ's electron-beam welding of the reactor housing is being used as well as precision equipment for machining. In these same shops the instruments are tested, finished and greased.

In building No 4 is located the plant's main pattern shop, adjoining the sheet and rolled metal shop. There are two separate lines in the pattern shop; one of them makes billets from carbon steel, the other from stainless. Each line is equipped with modern high-output machines; the entire cycle of operations, from the dressing and trimming of the sheet metal to the assembly of semi-finished products and the removal of the cuttings is fully mechanized. This same building is where they produce the apparatus that goes into the reactor housing, the heat exchangers of the first circuit, the housings, cylindrical casings and other items made from austenitic steels; in addition, this is where they will manufacture the welded structural steel assemblies for the shaft interior and the auxiliary equipment, the biological shielding assemblies and the transportation equipment.

In order to satisfy its own requirements for welded materials, on whose quality the reliability of the AES equipment depends to a considerable degree, provisions have been made for the construction of building No 6. In this building they will carry out the manufacture of electrodes and fluxes. Here also is located a shop for the reprossessing of steel shavings and metal cuttings.

In connection with the exceptionally great demands made on the quality and reliability of equipment for atomic power stations, particular attention is being devoted to inspection. In the atomic power equipment construction industry inspection operations comprise up to 30 percent of the entire production cycle in the manufacture of the equipment. The starting materials, semifinished and finished products are subject to inspection. At "Atommash" modern methods of non-destructive inspection are employed: ultrasonic, magnetic-powder, capillary and radiographic. The rooms in which the radiation inspection is conducted are equipped with mechanized devices which deliver the items to the inspection zone; the inspection areas are combined into a single complex with its own auxiliary equipment.

The "Atommash" plant will be continuously supplied with special equipment and a great number of cutting tools, measuring devices, accessories, stamps and production organization equipment not only during the construction stage but during the period of subsequent operation as well. Within the production complex provisions have been made for a special building for the manufacture of all the listed equipment--building No 5 (with its own warehouse system, its own pattern shop, machine shop and welding and assembly shop). Here new types of non-standard production equipment will be built and their adjustment and initial industrial testing will be carried out. In building No 5 will be installed continuous-flow lines for the manufacture of a special cutting tool.

The problems of providing production training are also served to a considerable degree by building No 3, whose first line was built and put into operation as early as 1976. Within the building is located an entire complex of shops where non-standard equipment, fittings and special tools are produced. Here, too, is where the working staff undergoes training.

Thanks to the timely introduction of building No 3's first line, 26,000 t of non-standard equipment and 15,000 t of inserts and structural steel assemblies made to builders' orders have been manufactured for the plant's shops in the last three years. Galvanic processing and the production of goods for domestic consumption will be located in the second line of building No 3.

During the designing and construction of the "Atommash" plant great attention is being devoted to the protection of the environment. The measures that are being carried out insure the absolute safety of the personnel who deal with the radiation inspection. All industrial drainage is rendered harmless in the local purification works built on the plant's property. After this it undergoes mechanical and biological purification at specially constructed urban purification works.

A multilevel, multicomputer complex is envisaged to govern the plant's automated production control system. Wide use will be made of various types of equipment for the preparation of data and the registration of information; of techniques for central control, production, public-address and paging communications; of HF communications with the cranes and radio communications with the movable transporters; of equipment for an automated design system; of copying and enlarging equipment; of industrial television installations, etc.

Taking into account the great volume and the diverse network of the automated control system, provisions have been made for the construction of a computer information center in the plant. In order to train qualified personnel, an industrial-technical school has been created at the plant, while plans have been made to construct two more schools and put them into operation as well. There is a technical school at the plant to train specialists with average technical backgrounds.

The production of atomic power station equipment demands continual work on the maintenance of high quality and reliability in the manufactured products. With this goal in mind, such services have been created as the department of the chief metrologist, the central plant laboratory (TsZL), the central measuring-equipment laboratory (TsIL) and the central laboratory for non-destructive inspection methods (TsLNMK). All of these sections are located in a separate laboratory building. Provisions have been made at the "Atommash" complex for the creation of the corresponding scientific and design sections with an industrial testing base, laboratories, modern equipment and instruments. The harmonious work of the builders, installers and plant workers has made it possible not only to put these productive capacities into operation ahead of schedule but also to accelerate their mastery. It was also at the "Atommash" plant that the motto "Build Ahead of Schedule--Master Ahead of Schedule" was born.

The great services of the Don workers in the development of the economy are noted in the greeting of the General Secretary of the CPSU Central Committee and Chairman of the Presidium of the USSR Supreme Soviet, L. I. Brezhnev, to the workers of Rostovskaya oblast. No small part in this success belongs to the builders and operators of "Atommash."

In a short period of time a workers collective with thousands of members was organized at the plant. Thousands of workers and engineers went through training and apprenticeship at related enterprises. They have mastered many complicated production processes: automatic-machine welding, facing, heat treatment, non-destructive inspection, etc. Strict production discipline and great demands for cleanliness and production efficiency, necessary for insuring the high quality and reliability of reactor equipment, have been asserted at the plant. A production control system with a maximum centralization of control functions has been developed and introduced. All of this makes it possible to accelerate the mastery of the productive capacities that have been introduced.

The workers note the 110th anniversary of the birth of V. I. Lenin with new working success. By this date, dear to each Soviet man and woman, work will be completed on the assembly of the upper and lower halves of the first atomic reactor, and the production processes for the anticorrosion facing of parts such as flanges and for the automatic welding of manifolds onto the steam generator, etc., will be mastered.

"Atommash" is not just a large-scale plant. It is a socio-industrial complex in the sountry's South. An entire city with homes having a total living space of 1.3 million m^2 (about 700,000 m^2 of living space have already been put into service) is under construction. In order to provide the people who work at "Atommash" with food supplies, a model subsidiary farm and settlement is being built. Already 120,000 people live in Volgodonsk. By the end of the 11th Five-Year Plan the Volgodonsk population will be 200,000 to 230,000 people.

A vivid embodiment of the socio-economic program being carried out by the Communist Party and the Soviet government can be found in the construction of the "Atommash" plant.

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ENERGY CONSERVATION

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WAYS TO IMPROVE STANDARDIZATION, SAVING OF ENERGY IN GAS INDUSTRY

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[Article by V. N. Rozov, D. T. Aksenov, I. A. Strel'tsov, and V. I. Samylov, Ministry of the Gas Industry, All-Union Scientific Research Institute of Economics, Organization of Production and Technical-Economic Research in the Gas Industry: "Standardization of Material and Technical Resources: Ways to Improve Standardization and Saving of Energy Resources in the Gas Industry"]

[Text] In accordance with the decree of the CPSU Central Committee and the USSR Council of Ministers of 12 July 1979 "On Improving Planning and Strengthening the Influence of the Economic Mechanism on Increasing Production Efficiency and Work Quality" work is underway in the gas industry to perfect the system of planning indicators that reflect the specific nature of the branch and the subbranches. Here the main tasks are guarantee of objective evaluations of the contribution by the collectives of all levels to the production process, determination of the necessary resources for this purpose, efficient use of production facilities, material, energy and other resources, as well as stimulation of the fulfillment of the assignments and increase in the production efficiency. This determines the special importance of creating a complex system of standards in the gas industry. One of the central places in it is occupied by the system of standards for expenditures and losses of energy resources. This is explained, on the one hand, by the large scale nature of the branch and its large needs for fuel and energy resources (FER) and the finiteness of the organic fuel supplies, and on the other hand, the need for their efficient use and improvement in the planning system.

As an energy carrier natural gas is a product of the branch and an energy resource that is used for in-house needs of the branch. Its consumption is about 10% of the extraction volume. Besides gas, the main types of energy resources consumed in the gas industry are electricity and heat (see table).

FER Consumption in the Gas Industry

Energy Resource	Years		
	1973	1975	1978
Natural gas, million m^3	13069.1	22119.3	30300.5
Electricity, million kw-h	5117.6	5926.4	10915.4
Heat, thousand Gcal	2286.1	5428.6	11565.2

As is apparent from the table, the consumption of energy resources in the branch is continually rising. Thus, the volume of consumption of boiler-furnace fuel (natural gas) in 1973-1978 increased 2.32-fold, and of electricity and heat, respectively 2.13- and 5.06-fold.

The outlays for FER in the variable portion of the net cost of gas extraction and transportation are over 60%. In the future the absolute and relative demand by the branch for FER will rise. The main reasons for this are the growth in the volumes of extraction of gas, increase in the quality of its preparation for further transportation, rise in the distance of gas transporting, and increase in the extent of gas refining at the gas refineries. This governs, in addition to the total growth in FER consumption, the increase in specific expenditures. In particular, the specific expenditures of gas and electricity for gas transportation will rise in the future respectively 1.57 and 1.88-fold. Analysis of the energy resource consumption in the gas industry demonstrates that in the branch there are large reserves for reduction in consumption and losses of natural gas, in the first place, during its long-distance transporting. An important reserve of saving energy resources is the improvement in planning and increase in their efficient use at the branch enterprises, which will permit a reduction in gas consumption for in-house needs, at the minimum, by 10-15%.

Under the conditions of known nonuniformity in the work of the gas supply system as a whole, and its gas fields and gas pipelines, the efficient use of energy resources is possible with scientifically substantiated standards that guarantee tracing of the standard-determining factors and parameters. This is an important specific feature that significantly complicates the development and creation of such a system of standards.

Now and in the future the development of the gas industry will be based on the broad use of the leading achievements of scientific and technical progress, which is expressed on the whole: by the concentration of facilities of the gas fields, gas-transportation systems, and gas refineries; by the growth in the unit output of the power-technological units and introduction of new types; by the increase in energy efficiency by improving the technology of extraction and transporting of gas, increase in the heat-use of fuel in the recovery systems, optimization of the operating patterns; complex automation and tele-automation of the branch facilities.

The norms and standards for consumption and losses of FER in the synthesized form reflect, on the one hand, the effect of introducing progressive achievements, and on the other hand, the actually planned conditions for functioning of the facilities, shops and units.

Besides the development of methodology for constructing a block system of FER norms on the whole, the main conditions for solving this task are: development of a system of planning indicators for the subbranch as a system of gages of energy consumption, methodology for constructing block-systems of FER norms, methods for computing the norms for each production in the subbranches; guarantee of the accounting for actual expenditures and losses of FER, gas flows in the systems of extraction, transportation and storage of gas, and others.

The VNIIEgazprom [All-Union Scientific Research Institute of Economics, Organization of Production and Technical-Economic Research in the Gas Industry] has worked out a complex program for improving the methodology and creating a system of FER standards at all levels of production control in 1980-1985. Scientific research and planning institutes, design organizations, associations and enterprises of the branch, i.e., the system of specialized scientific and scientific-production subdivisions that was formed in the branch in the current five-year plan are participating in the fulfillment of the complex program. The Ministry of the Gas Industry is supervising the solution of this problem that is important for the gas industry; the head scientific organization is VNIIEgazprom.

The basis for the construction of the branch block-system for FER standards in the gas industry is the formation of a system of standards for the subbranch (for technology) and for the organizational structure (production association, all-union production association) of the branch based on per-objective block-systems of FER standards in each type of branch activity (drilling, extraction, transportation of gas, etc.). At the same time, it is kept in mind that the per-objective block-systems of standards provide tracing of their functioning patterns and other standard-determining factors.

The figure [not included] presents a plan for the branch block-system of standards as a whole for all types of FER; it shows the principles of its formation according to the technological and organizational structure of the branch from the block-systems of standards for standard objects, as well as the structure and principles of their formation. The per-objective block-systems include sets of mutually-related standards for the main and auxiliary production, as well as for nonproduction consumers. The establishment of a functional link between the individual blocks and the principles for formation of the tracking information systems are stated in publications [1,2,3].

According to the structural essence the systems of standards for the main and auxiliary production are identical; their systems for standard gages differ.

The system of shop standards of main production consists of a set of mutually related standards for the main production units, differentiated to the primary energy-consuming blocks, and a set of standards for the general shop consumers of energy (power units: pumps, ventilators, etc.), and for the general plant systems of heating, illumination, etc.

At the given stage, besides the development of a system of gages for resource-consumption and methods of unitizing and de-unitizing the standards in such a system the main tasks are the development for the subbranches, production associations and all-union prodution associations programs of techniques to perfect the standardization of energy resources that provide for the detection of complete lists of the norms and standards of consumption and losses of FER for each type of objects, production associations, all-union production associations, subbranches and for the branch as a whole, and the compilation on this basis of a plan of scientific research work to create the necessary instructional-method documents, norms and standards with differentiation of the volumes of work according to years and specific executors. These tasks will be solved with regard for the conditions of functioning of the automated control system (ACS) of all levels. In the coming five-year plan it is planned to set up and introduce in the gas industry and automated complex system of standards (including the block-system for FER) constructed on the aforementioned principles.

In relation to the fact that such a problem is very labor-intensive and cannot be solved in a short period, while it is necessary to perfect standardization immediately, the program provides for the use of the extant techniques, instructions, their perfection, and development on their basis of progressive norms and standards for the FER and fuel-lubricant materials for the enterprises, production associations, all-union production associations, for the subbranches and for the branch as a whole. It is planned to fulfill these developments in stages in the shortest periods.

The main tasks at the first stage are the development of methods of complex standardization of the most energy-intensive facilities, and in the first place, norms for the consumption and losses of FER in gas transportation (up to 85% of the consumption of natural gas and electricity in the branch are expended for gas transportation), refinement of the techniques, and then individual differentiated norms for FER consumption for the most important energy-consuming equipment, and setting up of accounting of the actual consumption and losses of FER in this subbranch. It is planned to conduct analogous work for all the subbranches.

The timely fulfillment of the complex program for perfection of the methodology and creation of a system of FER standards on all levels of production will permit the use of the available reserves of saving energy resources, and will promote an increase in their efficient use in the gas industry.

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FUELS

GOALS FOR OIL, GAS INDUSTRY IN FIVE-YEAR PLAN REVIEWED

Moscow GEOLOGIYA NEFTI I GAZA in Russian No 3, Mar 80 pp 1-5

[Editorial: "Let Us Turn the Final Year of the Tenth Five-Year Plan into a Year of Leninist Shock Work"]

[Text] Our nation has entered the concluding year of the Tenth Five-Year Plan. The Soviet people are aware that the national economic level achieved in 1980 will become that reference point or that basis which will determine the quotas of the 11th Five-Year Plan for the economic and social development of our state. The workers of the nation have been greatly inspired by the results of the November (1979) Plenum of the CPSU Central Committee and the speech given at it by the General Secretary of the CPSU Central Committee and Chairman of the Presidium of the USSR Supreme Soviet, Comrade L. I. Brezhnev, and the decisions of the Second Session of the USSR Supreme Soviet.

In arousing gigantic creative energy in the masses, the Communist Party is focusing this on carrying out the most complicated and the most pressing tasks of developed socialism, namely the tasks of improving production efficiency and work quality, accelerating scientific and technical progress, making maximum use of the potential growth factors for ensuring harmonious and comprehensive development for all the economic sectors and all the regions of the nation.

The results of the 4 years of the Tenth Five-Year Plan strengthen the confidence of the Soviet people in the correctness of the course outlined by the party. Over this time the national economy in all areas has moved substantially forward. Over the 4 years, national income has increased by 16.2 percent, and its rise was 323 billion rubles in comparison with the corresponding period of the Ninth Five-Year Plan. The output of petroleum (including gas condensate) in 1979 was 586 million tons, and this was 94 million tons more than in 1975. Gas output reached 407 billion m^3, and has increased by 40 percent since 1975. The increase in production in 1979, in comparison with 1978, was 11 percent for the Mingazprom [Ministry of Gas Industry], for labor productivity it was 8 percent, and for the Minnefteprom [Ministry of Petroleum Industry], the respective figures were 3 and 2 percent.

Comrade L. I. Brezhnev congratulated the collectives of the enterprises and organizations of the gas industry and the construction and installation organizations involved in building projects related to the production, processing and transporting of gas for achieving high targets in a short period of time in developing the gas industry and for the significant overfulfillment of the plan quotas for gas output in 1979 and the 4 years of the five-year plan. In his greetings, Comrade L. I. Brezhnev pointed out: "The remarkable results of your work are a major contribution to implementing the party's program for an all-round increase in the nation's fuel and energy resources and a vivid example of carrying out the decisions of the November (1979) Plenum of the CPSU Central Committee for ensuring the continuous operation of the national economic sectors and meeting the needs of the population for fuel and energy." Comrade L. I. Brezhnev expressed confidence that "the workers of the gas industry, the construction and installation workers, in making extensive use of advanced experience and further improving the efficiency of their work, will worthily celebrate the 110th anniversary of the birthday of V. I. Lenin and will do everything to complete the fulfillment of the 1980 plan and the five-year plan as a whole ahead of time."

The oil and gas reserves which have been explored in our nation are capable of covering the growing needs of the national economy. During the Tenth Five-Year Plan, the prospects of the Western Siberian Oil and Gas Province were significantly broadened, and this is the main raw material base for the output of oil and gas in the nation. Here 39 new oil and gas deposits were discovered. The discovery of oil deposits on the Buzachi Peninsula provides an opportunity to organize its output in a new area of Kazakhstan. The presence of recoverable oil and gas reserves has been shown in the subsalt deposits in the littoral zone of the Caspian Depression along its entire length. Significant prospects for gas strikes are linked to the Astrakhan arched uplift and the Sol'-Iletsk outcropping of the foundation.

The geological explorers of the Udmurt ASSR fulfilled the 5-year quota for the increase of gas reserves ahead of time, as did the geologists of Tyumenskaya Oblast and Uzbekistan for increasing gas reserves. Recoverable oil and gas strikes were affirmed in the Paleozoic deposits in Tomskaya Oblast. In the Yelley-Igayskiy area at a depth of 3,800-4,000 m, an oil and gas gusher was struck from the Middle Devonian deposits. The second stage of the Urengoy--Chelyabinsk gas line was put into operation, and this was over 1,600 km long; also completed were the Shebelinka--Dnepropetrovsk--Krivoy Rog--Izmail and Gryazovets--Leningrad pipelines each 600 km long. During the 4 years of the five-year plan, 7,300 km of oil and gas lines were built in Western Siberia, 22 compressor and oil pumping stations were built, and 23 oil and gas deposits were connected to the pipeline systems, including 16 deposits ahead of time. At the end of 1979, the collective of the Nadymgazprom [Nadym Medvezh'ye] Association reported that it had produced 300 billion m^3 of gas since the beginning of the operations at the Medvezh'ye deposit. For the collective of the Shatlykgazdobycha [Shatlyk Gas Production] Association, the Tenth Five-Year Plan has truly become a time of birth, growth and development. In 1979 alone, 37 billion m^3 of gas were produced from the Shatlyk deposit. Just 20 years ago, such a quantity of gas was the output for all the Soviet Union.

The plan for oil production as set for the Minnefteprom for 1979 was fulfilled. From the petroleum workers the nation obtained 438,000 tons of oil and gas condensate above the plan. The drilling workers of the Minnefteprom drilled 15.1 million m of rock and turned over around 6,800 oil and gas wells to the field workers. The annual plan was successfully realized by 22 oil-producing regions which turned out 655,000 tons of oil and gas condensate above the plan. Some 14 petroleum-producing associations fulfilled the additional quota.

The plan for preparing the explored oil and gas reserves as set for 1979 for the USSR Mingeo [Ministry of Geology] was fulfilled as a whole, however certain geological prospecting organizations did not meet the established quotas. The plan for the increase in explored oil and gas reserves was not fulfilled by the geological prospectors in the Ukhta, Tomsk and Novosibirsk territorial geological administrations and the Lenaneftegazgeologiya [?Lena Oil and Gas Geology] Association.

In compiling the 1980 plan, consideration was given to the important decisions set by the CPSU Central Committee upon the initiative of Comrade L. I. Brezhnev on the fundamental questions of national economic development. For example, it was considered necessary to ensure a steady growth of the fuel and energy complex.

Proceeding from the tasks of national economic development, the 1980 plan has provided an output of 606 million tons of oil and gas condensate, and this is 20 million tons, or 3.6 percent, more than the level reached in 1979, while the production of gas is to be 435 billion m^3 of natural gas, or 7 percent more than in 1979. The basic increase in petroleum production will come from the regions of Western Siberia, and this will compensate for the natural decline in output at the old deposits, and will ensure its further growth. There is also to be an increase in petroleum output in the regions of the Komi and Udmurt ASSR's, Georgia and Sakhalinskaya Oblast.

In Western Siberia, petroleum production will be raised to 315 million tons, and for gas over 160 billion m^3. Construction will be completed at the Surgut Gas Processing Plant with a capacity of 4 billion m^3 a year, and the Surgut GRES-1 with a capacity of 2.5 million kilowatts.

The session of the USSR Supreme Soviet emphasized that the quotas for increasing the output of oil and gas will be carried out under conditions of opening up new deposits in the remote and inaccessible regions as well as increasing the distance of transporting these types of fuel. This, naturally, will involve a significant rise in the capital investments and current expenditures. In order to meet the planned volumes of oil and gas output, it is essential to accelerate the construction of projects at the new oil and gas fields, and to promptly complete the oil and gas lines, the compressor and pumping stations, and the gas processing plants. It is essential to improve housing and municipal service construction in the new regions, particularly in Western Siberia and the Komi ASSR, for retaining worker and specialist personnel, and for creating favorable conditions for labor, recreation and cultural growth here.

Along with the development of the nation's fuel and energy complex, an ever greater economic effect is to come from the rational use of energy resources and their greatest possible savings. A 1-percent reduction in the consumption of electric power and fuel will mean a savings of around 17-18 million tons of conditional fuel units a year, that is, a savings of millions of rubles in capital investments.

Our nation has entered the concluding year of the Tenth Five-Year Plan. Comrade L. I. Brezhnev at the November (1979) Plenum of the CPSU Central Committee pointed out that 1980 is to be "not only the concluding year of the current five-year plan, but also the basis on which the following five-year plan is to be built. This is a year of active preparations for the 26th Party Congress. The evaluation of the work done and the tasks for 1980 must be approached precisely from such positions."

To fully utilize the initiative of people and with redoubled energy to carry out the policy of the 25th CPSU Congress of raising production efficiency and work quality are the duty of each specialist, and each economic, party and soviet leader. We must solve a great and complicated task of not only successfully concluding the final year of the Tenth Five-Year Plan but also create a sound basis on which the following 11th Five-Year Plan will be built.

In 1980, the Tyumen' petroleum workers must increase oil output by 32 million tons.

In order to deliver the oil and gas to consumers it is essential to lay still 8,685 km of pipelines. The most important of them are: Petrovsk--Yelets, Urengoy--Chelyabinsk, and Shurtan--Syrdar'inskaya GRES.

All the labor collectives have responded to the appeal of the CPSU Central Committee to widely develop the competition to properly celebrate the 110th anniversary of the birthday of V. I. Lenin, and to make the final year of the five-year plan a year of work in the Leninist manner.

All that has been outlined by the 1980 State Plan for Economic and Social Development of the USSR should be fulfilled and overfulfilled. Precisely this notion permeates the socialist obligations which have been assumed by many labor collectives. The party has urged that primarily reserves be disclosed for improving the efficiency and quality of work, that technical reequipping be carried out more actively, that advanced experience be mastered more thoroughly, in bringing about the more rational utilization of all types of resources and improving the organization of labor and production management.

The Komsomol youth collectives of geologists in Tyumen' have set the shock watch in honor of the 110th birthday of V. I. Lenin. In 1979, six brigades reported that they had completed the quotas of the Tenth Five-Year Plan, and two brigades were working for 1982. The competition of drilling workers and prospectors is headed by the brigade of Vladimir Solov'yev from the Surgut Oil Prospecting Expedition. In 1979, this collective set a record for the sector in drilling 38,000 m of deep test wells, and in 1980 will storm the new target of 41,000 m. More than 10 discovered oil deposits are to the labor score of the drillers. The collective of Glavsibtruboprovodstroy [?Main Siberian Pipeline Construction Administration] is working successfully. It promised to complete at least 1,400 km of mainline pipe and by the 110th birthday of V. I. Lenin to complete construction of the head sections of the second stage of the Urengoy--Chelyabinsk--Petrovsk--Novopskov gas line and the Urengoy--Gryazovets gas line with a total length of 730 km; the new Muravlenkovskoye field is to be connected to the existing oil pipeline systems ahead of time.

At the November (1979) Plenum of the CPSU Central Committee, Comrade L. I. Brezhnev said: "In terms of the 1980's, the task is to substantially improve the fuel and energy balance of the nation and first of all to reduce the share of petroleum as a fuel for electric plants.... For this it is essential, in the first place, to move more decisively to increasing the gas output rate, particularly in Western Siberia, and to widely replace Mazut with gas. Secondly, it is essential to more rapidly develop nuclear power. And not only for producing electric power, but also for the needs of central heating. Here very substantial reserves are to be found, and this question is very promising. Thirdly, it is essential to accelerate the development of the Ekibastuz, Kansk-Achinsk and Kuznetsk fuel and energy complexes, and, finally, the construction of the corresponding power transmission lines, and above the Ekibastuz--Center line operating on direct current with a voltage of 1,500 kilovolts."

In 1979, the nation's nuclear plants generated over 50 billion kilowat hours of electric power. About 17 million tons of organic fuel would be required to produce such a quantity of nuclear power. Throughout the world. the thermal power plants release 200-300 million tons of ash and around 60 million tons of sulfur anhydride into the atmosphere annually. By 2000, these figures could rise, respectively, to 1.5 billion tons and 400 million tons. The AES are virtually independent of the fuel supplies, they do not require oxygen and do not pollute the atmosphere with ash and other compustion products. The advantages of the AES are obvious.

One of the fundamental tasks in the nation's economic development is an acceleration of scientific and technical progress. Advances in this area decisively influence a rise in the efficiency of social production and the carrying out of the party's economic and social program. An important role in the solving of this problem is played by a strengthening of the ties between science and production, by a rise in quality and an acceleration of scientific developments, and by the rapid introduction of their results into production.

In 1979, the scientific research institutes of the USSR Mingeo, the Minnefteprom and the Mingazprom completed the development of a most important national economic problem in the area of determining the basic directions for geological prospecting in 1981-1985 with an adjustment of the potential oil and gas resources of the oil and gas-bearing provinces and areas of the USSR. They drew up comprehensive programs for studying and surveying the oil and gas fields for an entire number of regions of joint operations for the associations and enterprises of the USSR Mingeo, the Minnefteprom and Mingazprom. The designated programs undoubtedly will help to improve the efficiency of geological prospecting and the quality of exploratory work for oil and gas in the nation. The scientific research organizations are actively and effectively developing cooperation among the scientific and production organizations and they are widely concluding contracts for cooperation between the scientific and production collectives. The creative ties and the pooling of efforts for solving national economic problems have become a good tradition for the workers in production and the scientific institutions. At the same time as a whole the economic effect from employing the results of research in the geological prospecting and exploratory processes and in working the oil and gas fields could be significantly higher. The nonfulfillment of the quotas by individual geological administrations of the USSR Mingeo and by the associations of the Minnefteprom obviously indicates that the effectiveness of a number of scientific developments does not meet the present production needs. Some of them are of a very general nature, and their effectiveness is low. The lack of the proper drive to increase the effectiveness of scientific research at the same time prevents a focusing of scientific forces and material means in the main areas, and at times concentrates on solving secondary, particular problems which do not have a decisive effect upon accelerating scientific and technical progress in the geological prospecting and exploratory processes or on increasing the effective yield in exploiting the oil and gas fields. All of this reduces the effectiveness of scientific search. The collectives of the scientific research and design organizations under the USSR Mingeo, the Minnefteprom and Mingazprom should focus attention on a further rise in the theoretical level and quality of research and on accelerating the introduction of achievements from scientific and technical progress into production. They should constantly broaden creative ties with the territorial geological administrations, associations and production organizations, and should provide them with help in improving the technical base of production.

In outlining a program of long-range scientific research, it is essential to focus attention on the most urgent scientific areas and subjects to be carried out, to ensure a rational concentration of scientific forces and material resources, and to wage a decisive struggle against the continuing of projects in unproductive areas which do not open up opportunities for developing fundamentally new procedures and methodological developments as well as new equipment and production methods.

In reinforcing the advances made over the 4 previous years, the collectives of the associations, enterprises and organizations of the USSR Mingeo, the

Minnefteprom and Mingazprom should make a maximum effort to turn the final year of the Tenth Five-Year Plan into a year of Leninist shock work, having fulfilled the plan quotas of the Tenth Five-Year Plan both in terms of the increase in reserves and for the output of oil and gas.

The fourth year of the five-year plan has handed on the baton to the fifth, final year. The broad range of tasks which must be the focus of the energy and aspirations for the participants of the socialist competition has been clearly defined. The collectives of the associations, enterprises and organizations of the Minnefteprom and Mingazprom have promised to produce above the plan for 1980 the following: 82,000 tons of oil in the Tatar ASS ASSR, 10,000 tons of oil in the Bashkir ASSR, 825 million m^3 of gas in the Ukraine, 112 million m^3 of gas and 25,000 tons of fuel in Azerbaijan, 100 million m^3 of gas in Uzbekistan, 31,200 tons of oil and 0.6 billion m^3 of gas in Turkmenia, 10,000 tons of oil in Georgia, and 70,000 tons of oil and 16 million m^3 of gas in Kazakhstan. Since the beginning of the Tenth Five-Year Plan, the oil workers of the Komi ASSR have dispatched 50 million tons of oil for refining. This is approximately 10 million tons more than over the entire previous five-year plan. Over the last 4 years oil output at the the fields of the youngest Usinskneft' [Usinsk Oil] Administration has increased by more than 3-fold, and in 1979 was over 11 million tons. The collective of the oil field No 2 of the administration is struggling to produce at least 1,000 tons of liquid fuel above the plan by the 110th birthday of V. I. Lenin. The oil field workers from the Bavly fields which are the oldest in Tataria have produced the 100-millionth ton of oil since the start of working the deposit. Over the 4 years of the five-year plan the Bavlyneft' [Bavly Oil and Gas Producing] Administration increased output at their oldest fields in the republic by close to 400,000 tons. And in the final year of the five-year plan, the administration has promised to produce 4.13 million tons of product for the nation. In the concluding year of the five-year plan, the Turkmen oil and gas workers have promised to provide the nation with millions of tons of oil and bring gas output up to 80 billion m^3.

The decisions of the November (1979) Plenum of the CPSU Central Committee and the speech of Comrade L. I. Brezhnev at it are a concrete militant work program in all areas of communist construction. For all the Soviet people at present there is no more important and responsible task than implementing this program.

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FUELS

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PETROLEUM GEOLOGIC ZONING OF AZERBAIJAN SSR STUDIED

Moscow GEOLOGIYA NEFTI I GAZA in Russian No 2, Feb 80 pp 29-35

[Article by A.N. Guseynov, Azneft', and F.A. Shirinov, AzNIPIneft': "Petroleum Geologic Zoning of the Territory of the Azerbaijan SSR"]

[Text] The inadequate level of geological-geophysical investigation of the territory of the Azerbaijan SSR until recently did not allow the implementation of tectonic and petroleum geological zoning of the depression zones of the republic, which is the chief factor when working out the theoretical bases of exploration and prospecting of oil and gas deposits.

The deep prospecting drilling and geological-geophysical studies which have been performed in recent years in a considerable volume, especially in the Srednekurinskiy depression, together with work done earlier, have yielded the opportunity of generalizing all the material obtained and compiling the first diagram of tectonic zoning of the depression zones of Azerbaijan.

Previously [4] we compiled a diagram of tectonic zoning of the depression zones of the republic (fig. 1) and indicated the existence here of four deep troughs, which in the Mesozoic-Cenozoic period underwent prolonged and steady deflection, where the accumulation of thick layers of sediments occurred (fig. 2). In all these troughs, occupied by isolated sedimentation basins, there were favorable conditions for accumulation and burial of OV [organic substances] and transformation of them into liquid and gaseous UV [hydrocarbons]. Genetically linked with these basins (Southern Caspian megabasin, Yevlakh-Agdzhabedinskiy, Iori-Adzhinourskiy and Northern Apsheron sub-basins) are all the established and proposed oil and gas deposits on the territory of Azerbaijan. Each of them has been considered as an autonomous system in realization of the processes of generation, accumulation and conservation of hydrocarbons (see fig. 1).

In this way, the territory of the depression zones of Azerbaijan has been schematically zoned tectonically and according to petroleum geology features.

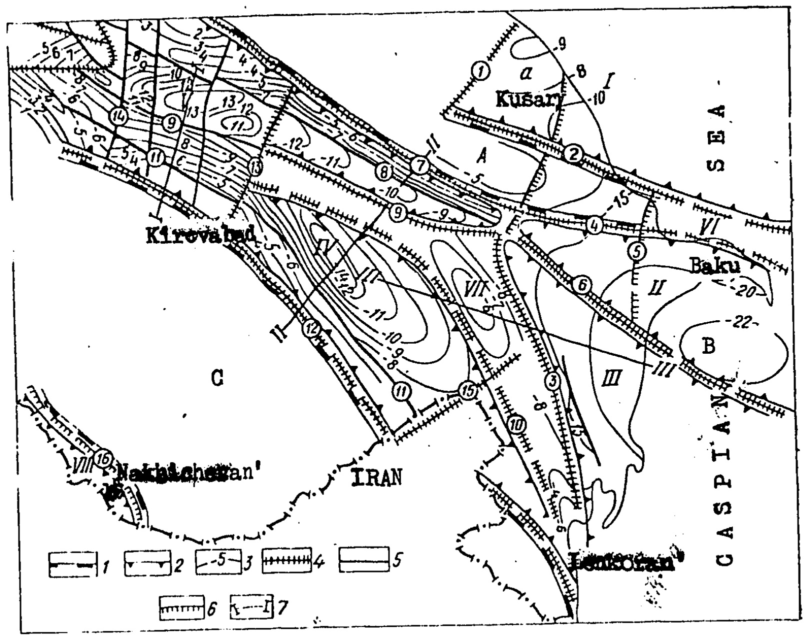

Fig. 1. Diagram of Tectonic Zoning of Depression Zones of Azerbaijan (refined and supplemented version)

Limits of tectonic elements: 1. first series (A. meganticlinorium of the Greater Caucasus, B. Southern Caspian depression, C. meganticlinorium of the Lesser Caucasus), 2. second series (troughs: I. Northern Apsheron, II. Gobustano-Apsheron, III. Nizhnekurinskiy, IV. Yevlakh-Agdzhabedinskiy, V. Iori-Adzhinourskiy; interbasin zones of buried upheavals: VI. Northern Apsheron, VII. Mingechaur-Saatly-Talysh; VIII. Priaraksinskiy depression; superimposed troughs: a. Kusaro-Divichinskiy, b. Nakhichevanskiy); 3. isohypses of the surface of the pre-Jurassic foundation, kilometers; Fractures and flexures (numbers in circles: 1. Samurskiy, 2. Siazanskiy, 3. Western Caspian, 4. Germianskiy, 5. Yashminskiy, 6. Adzhichay-Alyatskiy, 7. Kvareli-Kutkashenskiy, 8. Northern Adzhinourskiy, 9. Udabno-Geokchayskiy, 10. Mingechaur-Lenkoranskiy, 11. Kurinskiy, 12. Predmalokavkazskiy, 13. Gyandzhechay-Alazanskiy, 14. Kazakh-Signakhskiy, 15. Nizhnearaksinskiy, 16. Nakhichevanskiy); 4. deep-seated, 5. boundary, 6. interior; 7. lines of geological profiles.

This article is devoted to the next stage of zoning, that is, to isolating in the limits of each oil and gas bearing basin (NGB; neftegazonosnyy basseyn) the zones which differ from one another in geological development, structural features, conditions of formation of the zones of oil and gas accumulation and so on, which has important practical significance for setting up and organizing geological exploration in the limits of each oil and gas bearing basin.

It is necessary to note that during petroleum geologic zoning of the territory of Azerbaijan we adhered to their designations accepted in the literature: oil and gas bearing territories (NGO; neftegazonosnyye oblasti), oil and gas bearing regions (NGR; neftegazonosnyye rayony) and zones of oil and gas accumulation (ZNGN; zony neftegazonakopleniya) [2, 3, 5, 6, 8-12 and others].

Thus, singled out on the territory of the depression zones of Azerbaijan are the following NGO, NGR, and ZNGN (fig. 3).

The largest part of the Northern Apsheron oil and gas bearing territory (NGO) covers the water area of the Caspian Sea and is characterized by submergence of the foundation up to 15 kilometers. On dry land it is represented by the Kusaro-Divichinskiy oil and gas bearing region (NGR), where the capacity of the sedimentary mantle reaches 10 kilometers. The region to the northeast is bounded by the Samurskiy deep fracture, and to the southwest the Siazanskiy [8]. More than 20 uplifts have been ascertained here. There are folds of considerable dimensions, complicated by explosive events; the capacities of individual stratigraphic intervals of the Mesozoic-Cenozoic period are reduced in them. The main oil and gas bearing suites are individual suites of the Paleogene-Miocene and the Cretaceous. Small accumulations of oil and gas have been established in the middle-Jurassic deposits. There are industrial deposits of oil on the sites of the Siazan' monoclinal (Chandagar-Zarat, Siazan'-Nardaran, Saadan, Amirkhanly, Zagly-Zeyeva).

The Gobustano-Apsheron oil and gas bearing territory (NGO)[1] is part of the Southern Caspian NGMB [not further identified] and is located in the limits of the trough of the same name. The northern boundary is the southeastern submersion of the meganticlinorium of the Greater Caucasus (on dry land) and the Northern Apsheron zone of interbasin uplifts (in the sea), which separate it from the adjacent Northern Apsheron oil and gas bearing territory. The southwestern boundary of the territory is the Adzhichay-Alyatskiy fracture and its sea continuation. In the southeastern direction on the side of the Southern Caspian basin the territory is expanded and deepened, and there is a sharp increase in the capacities of the alpine sedimentary mantle (from 10 to 20 kilometers and more, see figures 1, 2). Singled out in this territory on dry land are two oil and gas bearing regions: the Shemakhino-Gobustano and the Apsheron, with the Yashminskiy flexure serving as the boundary between them.

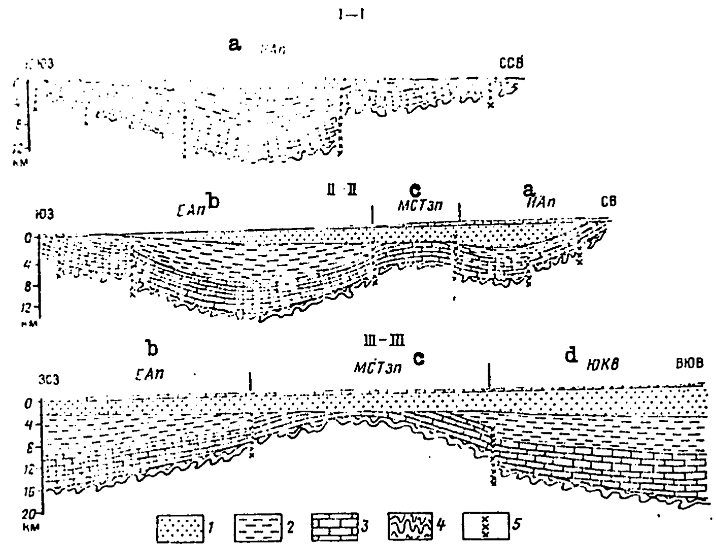

Fig. 2. Geological Profiles

Deposits: 1. Anthropogene-Pliocene, 2. Miocene-Paleogene, 3. Mesozoic (Cretaceous and Jurassic), 4. Surface of the pre-Jurassic foundation, 5. Deep fractures.

Troughs: a. Iori-Adzhinourskiy, b. Yevlakh-Agdzhabedinskiy,
c. Mingechaur-Saatly-Talysh interbasin uplift zone,
d. Southern Caspian Depression

The Shemakhino-Gobustano oil and gas bearing region occupies the northeast part of the territory. The size of the sedimentary mantle here fluctuates from 10 to 20 kilometers. The region is characterized by the highest density of local structures (more than 100 folds of different sizes and configurations). Participating in their structure are deposits from the Lower Cretaceous to the Apsheron stage inclusively. All these folds are narrow, asymmetric, and complicated by longitudinal explosive breaks of an upthrust and fault character. The signs of oil and gas content have been established in deposits of the Cretaceous and Cenozoic. Industrial accumulations of oil have been discovered on the site of Umbaki in formations of the Maykopskiy suite and the Chokrakskiy horizon. Future prospects are linked with the Mesozoic complexes.

The Apsheron oil and gas bearing region occupies the whole territory of the Apsheron peninsula. The region is distinguished by a large size of the sedimentary mantle (over 20 kilometers). Counted here are more than

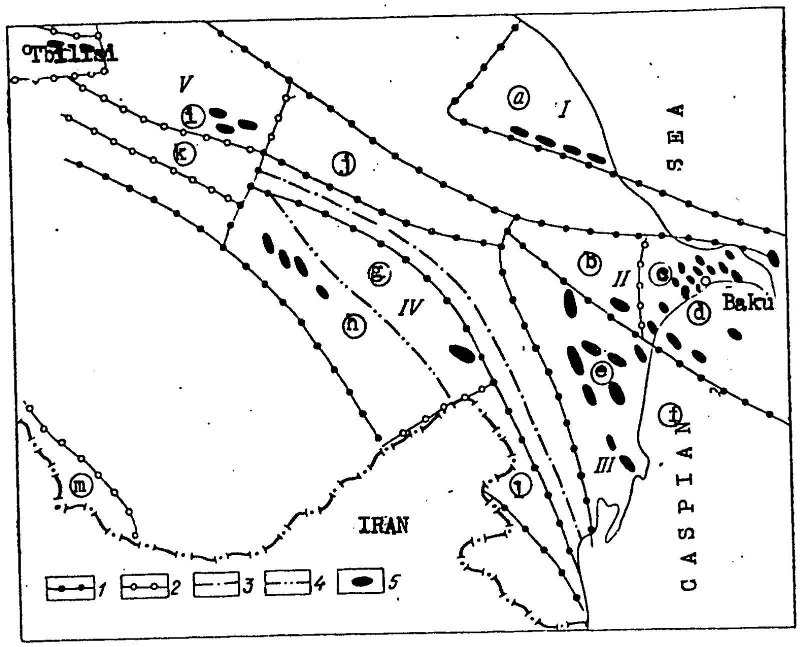

Fig. 3. Diagram of Petroleum Geological Zoning

Boundaries: 1. oil and gas bearing territory (NGO) (I. Northern Apsheron, II. Gobustano-Apsheron, III. Nizhnekurinskiy, IV. Yevlakh-Agdzhabedinskiy, V. Iori-Adzhinourskiy),

2. Oil and Gas Bearing regions (NGR) (a. Kusaro-Divichinskiy, b. Shemakhino-Gobustanskiy, c. Apsheron, d. Apsheron Archipelago, e. Nizhnekurinskiy, f. Baku Archipelago, g. Muradkhanlinskiy, h. Kirovabadskiy, i. Lenkoran, j. Adzhinourskiy, k. interfluve of the Kura and Iori, l. Mirzaanskiy, m. Nakhichevanskiy possibly oil and gas bearing)

Axis lines: 3. Mingechaur-Saatly-Talysh interbasin uplifts; 4. Yevlakh-Agdzhabedinskiy trough; 5. deposits of oil and gas.

40 anticlinal folds, 25 of which are being industrially developed. The folds are asymmetric, complicated by longitudinal and transverse explosive fractures. The main targets of industrial development are the deposits of the productive layer. Small flows of oil and gas have also been detected in the Miocene deposits. The future prospects of the region are connected with the Mesozoic deposits.

The Nizhnekurinskiy oil and gas bearing territory (NGO) is part of the Southern Caspian NGMB and is located between the Adzhichay-Alyatskiy (to the northeast) and Western Caspian (to the southwest) deep fractures.[2] It is widely exposed on the side of the Southern Caspian depression. Singled out in the limits of it are the Nizhnekurinskiy oil and gas bearing region and the oil and gas bearing region of the Baku Archipelago. Their arbitrary border passes along the shoreline of the Caspian Sea.

The Nizhnekurinskiy oil and gas bearing region is characterized by the considerable size (more than 20 kilometers) of the sedimentary mantle. Twenty anticlinal uplifts have been established here, characteristic for which is an asymmetrical structure, and the presence of axial-longitudinal and numerous transverse fractures. The deposits of the middle and upper Pliocene, developed on six sites, are oil and gas bearing. The deposits of the Miocene and Paleogene are also considered promising.

The Yevlakh-Agdzhabedinskiy oil and gas bearing territory (NGO) is bounded to the northeast by a zone of buried uplifts in the Mingechaur-Saatly-Talysh belt, more precisely the Mingechaur-Lenkoran deep fracture. To the northwest its boundary is the Gyandzhechay-Alazanskiy transverse fracture, and to the southwest the Predmalokavkazskiy longitudinal fracture. The size of the alpine sedimentary mantle here changes from 5 to 14 kilometers and more. Singled out in the limits of the oblast are: the Kirovabadskiy, Muradkhanlinskiy and Lenkoran oil and gas bearing regions, in which four deposits of oil have been discovered in the deposits of the Chokrakskiy horizon, the Maykop suite, the Eocene and in volcanic rocks of the Upper Cretaceous. Oil and gas saturations were also noted in formations of the Akchagyl'skiy and Sarmatskiy stages. Further prospects are connected with the Mesozoic rocks.

The Kirovabad oil and gas bearing region is located in the southwest part of the Yevlakh-Agdzhabedinskiy oil and gas bearing territory. To the southeast the boundary passes along the Nizhnearaksinskiy transverse fracture, and to the southwest the Predmalokavkazskiy deep fracture, and to the northeast it arbitrarily passes through the axis line of the Yevlakh-Agdzhabedinskiy trough. The size of the sedimentary mantle fluctuates here from 5 to 14 kilometers. Deposits of oil have been discovered and are being worked at the Naftalan, Mirbashir, and Kazanbulag sites. The Maykop and Eocene, and possibly also the Mesozoic deposits contain oil and gas.

The Muradkhanlinskiy oil and gas bearing region occupies the northeastern interior half of the Yevlakh-Agdzhabedinskiy trough. Serving as its borders to the southwest and the northeast, respectively, are the axis lines of the Yevlakh-Agdzhabedinskiy trough and the Mingechaur-Saatly-Talysh buried uplift, to the southeast the Nizhnearaksinskiy deep fracture, and to the northwest the Gyandzhechay-Alazanskiy. The depth of occurrence of the pre-Jurassic foundation changes from 6 to 14 kilometers. Industrial deposits of oil have been established in the beds of the Chokrakskiy horizon, the Maykop suite, the Eocene and in Upper Cretaceous rocks of volcanic origin. One deposit, the Muradkhanly, is being developed. Further prospects are connected with the Mesozoic-Cenozoic complex of deposits.

The Lenkoran oil and gas bearing region occupies the southeastern end of the Yevlakh-Agdzhabedinskiy trough. The boundaries of the region to the northwest and the southwest are, respectively, the Nizhnearaksinskiy and Predmalokavkazskiy deep fractures, and to the northeast the axis line of the Mingechaur-Saatly-Talysh zone of buried uplifts. The size of the sedimentary mantle reaches 8-9 kilometers. Intensive signs of oil and gas have been discovered in the Oligocene-Miocene deposits. Prospects of the presence of oil and gas are connected with formations of the Miocene, Oligocene, Eocene and Mesozoic.

The Iori-Adzhinourskiy oil and gas bearing territory is located in the northwest part of the Kurinskiy intermontane depression and occupies the trough of the same name [2, 5, 9]. The size of the sedimentary mantle in its limits changes from 2 to 13 kilometers. The main oil and gas bearing complexes are the deposits of the Eocene in the Maykop suite, the Chokrakskiy horizons, the Sarmatskiy stage and the Shirakskiy suite, which are being developed on the sites of Patara-Siraki, Taribani, Mirzaani, Teleti, Noriya, and Samgori-Patardzeuli. Singled out in this territory is a number of isolated oil and gas bearing regions, two of which are located on the territory of Western Azerbaijan: the Adzhinourskiy and the interfluve of the Kury and Iori (see figures 1, 3).

The Adzhinourskiy oil and gas bearing region occupies the southeastern part of the Iori-Adzhinourskiy oil and gas bearing territory. Serving as its boundaries are deep fractures: the Kvareli-Kutkashenskiy to the northeast, the Gyandzhechay-Alazanskiy to the northwest, and the Udabno-Geokchayskiy to the southwest. The size of the alpine sedimentary mantle here fluctuates from 8 to 12 kilometers. Traced in its limits are five anticlinal zones, uniting more than 30 anticlinal uplifts. A sharp lack of correspondence of the structural is established between the Mesozoic-Paleogene and the overlapping complexes. Deposits of oil and gas have not been discovered in the region. The prospects are linked with deposits of the Shirakskiy suite, the Sarmatskiy stage, the Maykop suite, the Eocene and the Mesozoic.

The oil and gas bearing region of the interfluve of the Kury and Iori occupies the southwestern part of the Iori-Adzhinourskiy oil and gas bearing territory, which corresponds tectonically to the southwest side of the trough of the same name. The area of the region is bounded by deep fractures: by a continuation of the Kurinskiy to the southwest, by the Gyandzhechay-Alazanskiy to the southeast, and by the western continuation of the Udabno-Geokchayskiy to the northeast. The northwestern boundary is arbitrarily drawn along the Kazakh-Signakhskiy transverse fracture. The size of the sedimentary mantle varies from 5 to 11 kilometers. About 40 uplifts have been established here, grouped in six anticlinal zones. The folds are asymmetric, broken, and they have overthrusts and inversions in the south. Deposits of oil and gas have not been discovered in the region. The prospects are linked with the Sarmatskiy, Maykop, Eocene and Mesozoic deposits [2, 5, 6].

The Nakhichevanskiy possible oil and gas bearing region is located in the Araksinskiy zone and occupies the Nakhichevanskiy imposed trough, made up of Miocene molassa layers. The prospects are linked with the Miocene deposits.

It is evident from what has been presented above that deep fractures have been taken as the boundaries of the isolated subvividions during tectonic and petroleum geological zoning of the territory of the depression zones of Azerbaijan. This is not by chance, because along them there were shifts of split blocks of the pre-alpine foundation.

The fractures played a dominant role in the formation of the troughs, they contributed to the emergence of different structural-facial zones and to the appearance of their own geotectonic regimes of development peculiar to each of the isolated sections of the basin, they controlled the placement of deposits of oil and gas, and so on [1, 6, 7, 9-12].

We would like to note in conclusion that the diagrams of tectonic and petroleum geological zoning presented in the article lay no claim to full solution of these questions. Their further refinement and change on the basis of new materials and generalizations is completely probable. But, at the same time the zoning that has been done now will help substantially to evaluate objectively the prospects of oil and gas being present in individual territories, to select the scientifically valid directions of exploring for oil, and to increase the effectiveness of this work.

FOOTNOTES

1. The Gobustano-Apsheron and Nizhnekurinskiy oil and gas bearing territories occupy troughs of the same name in the range of the NGSB [not futher identified] and are independent tectonic elements of the Southern Caspian NGMB on dry land. Isolation of these troughs along the surface of the pre-Jurassic crystal foundation has not been estsblished. The same thing is observed in the Northern Apsheron trough.

2. Considering that the southwestern border of the interbasin uplift in the Mingechaur-Saatly-Talysh zone still has not been specified, an arbitrary border between the Nizhnekurinskiy, Yevlakh-Agdzhabedinskiy and Iori-Adzhinourskiy oil and gas bearing territories is drawn along the axial lines of these interbasin uplifts (see figures 1, 2, 3).

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