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USSR Report

ENERGY

(FOUO 10/81)

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ELECTRIC POWER

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ELECTRIC POWER GROWTH IN ELEVENTH FIVE-YEAR PLAN

Moscow ELEKTRICHESKIYE STANTSII in Russian No 5, May 81 pp 2-6

[Text] In the review report to the congress, general secretary of the CPSU Central Committee, comrade Leonid Il'ich Brezhnev provided a deep marxist-leninist analysis of the path traveled by our party and our people following the 25th CPSU Congress, as well as an analysis of the successes of the domestic and foreign policy courses and economic policy of the party.

Our nation's national riches have increased considerably in the 10th Five-Year Plan. As compared to the Ninth Five-Year Plan, the national income increased by a factor of 1.24 and four-fifths was used directly for the needs of the populace, residential, social and cultural construction. Industrial output grew by a factor of 1.33 and capital investments in the nation's fixed capital increased, growing by a factor of 1.29. More than 1,200 large industrial enterprises were constructed.

It was also noted in the report that along with the great achievements which cause a rightful pride, the party sees difficulties, deficiencies and unresolved problems too. Still ahead is the decisive elimination, based on accumulated experience, of obstacles which interfere with economic growth.

The major points of the review report of L.I. Brezhnev in the field of economics were further developed in the report of the chairman of the USSR Council of Ministers, comrade N.A. Tikhonov: "The Major Trends of USSR Economic and Social Development during 1981 - 1985 and over the Period up to 1990".

The largest fuel and energy complex in the world has been created in our country, which includes the fuel extraction and fuel refining sectors of industry and electrical power engineering.

The extraction and production of primary fuel and energy resources amounted to almost 1,900 million tons of conventional fuel in 1980, or about 20% of world production. Some 603 million tons of oil and gas condensate were extracted, as well as 716.4 million tons of coal and 435 billion m^3 of natural and byproduct gas.

These results and the dynamic development of the Soviet economy are especially impressive against the background of the continuing economic decline, rise of inflation and mass unemployment and other crises engulfing the capitalist nations, primarily the U.S., the largest nation and the leader of the capitalist world.

The nation's power engineers also made their own contribution to national economic development in the 10th Five-Year Plan. While the national income increased by a factor of 1.24 over the five-year plan, the generation of electrical power increased by a factor of 1.25 and amounted to 1,295 billion KWH in 1980, while per capita electrical power production grew over this period from 4,081 up to 4,870 KWH per year.

In line with the resolution of the 25th CPSU Congress, electrical power generation at nuclear and hydroelectric power stations increased, which amounted to about 260 billion KWH in 1980 and was more than 70% greater than the power generated at the same electric power stations in 1975.

The level of electrical and thermal power generation achieved in the 10th Five-Year Plan was assured to a considerable extent by bringing new capacities on line at electric power stations. Overall, 54.3 million KW of new capacities were brought on line in the 10th Five-Year Plan; of them, about 19 million KW were at KES's, more than 15 million KW at TETs's, about 12 million KW at GES's and 7.9 million KW at AES's.

The installed capacity of all of the nation's electric power stations reached 267 million KW by the end of 1980 and of them, KES's had 118.4 million KW, TETs's had 74 million KW, AES's had 12.5 million KW, GES's had 52.5 million KW and diesel and other electric power stations had 9.6 million KW.

The past five-year plan was marked by a further rise in the concentration of combined energy production and centralization of the power supply.

By the beginning of 1981, more than 65 electric power stations of all types with a capacity of one million KW and more were in operation, having an overall capacity of 140 million KW; 33 electric power stations had a capacity of more than 2 million KW, and of them, 22 were TES's, 4 were AES's and 7 were GES's.

The installed capacity of heating plants increased by a factor of 1.27 during 1976--1980. The coefficient of centralization of heat production (by means of heating plants and boiler facilities with an output of 20 Gcal/hr and up) increased from 72.4 up to 78.4 percent over the last 10 years, with a rise in centralized heat production over this same period by a factor of 1.5. The coefficient of electric power supply centralization exceeded 97 percent in 1980.

The development of thermal electric power stations in the 10th Five-Year Plan was characterized by the wide-scale use of large power sets with capacities of 500 to 800 MW at KES's, and heating plants of 135, 180 and 250 MW at TETs's.

Considerable attention was devoted to questions of the efficient utilization of fuel in generating electrical and thermal power. A complex of measures was directed towards this in the 10 Five-Year Plan, which had a considerable impact. The share of electrical power generation with respect to the heating cycle increased by a factor of more than 1.2 and about 3.2 million KW of obsolete uneconomical power equipment was removed, and at several electric power stations, power equipment was modernized, the generation of electrical power by condensation plants with a steam pressure of 90 kgf/cm^2 and below was reduced, while the level of optimization of

load distribution among electric power stations and power units was improved, based on the use of computers. All of this, and the improvement in the operation of the power equipment in other modes, as well as the increase in the operational level, made it possible to reduce the specific conventional fuel consumption per KWH of output by 12 grams over the five-year plan. In 1980, the specific conventional fuel consumption per KWH was 328 grams, and was 172.9 kg/Gcal for heat output.

Technical progress in the development of nuclear power engineering was characterized by bringing a VVER-1000 pilot power unit on line, having an electrical capacity of 1,000 MW, as well as a type BN fast neutron reactor power unit with a capacity of 600 MW. Predominantly, reactors with a unit capacity of one million KW were placed in service in the 10th Five-Year Plan at nuclear electric power stations.

Electrical power networks at all voltages underwent a significant expansion in the 10th Five-Year Plan. By the end of 1980, the overall length of electrical power transmission lines at voltages of 35 to 750 KV reached more than 770,000 km, while lines of 0.4 to 20 KV reached almost 5 million km, including 3.7 million km in rural areas and about 1.2 million km in cities.

The construction of the alternating current 1,150 KV Ekibastuz--Urals and the direct current 1,500 KV Ekibastuz--Tsentr electrical power transmission lines was begun.

The capacity and boundaries of the USSR Unified Power System expanded considerably in the 10th Five-Year Plan; the OES [Integrated Power System] of Siberia and individual power systems and power centers were connected to the unified system in 1978. The installed capacity of the USSR Unified Power System reached almost 230 million KW by the end of 1980. The electrical networks of this power association is the largest in the world and encompasses a territory in which more than 220 million people live, while the distance between its eastern and western boundaries exceeds 7,000 km.

The major electrical grids which tie large electric power stations are the networks at voltages of 220, 330, 500 and 750 KV AC. The overall length of the electrical power transmission lines in all 11 OES's reached 23,800 km at a voltage of 330 KV, 26,800 km at 500 KV and 3,000 km at 750 KV by the end of 1980.

The expansion of the electrical links between the OES's and the regional power systems as well as their outfitting with modern operational mode and emergency automation increased the carrying capacity of the interregional links, and improved the reliability and efficiency of the electrical power supply for the national economy.

The parallel operation of the electric power stations of the USSR Unified Power System has made it possible to consolidate the capacity of electric power stations and the unit capacities of power units and plants, where the large carrying capacity intersystem links are available, and because of this, to reduce the specific capital investments in the construction of electric power stations and improve the operational characteristics of power units and plants. As a result of this, as well as because of the improvement in the utilization of water resources and other

operating mode control measures, the efficiency in the utilization of power resources has improved, while the fixed conditional costs at electric power stations have been reduced. It is figured that the creation of the USSR Unified Power System within the 1980 boundaries, taking into account expenditures for the construction of intersystem power transmission lines, provided for a capital investment savings of more than two billion rubles in the development of power engineering and reduced the annual operational expenditures by about 700 million rubles.

A characteristic of the development of power engineering over the last decade has become the construction of large electric power stations as a part of territorial production complexes.

The construction of the Pavlodar--Ekibastuz, Western Siberian (Tyumen'), Southern Tadzhik and Sayansk territorial production complexes continued in the 10th Five-Year Plan and the creation of the Kansko-Achinsk and Neryungrinsk fuel and energy complexes was begun. The construction of the power engineering facilities of these complexes and other power facilities has necessitated considerable capital investments.

Large capital investments were routed into the construction of residential, cultural and personal service facilities, as well as the mechanization of construction and the expansion of the construction base of the sector.

Residential housing with an overall area of more than 9 million m^2, kindergartens and nurseries with 46,700 places, schools for 47,700 students and numerous other facilities for cultural and everyday functions were placed in service in the 10th Five-Year Plan, according to the USSR Ministry of Energy.

There were also shortcomings in power engineering construction, the most significant of which were the late placement of power facilities in operation and the estimated construction cost overruns.

It is noted in the resolutions of the 26th CPSU Congress that the nation's attained level of economic and social development makes it possible to solve problems of an even greater scale. The main task of the 11th Five-Year Plan consists in ". . . providing for a further improvment in the well-being of the Soviet peoples based on the reliable and consistent development of the national economy, the acceleration of scientific and engineering progress and the shifting of the economy over to an intense path of development, the more efficient utilization of the nation's production potential, the utmost thrift with all kinds of resources, as well as improving work quality."

Working from the economic strategy of the CPSU and the main task of the 11th Five-Year Plan, the task ahead is that of providing for a consistent growth in the economy, refining the structure of public production, continuing the technical re-equipping of base industrial sectors - power engineering, metallurgy, machine building, etc., increasing the efficiency of public production and improving product quality, making economic use of material resources, as well as, in particular, providing for a savings of fuel and energy resources over the five-year plan in the national economy amounting to 160 to 170 million tons of conventional fuel.

Based on the utilization of the achievements of science and engineering, the following are planned: increasing the unit capacities of machines and equipment while simultaneously reducing their size, weight and power consumption; increasing the scales of utilization of renewable energy resources in the national economy -- water power, solar, wind and geothermal; and the design of chemical technological processes which spare energy resources.

Provisions have been made in industry for considerably stepping up the scales of the introduction of new high efficiency equipment and technology into production, which provide for a reduction in material consumption, an improvement in product quality, better utilization of fuel and energy resources, a reduction in oil and petroleum product consumption as boiler and furnace fuel, as well as an advanced pace of nuclear power development.

To assure the planned level of national economic development, it is planned that in 1985, the extraction of oil and gas condensate will be brought up to 620 to 645 million tons, the extraction of natural gas up to 600 - 640 billion m^3 and coal extraction up to 770 - 800 million tons, while the quality of coal delivered to the national economy will improve. Electrical power generation will continually rise, and in 1985 will reach 1,550 to 1,600 billion KWH, and of this, 220-225 billion KWH should be produced at nuclear electric power stations and 230-235 billion KWH at hydroelectric power stations. The increase in electrical power generation in the European area of the USSR will be provided primarily by nuclear and hydroelectric power stations.

The advanced pace of development of nuclear power engineering and hydroelectric power engineering markedly change the structure of electrical power generation in the 11th Five-Year Plan. In 1985, The percentage of steam turbine TES's in the generation of electrical power will fall down to 70 percent instead of nearly 80 percent in 1980, the percentage of AES's will increase up to 14 percent instead of the 5.6 percent in 1980 while the percentage of GES's will increase from 13.4 to 14.5 percent and the remaining 1.5 percent will be produced at non-turbine electric power stations.

The role of centralized heat supply sources, in particular TETs's, in the heat supply for the national economy will undergo a further increase in the 11th Five-Year Plan. In 1985, the total output of thermal energy by all of the nation's TETs's will reach 1,335 million Gcal, which exceeds the thermal energy output in 1980 by 200 million Gcal.

The start of the realization of a fundamentally new direction in centralized heat supply for large cities is planned for the upcoming years. The issue is the construction of several high capacity nuclear heating supply stations, each of which will be able to reliably provide heat to a city with a population of several thousand, without polluting the environment in this case.

To meet the rising needs of the national economy for electrical and thermal power, it is planned that 71 million KW of new electrical power station capacities will be brought on line in the 11th Five-Year Plan, and of them 34 million KW will be at KES's and TETs's, 24 to 25 million KW at AES's and 12 million KW at GES's.

The bringing on line of thermal electric power station capacities is primarily planned in the eastern regions of the nation, where in addition to building up capacities at existing TES's, the Ekibastuzskaya GRES-1, Syrdar'inskaya, Gusinoozerskaya, Primorskaya GRES and others, capacities will be introduced at large new TES's which are under construction, including the Berezovskaya GRES-1 (the Kansko-Achinsk brown coal basin), the Ekibastuzskaya GRES-2, Surgutskaya GRES-2, Neryungrinskaya and Kharanorskaya GRES's, Angrenskaya GRES-2, etc.

No new large thermal electric power station will be built in the nation's European region. It is planned here that capacities will be brought on line at the Zuyevskaya GRES-2 and the Azerbaijanskaya GRES which are under construction and a number of in service and under construction TETs's will be brought up to their design capacity.

The development of power engineering in the European regions will be primarily based on the construction of large AES's, as well as the mastery of the energy of the rivers of the northern Caucasus and the Trans-Caucasus. Besides building up the capacities of existing AES's - the Leningradskaya, Kurskaya, Chernobyl'skaya, Rovenskaya and Kol'skaya, capacities will also be introduced at new AES's: the Smolenskaya, Kalininskaya, Rostovskaya, Balakovskaya, Ignalinskaya, Yuzhno-Ukrainskaya, Khmel'nitskaya, Zaporozhskaya and Krymskaya.

The large scale construction of GES's will be undertaken primarily in the eastern regions. Here, new capacities will be brought on line at the Sayano-Shushenskaya, Bureyskaya, Kolymskaya GES-1, Kurpsayskaya, Baypazinskaya and Tashkumyrskaya GES's. The construction of the Boguchanskaya, Rogunskaya and a number of other GES's will be expanded.

In the European area, the construction of the Khudoni GES, the Namakhvanskaya, Miatlinskaya and Daugavpilskaya GES will be expanded and new capacities will be placed in service at the Cheboksarskaya, Nizhnekamskaya, Shamkhorskaya, Zhinval'skaya and a number of other GES's. In connection with the construction of large AES's designed for the operation in the base region of the load graph of power systems, several pumped storage electric power stations will be constructed to carry the peak loads and fill in the nighttime drops in the loads, including the Zagorskaya, Kayshyadorskaya, Dnestrovskaya, etc. It is planned that two million KW will be placed in service in just the first two of these stations in the 11th Five-Year Plan.

With this change in the structure of electrical power generation, the demand of electrical power engineering for organic fuel in the nation's European area in 1985 will increase only by 4 to 4.5 percent as compared to 1980, primarily because of the increased production of heat at TETs's and peak load boiler facilities, while the growth in the demand for electrical power using organic fuel for the nation as a whole will be 8 to 9 percent in the comparable years.

An analysis of the possible development of the nation's fuel bases, taking into account the exhaustion of several old fuel deposits in the European regions of the USSR and the Urals shows that the major fuel and energy resources towards which

the development of electrical power engineering will be oriented in the upcoming 10 to 15 years are:

--In the nation's European regions, nuclear power for AES and partially for heat supply sources;

--Kuznetsk and Ekibastuz coals in the Urals as well as electrical power transmitted from the Ekibastuzskaya, Berezovskaya and Surgutskaya GRES's;

--Kansko-Achinsk coals and hydroelectric resources in Siberia;

--In Central Asia, local coals, gas (predominantly high sulfur content gas) and the hydroelectric resources of large central Asian rivers;

--In Kazakhstan and regions of Uzbekistan and Kirgizia adjacent to it, Ekibastuz and Maykybuensk coals;

--In the Far East, in the Yakut and Transbaykal regions, it is planned that local coals (also gas in Yakut) as well as the hydroelectric resources of the rivers of the region be used.

The positive experience with the planning, construction and operation of nuclear electric power stations, along with their quantitative growth, confronts nuclear power engineering with large new problems:

--Satisfying the increased demands for electrical power in the European regions of the nation;

--Coming up with a practical solution of the problem of using nuclear energy for the purposes of centralized heat supply and creating the basis for the widescale utilization of nuclear fuel for these purposes at the end of the 1980's;

--Expanding the construction of AES's with power breeder reactors (fast neutron reactors) incorporated in a complex with the appropriate fuel cycle enterprises and preparing the widescale application of the combined production of electrical power and new nuclear fuel in the 1990's.

In the 11th Five-Year Plan, new capacities will be brought on line on an increasingly larger scale at large electric power stations with power units and plants having a high unit capacity.

The introduction of new capacities at KES's will be realized using power sets of 300, 500 and 800 MW, large hydroelectric plants of 200 to 640 MW will be installed in GES being constructed in the eastern regions of the nation and 10 reversible hydroelectric plants with a capacity of 200 MW each will be placed in service at pumped storage electric power stations constructed in the nation's European area.

The continuing consolidation of the capacity of thermal electric power stations and unit generation sets and heating plants, the further growth in electric power generation in the heat supply cycle and the increase in the operational level of

equipment will make it possible to reduce the specific fuel consumption in the 11th Five-Year Plan by 9 grams for each KWH delivered from the buses (from 328 down to 320-319 grams) and by 0.7 kg per output Gcal (from 172.9 down to 172.2 kg).

By virtue of this reduction in specific fuel consumption per KWH and per Gcal, in 1985 alone, about 9 million tons of conventional fuel will be saved, and taking into account the increase in the growth of electrical and thermal power generation at AES's and GES's, about 75 million tons of conventional fuel in all will be saved.

The structure of fuel consumption by thermal electric power stations of the USSR Ministry of Energy will change considerably in the 11th Five-Year Plan. The consumption of petroleum fuel will fall off sharply and the percentage of natural gas will increase substantially, while coal consumption will increase somewhat.

The structural dynamics of fuel consumption by the electric power stations of the USSR Ministry of Energy from 1975 through 1985 is characterized by the following data, in percent:

	1975	1980	1985
Fuel oil	29.5	35.2	25.9
Gas	22.0	24.2	31.5
Coal	44.5	37.9	39.6
Peat	2.1	1.0	1.5
Shale	1.9	1.7	1.5
Total	100	100	100

During the years of the 11th Five-Year Plan, electrical power networks will be further expanded both at voltages of 35 KV and up, as well as at 0.4 to 20 KV. During these years, it is planned that about 200,000 km of 35 to 1,150 KV electrical power transmission lines will be built, and of them, 21,000 km will be 330 to 1,150 KV power lines. The carrying capacity of the intersystem electrical power transmission lines will increase considerably. To improve the reliability of the electrical power supply for agricultural consumers, it is planned that the extent of rural networks at voltages of 35 to 154 KV be increased by 75,000 km, by 390,000 km for the 6 - 20 KV networks, and by 400,000 km for the 0.4 KV lines. The length of open wire and cable lines in municipal networks at voltages of 0.4 to 20 KV will likewise be increased by 200,000 to 220,000 km.

The main task of power engineers in the 11th Five-Year Plan is assuring the reliability of the supply of high quality electrical and thermal power to the national economy based on the timely fulfillment of the plan for bringing new capacities on line at electric power stations and in power networks, as well as the creation of requisite capacity reserve.

It is planned that the first stage of the 1,500 KV direct current Ekibastuz--Tsentr power transmission line will be constructed and placed in service.

To provide the Urals with electrical power, the 1,150 KV alternating current Ekibastuz--Urals power transmission line will be constructed and placed in service. To deliver power from the Berezovskaya GRES, the 1,150 KV Itat--Kuznetsk--Barnaul

power line will be built, which is the major section of the future Siberia--Kazakhstan--Urals transit line.

To deliver power from large AES's under construction, the construction of the 750 KV Severo-Zapad--Tsentr--Yug [Northwest--Center--South] trunk power lines and the 750 KV power line from the Smolenskaya and Kalininskaya AES's in the direction of Vladimir will be continued. These links are a part of the future 750 KV ring around Moscow.

The 750 KV networks in the South integrated power system will be further expanded to deliver power from the Chernobyl'skaya, Rovenskaya, Yuzhno-Ukrainskaya and Khmel'nitskaya AES's, and strengthen the ties to the "Mir" integrated power system of CEMA member nations. Electrical power transmission lines at 500 KV will be constructed to strengthen the links in the directions of Tsentr--Central Volga--Urals and Transcaucasus--Northern Caucasus--South, as well as to deliver power from the large electric power stations in Central Asia and to complete the Zeyskaya GES--Khabarovsk, Primorskaya GRES--Far East trunk lines, etc.

To improve the quality of electrical power with respect to voltage and reduce power losses in the mains, it is planned that about 60 million kvar of compensating capacities will be installed; of them, 20 million kvar of synchronous compensators and 40 million kvar of static capacitor banks.

Further steps to form the USSR YeES [Unified Power System] will be taken in the 11th Five-Year Plan. The connection of the Central Asian integrated power system to the USSR YeES is planned via the 500 KV Ekibastuz--Balkhash--Dzhambul power line. Because of this, and also the connection of other networks and power centers to the USSR YeES, the territory encompassed by the electrical networks of the USSR YeES will grow to 12 million km^2 with a population of 245 million people. The installed capacity of the electric power stations of the USSR YeES will exceed 300 million KW in 1985, while the annual amount of electrical power generated by them will be about 94 percent of the total generated in the nation. Such an expansion of the USSR YeES will increase the reliability of the electrical power supply to the national economy and have an additional impact by virtue of the better utilization of the power capacities and power carriers. Steps will be taken to further introduce and refine the means for operational mode and emergency automation, as well as expand the automated dispatcher control system (ASDU) to increase the level of reliability and economy of the USSR YeES.

It is planned that the central coordinating system (TsKS) of the ARChM [automatic frequency and active power control system] of the USSR YeES, and the centralized systems (TsS) of the ARChM will be improved in the integrated power systems (the transition from analog controllers to control computer complexes), the design of a reliable remote data retrieval and transmission system will be completed, which is necessary for the central coordinating system and the centralized systems of the automatic frequency and active power control system; as well as remote control and operational mode control systems for electric power stations, involving a large number of GES's and TES's in the participation in frequency and power control, and developing SAON [not further defined] and automatic frequency controlled load relief systems. The area of the system-forming network of the YeES encompassed by load equalization automation will be expanded. This automation, which provides for load

relief in case of emergencies on intersystem electrical power transmission lines for an electric power station in a transmitting region of the YeES and by disconnecting the most important users in the receiving region, prevents the division of the YeES into autonomous sections and the cascade spreading of outages.

It is planned in the 11th Five-Year Plan that automated control systems for production processes at electric power stations will be further refined, the information functions performed by them will be supplemented with control functions and integrated organizational and production process IOT-ASU automated control systems will be designed around general purpose computers.

Considerable attention will be devoted to the questions of improving control in the 11th Five-Year Plan. The implementation of all these and other measures, which follow from the "Major Trends of USSR Economic and Social Development During 1981 - 1985 and the Period up to 1990" will assure that power engineers successfully carry out the tasks assigned by the 26th CPSU Congress to the entire Soviet people.

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ELECTRIC POWER

BASIC ELECTRIC POWER TRENDS IN USSR

Moscow TEPLOENERGETIKA in Russian No 5, May 81 pp 2-4

/Article by A. A. Troitskiy of Gosplan USSR: "Basic Trends in the Development of the Electric Power Balance of the Country"/

/Text/ Great attention is being paid in the Soviet Union to the development of power fuel system industries. This situation has been clearly reflected in the decisions of the 26th CPSU Congress. Our country has rich natural resources of various types of fuel and is the only large industrially-developed country in the world which both now and in the future is basing its economic development on its own fuel and power resources.

Table one presents the growth in the extraction of basic types of fuel during recent times as well as the projected increase for it in the 11th five-year plan.

Table 1. Extraction Volume for Basic Types of Primary Fuel Resources in the USSR

Description	1970	1975	1980	1985
Extraction of primary fuel(total), in millions of tons of specific heat(percentage)	1227(100)	1551(100)	1875(100)	2180(100)
Including:				
Oil and gas condensate in millions of tons (percentage)	353(41)	490.8(44.7)	603.0(45.9)	620-645(41.8)
Gas, in billions of cubic meters (percentage)	198(19.4)	289.3(22.2)	436.5(27.5)	600-640(33.6)
Coal, in millions of tons (percentage)	624.1(35.9)	701.3(30.2)	715(25.2)	770-800(22.9)
Other types of fuel, percentage	3.7	2.9	1.4	1.7

The proportion of resources within the total extraction volume has been taken for conventional fuel.

Almost 75 percent of all primary fuel extracted is used as boiler-stove fuel, whose usage pattern in the USSR is presented in table 2. It is known that almost two-thirds of all boiler-stove fuel consumed is used to produce electric and thermal power in the country.

Table 2. The Dynamics and Pattern of Utilization of Boiler-Stove Fuel in the USSR

Description	1970	1975	1980	1985 (estimated)
Resources(total), in millions of tons of specific heat	932	1162	1396	1625
Including, in percentages:				
solid types of fuel	49.8	41.8	35.0	31.4
gas	32.3	36.8	42.6	49.4
liquid fuel	17.9	21.4	22.4	19.2
including mazut	15.4	18.5	19.4	16.0

The transforming influence of electrification on the country's productive forces and the living conditions of society is the reason for the steady growth in the proportion of fuel resources directed at satisfying the country's electricity requirements. Thus, during the last ten years the growth rate for electric power production in the USSR outstripped the growth rate for the total consumption of fuel power resources by more than 20 percent.

In the power fuel situation being put together now and especially in the future, electric power plays a large role in the gradual transformation of the pattern of the country's power fuel balance, and the further broad involvement in it of such efficient resources as nuclear power, inexpensive low-heat coal from the large eastern deposits, and also water power resources. These factors are additional stimulators of the deepening and broadening of electrification and the creation of new industrial power technology in place of processes which require the direct consumption of high-quality organic fuels.

The development of domestic power engineering has been intrinsically linked with the pattern of the power fuel balance, and its optimization. Thus, at an early stage, when there was not yet a strong fuel base and transport system in the country, the construction of electric power stations was directed by GOELRO/State Commission for the Electrification of Russia/ based on local resources, especially peat and water power. As the coal industry was developed and the economic indicators for the extraction and utilization of coal were improved, its role in the fuel balance of electric power stations grew steadily and in the 1950's reached 60 percent of all consumed power resources.

The use of oil and gas at electric power stations was significantly widened in the following period as large deposits of these fuels were opened and put into operation. As a result, the proportion of gas mazut fuel in the power fuel balance grew from 8-8.5 percent in the middle of the 1950's to 46-50 percent by the end of the 1970's and beginning of the 1980's, and calculating on the organic fuel used--even up to 55-60 percent.

A new power fuel situation demanding a sufficiently dynamic reorganization of the power fuel balance of electric power clearly appeared in the USSR from mid-1970.

By this time many of the country's main traditional bases for oil and gas extraction, located in the developed European regions of the USSR, began to be depleted and their output decreased. To provide for the national economy's growing requirements for power resources, new oil and gas deposits have been developed in the remote regions of Siberia which have complex natural-climatic conditions and where the costs are high to explore and extract fuel, and also to transport it into the areas of consumption. As a result, capital investments in these industries have grown 1.5 times faster in recent years than the fuel extraction level, and the production cost for oil and gas extraction grew 1.6-2 times during the last decade. A significant decrease in oil extraction at the traditional earlier-developed deposits has led to the fact that now about 80 percent of the industry's capital investments are being used to maintain the attained extraction level and only 20 percent of the investments are going toward an absolute growth in resource extraction.

A tendency for a further growth in the proportionate costs of the means and resources for fuel extraction, especially oil, also remains for the future and this circumstance is a major factor of the total power fuel policy.

From the data presented in table 1, it is evident that the growth of oil extraction in the country is decreasing from 138 million tons in the 9th five-year plan and 112 million tons in the 10th five-year plan to 17-42 million tons in the 11th five-year plan. To satisfy the country's requirements for light oil products it is necessary under these conditions to extend oil refining while at the same time decreasing the proportion of boiler-stove fuel output.

Besides that, with the extraction of a huge amount of power fuel resources, the mineral wealth of the earth is being seriously depleted. However rich the USSR may be in valuable fuel resources, the reserves of these resources are becoming exhausted and they are not being replaced.

The 1970's at the same time have been characterized by the preparation and development of work on the wide introduction of other types of fuel power resources for domestic electric power.

The industrial introduction of the use of nuclear fuel for electric power has been accomplished and such indicators have been achieved in electric power production at AES's which make the broad assimilation of nuclear fuel into the power fuel balance economically expedient.

Large reserves of inexpensive power coals have been developed in the eastern regions of the country, mainly in the Ekibastuzskiy and Kansko-Achinskiy coal basins, where the open pit mining of these types of coal has been provided for.

The further development of the rich water power resources of Siberia, Central Asia, and the Far East has been prepared.

These circumstances in toto have permitted us to determine the basic trends in the formation of the country's future power fuel balance which comes down to the necessity to decrease in every way possible the consumption of fuel oil and to broaden the use of nuclear fuel, power coals of the large eastern deposits, and water power resources. In the 11th five-year plan gas extraction will amount to 75 percent of the total growth in primary fuel extraction which will allow a speed-up in supplanting fuel oil in the balance of electric power stations, and also the use of gas at TES's directly in the mining regions.

This total power fuel concept has a different interpretation depending on the regional conditions, since each of the regions of the country possesses its own economic and resource features.

In the European part of the USSR, as has already been indicated, there are no fuel resources on which a substantial growth in the production of electric and thermal energy could be based. Therefore the selection of ways to provide the electric power development of this region with fuel has been limited to a comparison of the use of nuclear fuel and the organic fuel of the eastern deposits.

Calculations which have been made show that in the regions of the country west of the Urals it is more advantageous to develop electric power based on nuclear fuel. The question has been raised of constructing AES's to provide practically the entire increase in the production of electric power in this region. With that end in view, many AES's are already under construction in various regions from the Baltic and Western Ukraine to Armenia, the Volga area and Bashkiriya. During 1981-1985, some 24-25 million kilowatts of new capacities must be put into operation at AES's and the production of electric power at them must reach 220-225 billion kilowatt hours. This will permit a savings in 1985 of more than 65 million tons of organic fuel(by standard calculation). At the same time they are also providing for some increase in the use of water power resources in this region through the completion of the already-constructed GES's of the Volzhsko-Kamskiy cascade, the construction of a number of GES's in the Transcaucasus, in the Northern Caucasus, and elsewhere. However, the effective water resources of the European region are small and do not fully permit the solution of the maneuverability problem of covering the electrical system loads which are especially strained by the wide construction of AES's.

Taking into account the scarcity of organic fuel, they hope to resolve the power system maneuverability problems by speeding up the construction of GAES's /pumped-storage electric power stations/ which, as calculations of the institute Gidroproyekt /All-Union Planning, Surveying and Scientific Research Institute imeni S. Ya. Zhuk/ have shown, can with a charge from AES's be used effectively not only under peak but also under semi-peak conditions.

Because the creation of GAES's requires quite large capital investments, considerable time, and appropriate natural and terrain conditions, in some areas of the region it is necessary to draw in large amounts of high-quality fuel for the installation of mobile gas-turbine units.

The intention is to decrease organic fuel expenditure by taking into account technical resources, decreasing the number of hours of use of the capacities of TES's in the European region, dismantling a part of the obsolete equipment, and partially forcing out the use of mazut at TES's, replacing it with gas fuel.

They envision continuing work on drawing Baltic shale into the fuel balance of the region and the construction of new shale-extraction enterprises has been developed for this. However, the introduction of shale into the consuming electric power stations has only been projected for implementation beyond the 11th five-year plan.

In view of the broadening of the use of peat in agricultural production, plans call for a decrease in its use at the electric power stations of the European region.

The presence of rich power fuel resources in the eastern areas of the country makes it disadvantageous to construct AES's here in the foreseeable future. The intention is to develop electric power in these areas on the basis of local power fuel resources, the main ones of which are the open pit mine coals of the Ekibastuzskiy and Kansko-Achinskiy deposits, the natural gas of Tyumen' Oblast, and also the great water power resources of the rivers.

Calculations show that it is advisable to form electric power capacities in Siberia, Central Asia, and the Far East through a combination of powerful TES's and GES's in the approximate proportion of 60-70 percent and 40-30 percent respectively.

The 11th five-year plan calls for an increase in the use at electric power stations of Ekibastuzskiy coal by approximately 20 million tons, and Kansko-Achinskiy coal by no less than 10 million tons. They intend to develop the mining of Khoronorskiy and Gusinoozerskiy coals in the Transbaykal region, Neryungrinskiy coals in Yakutiya, Primorskiy in the Far East, and Angrenskiy in Central Asia. The use of Kuznetskiy coals at electric power stations will be increased by no less than five million tons, and keeping in mind their high heat value, they must be transported mainly to other regions of the country, chiefly to the Urals.

The plan is to continue the construction of large electric power capacities of the power complex in immediate proximity to the unique gas deposits in Western Siberia. Besides providing for the rapidly-growing requirements of the local area for electric power, this power complex later on, in accordance with its growth, will be used to supply power to the Urals which will also receive electric power from the Ekibastuzskaya GRES and where new capacities based on Kuznetskiy coal will be introduced at the Permskaya GRES. An increase in the use of local gas resources for electric power stations is also envisioned for Central Asia. With this end in view, it is planned to expand the Maryyskaya GRES and construct the new powerful Talimardzhanskaya GRES.

Plans call for the further development of the rich water power resources of the western areas of the country through the construction both of already-started and also of new large GES's, including such ones as the 6.4 million kilowatt Sayano-Shushenskaya, the 6.7 million kilowatt Sredne-Yeniseyskaya, and the 4 million

kilowatt Boguchanskaya in Siberia; the Bureyskaya GES and Kolymskaya GES in the east; the Shul'binskaya GES in Kazakhstan; the Rogunskaya, Baypazinskaya, and Kambaratinskaya GES's in Central Asia.

Thus if in the areas of the European part of the country west of the Urals, electric power stations will be constructed based mainly on nuclear fuel in the zones of electric power consumption, then in the eastern areas of the country electric power stations will be built immediately in the places where power resources are located and electric power will be transported over power transmission lines to the consumption centers.

They also envision the possibility of transporting electric power from the eastern areas into the central part of the country over the Ekibastuz-Center 1500 kilovolt d.c. inter-system VL/overhead line/.

All of this permits the formation of a sufficiently gradual rated power fuel balance pattern of electric power in 1985, presented in table 3, which is compared with the dynamics of this pattern in past years.

An analysis shows that the use of mazut at electric power stations of Minenergo /Ministry of Power and Electrification/ USSR during the 11th five-year plan must be decreased from 115 to 90 million tons or by 22 percent. Gas utilization volumes must grow by almost 40 percent and coal(as a natural fuel) by 12 percent. They envision the production of electric power at AES's to triple during the five-year period, and to increase 1.28 times at GES's. The role of saving and substituting for organic fuel in electric and thermal power production is growing substantially. Thus, if in 1975 this figure amounted to 48 million tons of specific heat with respect to 1970, and in 1980 of about 50 million tons of specific heat in relation to 1975, then in 1985 it must reach 70-75 million tons of specific heat.

Generally the intention is to decrease the specific consumption of fuel by up to 319-320 grams for a released kilowatt hour of electric power and up to 172.2 kilograms for 1 gigacalorie of heat. Together with broadening electric power production at AES's, plans call for the development of thermal power generation based on nuclear fuel. Work is continuing on the development of the combined production of thermal and electric power. A large complex of measures must be carried out on the reconstruction and modernization of the stock of operational TES equipment.

With a 25 percent growth in electric power production in the 10th five-year plan, the consumption of organic fuel for these purposes increased by only 18 percent. These proportions will become even more gradual in the 11th five-year plan. With a projected 23 percent increase in electric power production volumes by Minenergo USSR electric power stations, the growth in organic fuel consumption at them for these purposes will only be 5.4 percent.

The planned program for the development of domestic electric power in the years 1981-1985 has been intrinsically linked with the USSR power fuel balance and is distinguished by its high national economic effectiveness. The progressive transformations in the electric power fuel power balance permits just through economies and substitutions for organic fuel usage the fuel extraction industries to save no less than 10 billion rubles of capital investments.

Table 3. Pattern of Consumption of Power Fuel Resources by the Minenergo USSR Electric Power Stations

	Types of Fuel				
Years	Liquid fuel oil, in percentages	Gas, in percentages	Solid types of fuel, in percentages	Water power resources[1]	Nuclear fuel[1]
1970	19	19.3	42.7	18.2	0.5
1975	25	18.6	41.2	13.1	2.1
1980	27.9	18.2	32.5	15.3	6.1
1985 (estimate)	18.0	21.8	29.5	15.5	15.2

[1]Equivalent to the average standard expenditure of organic fuel for the production of electric power: for AES's including the Leningrad and Ignalinskaya electric power stations.

The decisions of the 26th CPSU Congress have not only clearly determined this grandiose program but have also pointed out concrete paths toward its realization.

8524
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ENERGY CONSERVATION

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PLANS FOR SUPPLYING ENERGY TO CHEMICAL INDUSTRY IN 11TH FIVE-YEAR PLAN

Moscow PROMYSHLENNAYA ENERGETIKA in Russian No 5, May 81 pp 2-6

[Article by L. I. Osipenko, USSR Deputy Minister of Chemical Industry]

[Text] The 26th CPSU Congress armed Soviet chemists with clear and distinct directions associated with providing chemical products to the national economy, raising production effectiveness, and achieving economical use of raw materials and energy. Among the numerous problems of chemical industry, those of power engineering are acquiring increasingly greater significance. At the end of the 10th Five Year Plan chemical industry was consuming about 5 percent of the electric power and 6 percent of the thermal power consumed by the country's industry. Total growth in the sector's power consumption during the five-year plan was 15 percent, and an increase to 23 percent is anticipated in the 11th Five-Year Plan.

Growth in energy expenditures in chemical industry stems from the increase in total energy consumption connected with growth in product output and unit energy expenditures owing to improvement of the quality of raw materials, greater depth and unity of processing, higher product quality, and greater outlays on environmental protection. But sensible use of energy, addition of secondary energy resources to the energy balance, and organized improvement of the sector's power engineering are promoting a decrease in energy consumption. For example construction of new high-capacity carbide shops, which are characterized by a higher degree of mechanization of production and auxiliary processes, higher product quality, and lower dust contamination of workplaces and the surrounding air, increases the need for energy. But at the same time, use of more-effective catalysts in the production of polyethylene and polypropylene, intensification of the process by raising the unit output capacity of the basic equipment used in the production of polystyrene, use of concentrated formalin in carbamide resin production, and transition to a continuous method in ion-exchange resin production will produce a significant savings of energy resources.

Attainment of the energy economization targets will make it possible to increase production of, for example, plastic by 1.71 times, and caustic soda by 1.38 times in the 11th Five-Year Plan. In this case the energy demand will correspondingly increase by only 1.41 and 1.33 times. There are plans for saving about 3 million tons of comparison fuel by 1985 by achieving a relative reduction in the energy requirements of production. In comparison with 1980, the average decrease in the sector's energy consumption norms will be 7.3 (for electric power) and 7.8 percent (for thermal power).

If we are to improve the sector's energy uses in the 11th Five-Year Plan, we will need to complete a complex of technical, technical-economic, and organizational tasks, ones which have an intersector nature in a number of cases. These tasks include:

intensifying production, and introducing machine units of greater unit productivity, exhibiting better characteristics from a technological and an energy point of view;

using the most sensible forms of energy and energy carriers, and minimizing unavoidable production losses;

achieving full utilization of secondary energy resources;

raising the dependability of the equipment, and reducing losses due to mishaps, unplanned machine idleness, and production wastes;

optimizing the work of power production equipment and of energy-using production equipment;

improving the system for controlling chemical industry's energy use.

Technological measures produce the greatest impact in energy economization. Chemical industry plans to achieve a large share of the energy savings through efforts to reconstruct and expand production operations; this includes improving the production processes. Moreover there are plans to change the structure and volume of production, including by increasing the volume of plastics and resins requiring less energy for their production, and increasing the proportion of the diaphragmic method in comparison with the mercury method in caustic soda production.

As structural changes occur in the methods of production of certain chemical products, factors promoting reduction of the consumption of some forms of energy and growth in the demand for others begin to operate. Thus transition to the diaphragmic method in caustic soda production means a savings of electric power, but thermal power consumption grows. In terms of the total energy consumed, this method is more economical than the mercury method it substitutes, and its introduction will mean a savings of 4,400 tons of comparison fuel in 1985.

Growth in production of synthetic fibers and filaments (capron, lavsan, nitron, and others) in comparison with artificial filaments (viscose and acetate) will mean an increase in electric power consumption and a decrease in heat consumption, since unit consumption of electric power for production of synthetic fibers is about 30 percent higher and unit outlays of thermal energy are 80 percent lower than in the production of artificial fibers. In this case the total savings in 1985 will be 188,000 tons of comparison fuel.

Sensible use of energy resources in the sector will be promoted by the planned reconstruction of principal and auxiliary production processes, coupled with replacement of energy carriers and reduction of the energy losses in production cycles. Thus reduction of mechanical losses in the principal production equipment of chemical fiber enterprises will result in a savings of 20 million kilowatt- hours of electric power in the 11th Five-Year Plan, and introduction of countercurrent

fiber washing will reduce heat consumption at a number of enterprises by 200,000 gigacalories. Conversion of heating and ventilation at a number of enterprises from steam to superheated water will insure a savings of about 100,000 gigacalories per year.

The fullest possible use of secondary energy resources has tremendous significance to the state. Presently chemical industry uses about 78 percent of its secondary fuel resources and 80 percent of its secondary thermal resources. Utilization of secondary energy resources by the sector's enterprises will grow significantly in the 11th Five-Year Plan. Thus hydrogen has not been used in caustic soda production due to the absence of special burners. Introduction of such burners will make it possible to save about 56,000 tons of comparison fuel by the end of the five-year plan. Other combustible wastes will also be returned to the energy balance. As an example combustion of chloroprene production wastes coupled with acquisition of secondary steam in the Yerevan "Nairit" Scientific-Production Association will produce a savings of about 900,000 gigacalories of thermal energy.

The utilization factor for the heat of distillery liquid in the production of soda ash has now reached 26 percent. In the future it will be raised to 77 percent with the help of special devices developed by the Tekhenergokhimprom Scientific-Production Association as a result of which the savings of thermal energy will be 400,000 gigacalories. Utilization of heat from combustion of waste gas to produce steam at the Volgograd "Kaustik" Production Association will mean a savings of about 450,000 gigacalories.

Raising the reliability of production equipment is an effective way to prevent wasteful energy and material expenditures. Thus implementation of a complex of measures to raise the reliability of the electric power supply to the Novopolotsk "Polimir" Production Association will make it possible to eliminate sizeable nonproductive losses (combustion of waste gasoline, additional outlays to warm up and start machine units and machinery after periods of idleness). The main way to reduce interruptions in power supply is to organize the electric power supply system in such a way that it would insure maintenance of a certain voltage for the most important consumers in the event of the breakdown of various sections and components of the system. An analysis of the breakdown rate of electric power facilities, being performed by the Soyuzkhimpromenergo Production Association, is helping to raise the reliability of electric power supply to chemical enterprises. This analysis will make it possible to develop effective measures against breakdowns.

The work experience of enterprises in chemical industry demonstrates the acute need for coordinating with the power supply systems on the ways and means of insuring dependable and stable electric power supply. The reason for this is that when a power system turns off power to a chemical production operation due to an overload (partial overload), sizeable material losses result due to disturbance of the production process, which may not be started up again until several hours or days later, even if electric power is restored quickly (in several minutes). By installing automatic selective unloading devices that turnoff power to a significant number of consumers but keep the most important mechanisms operating we can insure either continuation of the production operations in "idle gear" or its interruption without breakdown. In this case the production process could be resumed immediately after electric power is restored, and the losses to production would be minimized.

In order to raise the responsibility of energy supplying organizations to consumers, we need to reexamine the "Rules of Using Electric and Thermal Energy", particularly in relation to the compensation that must be paid to industrial enterprise for losses resulting from unexpected interruptions or poor quality energy supply; the amount of the compensation could be established not in terms of the cost of energy not provided, but rather in proportion to the production losses suffered by the enterprise. In order to create a legal basis for such liability, we need to develop, with the participation of the industrial ministries, and approve, in the interdepartmental organizations, the methodological directives for calculating the losses suffered by industrial enterprises owing to unexpected interruptions or poor quality energy supply, as well as due to restrictions imposed in opposition to the set limits of energy consumption by the enterprises in terms of power and energy.

The power-using energy-producing and production equipment of industrial enterprises often operates uneconomically owing to nonoptimum operating and loading conditions. The largest amount of electric power used by chemical enterprises (about 67 percent) is consumed in motors. The average efficiency of electric motors is rather high--about 90 percent, but when such motors work together with driven equipment (pumps, fans, mixers, and so on), efficiency does not exceed 40-50 percent, while even with optimum conditions it could not reach 60-70 percent. Power engineers of the chemical enterprises have the task of raising the efficiency of motors by 5-10 percent in the 11th Five-Year Plan, which will make it possible to save 1-2 billion kilowatt-hours of electric energy.

In a number of cases motors will be replaced or the conditions under which driven equipment is operated will be changed. Thus substitution of motors driving pumps used to circulate washing acids in sulfuric acid production at the Kirovakan Chemical Fibers Plant made it possible to save 180,000 kilowatt-hours, and intensification of the work of water recycling pumps produced a savings of more than 500,000 kilowatt-hours of electric power per year.

Condensate from heat-using production units is not fully recycled (40-50 percent) at many enterprises. The total losses of thermal energy in the sector owing to the failure to recycle condensate can be estimated at 20,000 gigacalories per year. In the next few years we need to eliminate the correctable losses of condensate, which total not less than 5,000 gigacalories per year.

The sector has a centralized system for calculating normative outlays and revealing the reserves of fuel economy in industrial boiler rooms; this system employs economic-mathematical models and computers. According to data obtained by this system, unit outlays in boiler rooms exceed the computed normative outlays by an average of 5 kg comparison fuel per gigacalorie, which is an annual economization reserve of 100,000 tons of comparison fuel. This reserve must be realized in the 11th Five-Year Plan.

Presently the chemical enterprises are operating a large quantity of obsolete energy producing and energy using equipment, which requires replacement, reconstruction, modernization, and adjustment. The Soyuzkhimpromenergo Production Association is pursuing an effective effort to adjust its equipment while simultaneously modernizing it and increasing its productivity. Modern technical concepts are being applied as a means for raising the effectiveness of existing equipment. For example dynamic

compressor supercharging devices that raise productivity by 10 percent while simultaneously reducing unit outlays of electric power by 3-5 percent are being employed, and type DKVR boiler units are being reconstructed, such that their output capacity is being raised by 1.6-2.5 times while maintaining optimum unit fuel consumption.

A plan for reequipment of the sector in the 11th Five-Year Plan and in the period to 1990 is being written as a means for systematically increasing the technical-economic level of the work of equipment in chemical industry. This plan foresees broad introduction of energy-conserving and wasteless production operations, and reconstruction and modernization of power producing equipment and power supply systems.

Comrade L. I. Brezhnev noted in the CPSU Central Committee report to the 26th CPSU Congress: "Solution of the problems facing us and utilization of the possibilities we have at our disposal depend in many ways on the level of leadership of the national economy, and the level of planning and control." These words can be applied quite validly to industrial power engineering, which has many unsolved problems associated with management organization.

The following integrated control tasks have dominant significance in relation to achieving sensible use of and economizing on energy in chemical energy:

Consideration and analysis of consumption and use of energy resources in high-energy devices and processes (in relation to specific sections, shops, and production operations, and in relation to the enterprise as a whole);

standardization of consumption and use of fuel and energy used to produce finished products, and to run individual high-energy operations, processes, and devices, and to produce high-energy semifinished and intermediate products;

control and regulation of consumption and use of energy in principal and auxiliary production facilities;

planning and implementation of organizational-technical measures aimed at conserving energy resources;

internal cost accounting of energy resources consumed by shops in the principal and auxiliary production operations, and enhancement of the material interest of enterprise workers in implementation of measures to save fuel and all forms of energy and energy carriers employed;

development and introduction of a system of technical, technical-economic, and organizational-technical documents concerning power supply and energy use.

All chemical enterprises are keeping records on energy consumption for the purpose of settling accounts with energy supplying organizations. Maintenance of records on use of energy resources within the plants is much more poorly organized, especially in relation to thermal energy and local energy carriers--cold, compressed air, nitrogen, and water. The reason for this is that when the enterprises were planned, the instruments required for such record keeping were not foreseen at all, or one instrument was intended for maintaining records on different energy outlays--in principal and auxiliary processes, for administrative needs, and by sanitary and utility systems.

If we are to solve the problem of maintaining records on energy resources on a national scale, we would need to develop intersector and sector instructions on organizing such record keeping and, on their basis, the appropriate requirements on the availability of energy accounting instruments at the enterprises. In their plans for rebuilding existing enterprises and building new ones, the planning organization must foresee a system for organizing energy accounting, and they must coordinate such systems with the particular patterns of external and internal energy supply. The Ministry of Instrument Making, Automation Equipment, and Control Systems must promote an increase in the production of energy accounting instruments with the purpose of satisfying industry's demand more fully.

Work has been started in chemical industry to review and develop new instructions on standardization of energy use. Working together with the Soyuzkhimpromenergo Production Association, the Minsk branch of the NIITEkhim [USSR Council of Ministers State Committee for Chemistry Scientific Research Institute of Technical and Economic Research] has developed a sector procedure for standardizing the use of energy resources, based on the all-union "Basic Provisions on Standardization of the Consumption of Fuel and of Thermal and Electric Power in the National Economy", approved by the USSR Gosplan in 1979. In order to improve standardization, the VNIPIenergoprom [not further identified] institute and the sector institutes and organizations must develop normatives (standards) of energy consumption for the most frequently encountered energy using production processes (heating in production and other furnaces, single and multistaged steaming, drying, liquid pumping, gas compression, and so on), tailoring the standards to the appropriate types of standard equipment.

Control and regulation of energy consumption can be most effective today only on the basis of remote control and centralization of power supply services, to include incorporating such functions in enterprise automatic control systems (at the level of automated production process control systems). Further introduction of dispatcher stations for the power supply services of chemical enterprises is planned for the 11th Five-Year Plan. In this connection the plans for rebuilding existing enterprises and building new enterprises must foresee dispatcher and control regulation systems for energy supply and energy use. To satisfy the demand for such systems, the Ministry of Instrument Making, Automation Equipment, and Control Systems must expand production and integrated delivery of dispatcher station equipment for the energy services of industrial enterprises. By planning organizational-technical measures aimed at saving energy in the sector's enterprises, we can achieve an annual savings of about 3 percent of the energy resource demand. The effectiveness of these measures can be raised significantly by considering information obtained from analyzing energy use--useful energy consumption and energy losses in the production, distribution, transformation, and consumption stages, and in specific machine units. Such an analysis may be performed only if it is closely tied in with the production processes, and therefore clear instructions on how to perform the analysis would be required. Under the methodological guidance of the Soyuzkhimpromenergo Production Association, sector institutes have developed directives for a number of production operations (five types of chemical fibers, soda, perchlorovinyl resin, polystyrene, methanol, etc.). Instructions on compiling and analyzing energy balances for chemical production operations consuming the largest amounts of energy are to be approved and published in the 11th Five-Year Plan. The necessary calculations are also to be mechanized by incorporating these functions into the automated control systems of the enterprise energy services.

Cost accounting between energy services and shops in the central and auxiliary production operations of chemical enterprises does not always foresee the appropriate sanctions for irrational energy consumption, for failure to satisfy energy norms, and for failure to implement energy economization measures. Payment of bonuses to the workers of production services (machine operators, mechanics, and so on) upon whom thrifty energy consumption depends directly is often not included in the system of material stimulation of energy resource economization. The existing instructions and statutes on cost accounting and material stimulation are to be reviewed appropriately in the 11th Five-Year Plan.

Production documents used in the control of industrial power engineering must provide guidelines for the work of plant power engineers, to include work associated with achieving sensible use and economization of energy resources. The time has come to have each enterprise develop and periodically update "energy guidelines for production" (on analogy with production guidelines), which should bring together the technical documents (equipment certificates and specifications, flow charts, operating rules, and so on), technical-economic instructions (on accounting, standardization, analysis, cost accounting, material stimulation, and so on), and organizational materials (job descriptions and instructions, documents associated with organizational structure, and so on).

Energy resource economization laboratories are to be created under the appropriate sector institutes during the 11th Five-Year Plan as a means for improving energy conservation in the subsectors. These laboratories are to deal with the problems of organizing standardization, planning, prediction, control, regulation, accounting, and analysis, and other problems associated with energy management. Methodological guidance is to be provided to these laboratories centrally by sector energy organizations of chemical industry--the Minsk branch of the NIITEkhim and the Soyuzkhimpromenergo Production Association. Creation of such laboratories will make it possible to improve both administrative and scientific-technical and technical-economic centralized leadership over the energy affairs of chemical industry.

If we are to fundamentally improve the function of industrial power engineering, we would need to develop standard all-union and sector organizational-functional schemes for the energy services of industrial enterprises; these schemes would need to be tailored to specific needs depending on the volume of energy resources consumed and produced by the enterprise, the quantity of power engineering facilities, the cost of energy equipment representing fixed capital, to include energy using production equipment serviced by power engineers, the number of units of equipment supporting the energy service, the categories of energy supply reliability in relation to the conditions of the production process, and other factors.

Fulfillment of the planned scientific-technical and economic-organizational measures will create the necessary groundwork for sensible energy consumption and reduction of the energy-intensiveness of chemical production; it will make it possible to improve the sector's energy indicators, and to successfully complete the tasks proposed by the 26th CPSU Congress.

The role of power engineering in supporting the normal functions of the principal production operation of an enterprise and in achieving sensible use of energy resources has risen in chemical and in a number of other industrial sectors. For this reason it would be expedient to raise the authority of senior power engineers in production associations using the largest amounts of energy to that of an association assistant chief engineer.

11004
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FUELS

UDC 553.98(57.51+571.53+571.56)

GEOLOGY OF OIL, GAS OF SIBERIAN PLATFORM

Moscow GEOLOGIYA NEFTI I GAZA SIBIRSKOY PLATFORMY in Russian 1981 (signed to press 28 Nov 80) pp 1-9, 551-552

[Annotation, foreword, introduction and table of contents from book "Geology of Oil and Gas of the Siberian Platform", edited by A. E. Kontorovich, V. S. Surkov and A. A. Trofimuk, Izdatel'stvo "Nedra", 2070 copies, 552 pages]

[Text] For the first time in Soviet geological literature, the book successively examines the stratigraphy, tectonics, paleogeography, geochemistry and hydrogeology of the Siberian platform from unified aspects. It describes the oil and gas fields, isolates and characterizes the regional oil and gas reservoirs, analyzes the laws governing the arrangement of the fields and reconstructs their history. It focuses especial attention on such geological features of the Siberian platform that complicate the arrangement and preservation of the oil and gas deposits as the ancient age, and to a considerable measure, the carbonate-evaporite composition of its sediments, intensive post-Triassic movements and trap magmatism.

The book is of interest to geologists, geophysicists, scientific workers, teachers of VUZ's, specialists in the field of oil and gas geology and long-term planning of the fuel and energy complex, and also students of VUZ's.

Foreword

Work to accelerate the search for and development of oil and gas fields, a new raw material base of the USSR oil and gas industry has been underway on the enormous territory of the ancient Siberian platform, between the Yenisey and the Lena.

The Siberian platform is a complexly constructed region with a range of oil and gas content from Riphean to Cretaceous, with extensive development of the carbonate-saliferous deposits. It is a region in which trap magmatism has been manifest with exceptional intensity. The scientifically substantiated, effective search for oil and gas in this region must be based on a detailed and complete knowledge of its geology, history of development, and laws governing the arrangement of the oil and gas fields. This entire broad circle of questions, stratigraphy, tectonics of the sedimentary mantle and substructure, arrangement and features of the structure of the regional reservoirs, geochemistry of the oil and gas bearing masses and naphthids, hydrogeology, structure and history of formation

of oil and gas fields, and the most effective strategy of searching for and exploring them are presented systematically and extensively in this book. It discusses many theoretical problems of oil and gas geology as well.

The authors of the monograph are specialists who are working in the scientific research and geological exploration organizations of the USSR Ministry of Geology and the USSR Academy of Sciences.

Doctor of geological-mineralogical sciences , Professor A. E. Kontorovich, Corresponding Member of the USSR Academy of Sciences V. S. Surkov and Academician A. A. Trofimuk supervised the work to prepare the monograph and its scientific editing.

Introduction

The Siberian platform is located in the limits of the East Siberian (Krasnoyarskiy kray and Irkutskaya Oblast) and the Far East (Yakutskaya ASSR) economic regions (fig 1) [photo not reproduced]. The area of these economic regions is 10.339 million km^2 and the population is 14.2 million, including 6.273 million km^2 and 5.9 million people in the Krasnoyarskiy kray, Irkutskaya Oblast and Yakutskaya ASSR. The territories of the Siberian platform that are promising for oil and gas comprise 3.470 million km^2.

The need to search for oil and gas fields in the Siberian platform was substantiated at the end of the 1920's-beginning of the 1930's by the leading Soviet geologists, Academicians A. D. Arkhangel'skiy, I. M. Gubkin, and N. S. Shatskiy. At the end of the 1930's, oil exploration was conducted in the lower courses of the Yenisei, in the central part of the North Siberian lowland, near the coasts of the Khatangskiy Gulf, Nordvik Bay and the Sea of Laptevyye, and in south West Yakutiya. As a result, the oil content of this vast region was confirmed.

After the end of the Great Patriotic War, the searches for oil and gas fields on the Siberian platform were continued, however, for many years they were conducted in small volumes and were essentially concentrated in three regions, in the southern part of the Irkutskaya Oblast, in the middle and lower course of the Vilyuy in the Yakutskaya ASSR, and later in the lower courses of the Yenisei, and its left bank in the Krasnoyarskiy kray. To sum up, in a regional plan, despite the long period of oil and gas exploration, the Siberian platform was studied extremely little. Nevertheless, by now a number of gas, gas condensate and oil-gas fields have been discovered. The industrial oil and gas content of the deposits of the Upper Proterozoic era, Paleozoic and Mesosoic was proved. Extraction of natural gas was begun in two regions, in the extreme northwest region, in the Taymyrskiy autonomous okrug of the Krasnoyarskiy kray, and in the east, in the Vilyuyskiy region of the Yakutskaya ASSR.

In the USSR Ministry of Geology, A. V. Sidorenko, Ye. A. Kozlovskiy, V. I. Igrevskiy, V. V. Semenovich, V. V. Fedynskiy and others, in the RSFSR Ministry of Geology L. I. Rovnin, A. T. Shmarev, R. A. Sumbatov, V. V. Ansimov, V. A. Dvurechenskiy, A. V. Ovcharenko and others, in the East Siberian Geological Administration of Oil and Gas Exploration (VSGU) I. P. Karasev, V. V. Samsonov, G. B. Rogozhnikov, A. S. Povyshev, B. L. Ryb'yakov and others, in the East Geophysical Trust (VGT) V. V. Tkachenko, M. M. Mandel'baum and others, in the Krasnoyarskiy Geological Administration (KGU), and then in the trust

Krasnoyarskneftegazrazvedka V. I. Mlotek, V. D. Tokarev, I. G. Levchenko, V. D. Nakaryakov, V. G. Sibgatullin, A. M. Ivanov, D. B. Tal'virskiy and others, in the Yakutsk Geological Administration (YaGU), and then in the trust Yakutneftegazrazvedka P. B. Taksior, V. Ye. Bakin, A. S. Tokarev, Yu. D. Gorshenin, A. A. Gudkov, D. P. Sidorov and others supervised the geological exploration work for oil and gas in the Siberian platform and analyzed their materials.

A major contribution to the scientific generalization of materials on geology and the oil and gas content of the Siberian platform in the postwar years was made by the collectives of the VNIGRI [All-Union Petroleum Scientific Research Geological Exploration Institute](E. A. Bazanov, V. V. Zabaluyev, V. D. Kozyrev, M. L. Kokoulin, Ye. S. Kuteynikov, K. K. Makarov, Yu. A. Pritula, and others), SNIIGGiMS [Siberian Scientific Research Institute of Geology, Geophysics and Mineral Raw Material] (V. I. Vozhov, V. N. Vorob'yev, M. P. Grishin, F. G. Gurari, S. A. Ka Kashchenko, A. E. Kontorovich, V. L. Kuznetsov, N. V. Mel'nikov, S. P. Mikutskiy, B. I. Rabinovich, V. Ye. Savitskiy, V. S. Starosel'tsev, I. N. Sulimov, V. S. Surkov, and others), IGiG SO AN SSSR [Institute of Geology and Geophysics of the Siberian Department of the USSR Academy of Sciences] (A. A. Trofimuk, E. E. Fotnadi, A. L. Yanshin, M. A. Zharkov, G. S. Fradkin and others), VostSibNIIGGiMS [East Siberian Scientific Research Institute of Geology, Geophysics and Mineral Ras Material] (A. S. Antsiferov, A. N. Zolotov, D. I. Drobot, O. I.Karasev, K. A. Savinskiy and others), IG YaF SO AN SSSR [Institute of Geography of the Yakutsk Department of the USSR Academy of Sciences] (N. V. Cherskiy, K. B. Mokshantsev, Ye. I. Bodunov and others), the scientific production association Sevmorgeo (I. S. Gramberg, D. S. Sorokov, G. D. Ginsburg and others). In recent years, the VNIIGeofizika [All-Union Scientific Research Institute of Geophysical Methods of Exploration], VNIIYaGG [All-Union Scientific Research Institute of Nuclear Geophysics and Geochemistry], MGU [Moscow State University] and MINKhiGP [Moscow Order of the Red Banner of Labor Institute of the Petrochemical and Gas Industry imeni Academician I. M. Gubkin].

An important feature of the organization of geological exploration in the Siberian platform that greatly predetermined the advances made in studying this extremely complicated region, was the close interrelationship of scientific research and production organizations in analyzing the results of work, compiling long-term and current plans, and in selecting the main directions and technique for conducting the work. This relationship became especially fruitful during the Ninth and 10th Five-Year Plans.

The development of the geological exploration for oil and gas in East Siberia and Yakutiya at all stages was and is greatly influenced by the basic works of the leading Soviet geologists and geophysicists: A. D. Arkhangel'skiy, A. A. Bakirov, V. V. Belousov, I. O. Brod, M. I. Varentsev, V. G. Vasil'yev, N. B. Vassoyevich, A. G. Vologdin, F. G. Gurari, I. S. Gramberg, I. M. Gubkin, V. P. Kazarinov, M. K. Kalinko, Yu. A. Kosygin, M. F. Mirchink, K. B. Mokshantsev, S. G. Neruchev, M. M. Odintsov, A.I. Olli, Yu. A. Pritula, N. N. Puzyrev, G. Ye. Ryabukhin, V. N. Saks, V. V. Semenovich, A. V. Sidorenko, B. A. Sokolov, V. A. Sokolov, V. V.Fedynskiy, V. A. Uspenskiy, E. E. Fotiadi, V. Ye. Khain, N. S. Shatskiy, K. R. Chepikov, N. V. Cherskiy, A. L. Yanshin and others.

The first major summary on the geology and oil and gas content of the Siberian platform, "Osnovnyy cherty geologicheskogo stroyeniya i perspektivy neftegazonosnosti Vostochnoy Sibiri" [Main Features of the Geological Structure and Outlook for the Oil and Gas Content of East Siberia], was prepared in 1945 by A. K. Vobrov, N. K. Gryazkov, F. G. Gurari, V. S. Karpyshev and other researchers under the supervision of N. A. Kudryavtsev.

Ideas regarding the geological structure and outlook for the oil and gas content of individual large sections of the Siberian platform that were formed as a result of geological and geophysical studies done by the end of the 1960's-middle of the 1970's were examined in the work done under the supervision of A. A. Trofimuk [69], E. E. Fotiadi [225], K. R. Chepikov [208], A. A. Borisov [42], V. D. Kozyrev [50], V. G. Vasil'yev [44], D. S. Sorokov [52], I. N. Sulimov [51, 314], and N. V. Mel'nikov [47]. An estimate of the outlook for the oil and gas content of the entire Siberian platform is given in the "Karty prognoza neftegazonosnosti Sibirskoy platformy" [Maps to Predict the Oil and Gas Content of the Siberian Platform] compiled in 1968 (edited by A. A. Trofimuk) and 1972 (edited by A. A. Trofimuk and V. V. Semenovich) by the collectives of VNIIGRI, SNIIGGiMS, VostSibNIIGGiMS, NIIGA [Scientific Research Institute of Geology of the Arctic], IGiG SO AN SSSR, VSGU, VGT, Krasnoyarskneftegazrazvedka and Yakutneftegazrazvedka.

The Main Directions for Development of the USSR National Economy for 1976-1980 stressed the need to accelerate the detection and exploration of oil, gas and condensate fields in East Siberia and the Yakutskaya ASSR. To solve this task the USSR Ministry of Geology has drastically intensified and expanded the regional geological work and parametrical drilling on the Siberian platform. This yielded exceptionally valuable information regarding the geological structure of the region, the history of its geological development and the oil and gas content. The purpose of this work is to make a systems analysis of this new information regarding the stratigraphy, tectonics, hydrogeology of the Siberian platform, the structure of the oil and gas fields, and the laws governing their arrangement and formation conditions from the position of the geology of oil and gas.

The Siberian platform in many respects is a unique region. It is a test site, a natural model for solving many key problems of stratigraphy, especially the stratigraphy of the Riphean, Vend and Lower Paleozoic, as well as the Jurassic and Cretaceous, the tectonics of the ancient platforms, trap magmatism, etc.

The complicated geological structure of the sedimentary mantle of the platform, the broad development in it of carbonate-saliferous masses, and the degree of saturation of the traps with intrusions make the use of geophysical methods of study extremely difficult. Therefore, the development of the oil and gas exploration in the Siberian platform, and its effectiveness to a considerable measure depend on successes in creating and using new geophysical methods and geophysical equipment both for field and for industrial geophysics. Thus, the development of the Siberian platform mandatorily results in considerable progress in geophysics.

Until now, the greatest advances in the development of theoretical geology of oil and gas were associated with the investigation of the oil and gas basins of the young platforms, in the first place, the West Siberian. These oil and gas basins have a comparatively simple geological structure. The oil and gas deposits in them were formed relatively recently, therefore the laws governing their arrangement and conditions of formation were interpreted comparatively easily. The oil and gas basins of the Siberian platform are considerably more complicated in structure and history of geological development.

The first feature of the Siberian platform basins is the extensive development and oil and gas content of the most ancient sedimentary masses, the Upper Proterozoic and Lower Cambrian. On other ancient platforms, the main oil and gas

complexes are considerably younger. Reconstruction of the conditions for formation of oil and gas fields in the Upper Proterozoic and Early Cambrian masses is closely associated with analysis of the features of development of the organic world in the Proterozoic and Early Cambrian periods, with the restoration of biological productivity of the basins of these epochs, and with the paleobiochemistry of the living substance of this organic world. The problem of the influence of the features of the Cambrian world of the Precambrian and Early Cambrian periods on the oil and gas content of the most ancient sedimentary masses, on the type and composition of the hydrocarbon accumulations in them still awaits resolution.

A distinctive feature of the oil and gas basins of the platform is also the dominance in the Upper Proterozoic and Lower Middle Paleozoic parts of their section of carbonate and carbonate-saliferous masses. The indicated feature, of course, is not specific and inherent only , or in the first place, to the Siberian platform, but as a consequence of the general lack of development of this question in evaluating the outlook for the oil and gas content of the Siberian platform, it requires mandatory resolution.

In the basins that until recently served as models for perfection of the theory of formation of oil and gas fields, the latter were formed comparatively recently or continue to be formed even now. As the majority of specialists assume, in the Siberian platform, the oil and gas deposits are ancient, and therefore consideration for the conditions and degree of their preservation for these basins is exceptionally important. In a theoretical respect, this question has only been resolved in the most general way [112, 135].

The extensive development of trap magmatism is yet another, very specific feature of the Siberian platform basins. The effect of it on the oil and gas content is generally evident, but this problem has not yet been worked out with the detail necessary to predict the oil and gas content and reconstruct the conditions for formation and preservation of the oil and gas deposits.

Finally, for the oil and gas basins of the Siberian platform one should note the fairly high intensity of the latest tectonic movements, in the first place, the ascending. Strictly speaking, the latest tectonic stage in the development of the oil and gas basins does not have any specific differences from those preceding it. However, this stage deserves especial attention, first of all, when it is associated with the main phase for formation of accumulations of oil and gas in the basin (this does not occur in the Siberian platform), and secondly, when the intensity of the tectonic movements is so significant, that it may fundamentally alter the preserved resources of hydrocarbons (HC) in the basin and the laws governing their arrangement. The latter situation has been suggested by many researchers for the Siberian platform [70]. There are still no strict criteria for considering the influence of this factor.

Thus, investigation of the laws governing the arrangement and history of formation and preservation of the oil and gas deposits in the Siberian platform not only has regional, but also great theoretical importance for oil and gas geology.

Analysis of the entire set of regional and theoretical problems of oil and gas geology of the Siberian platform is the starting point for scientific substantiation of the long-term trends in oil and gas exploration in its limits, the

development and optimization of plans of regional and exploration work for 1981-1985, and for the future, and the creation of a regional technique of searching and exploring for oil and gas fields. The suggested work must promote the resolution of this entire complex of theoretical, regional, method and geological-economic problems.

The substantiation of principles of the currently accepted oil and gas geological zoning of the Siberian platform [14, 207] and specific criteria for isolation of oil and gas provinces and oblasts in the Siberian platform will be given below. We will only indicate here that in the limits of the platform, two oil and gas provinces are isolated, the Leno-Tunguska and the Khatangsko-Vilyuyskiy, and a number of oil and gas oblasts are isolated on their territory (fig 2) [photo not included].

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