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USSR Report

ENERGY

(FOUO 1/82)

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CONTENTS

ELECTRIC POWER

ECONOMICS OF ELECTRIC POWER SYSTEM FORMATION

Moscow EKONOMIKA FORMIROVANIYA ELEKTRO-ENERGETICHESKIKH SISTEM in Russian 1981 (signed to press 20 Nov 81) pp 1-8, 320-321

/Annotation and introduction by I. M. Vol'kenau, A. N. Zeyliger and L. D. Khabachev from book "Economics of Forming Electric Power Systems", edited by A. A. Troitskiy, Izdatel'stvo "Energiya", 3,500 copies, 320 pages/

/Text/ This book outlines the technical and economic aspects of forming and developing electric power systems. Primary attention is devoted to the technology, methods and mathematical models of the technical-economic justification of solutions for developing electric power systems during the designing stage. The book also reviews questions having to do with the economics of forming and developing the USSR's Unified Electric Power System.

The book is intended for specialists engaged in planning and designing the development of electric power systems; it may also be useful for students in institutions of higher learning who are specializing in electric power.

INTRODUCTION

The concentration of the production of electric power at powerful regional electric power stations and the centralization of the supply of electricity from the overall high-voltage network of the electric power systems (EES) are the determining principle for the development of the USSR's power industry. This principle was first outlined in the GOELRO plan.

The basic factors which determine the efficiency of this trend in the development of electric power are:

-the conserving of capital investments in the power industry by increasing the capacity of power units and electric power stations and by making rational use of the capacity of hydroelectric power stations, and by decreasing the needed reserve and reducing the combined maximum of the power load as compared with the total maximum loads of individual systems, and by lowering the cost of construction;

-the conserving of operating outlays by reducing the relative expenditures of fuel and the number of personnel required for operation during the introduction of large, highly-efficient power units, and also by optimizing the use of different kinds of electric power stations within the electric power systems;

-the conserving of labor resources in operation and construction;

-increasing the reliability of the electric power supply by cooperation of the power systems in the event of various unfavorable events in the individual systems.

At different stages in the formation of the EES some of the above factors come into play, but all of them, to a varying degree, are constantly at work during the development of the EES.

The creation of the EES and their mutual joining together in accordance with this principle is the basic direction in the development of the Soviet Union's electric power industry. As a result at the present time more than 97 percent of the USSR's electric power production is accomplished at large electric power stations, which are joined together into 93 regional electric power systems (RES), the networks of which cover nearly 80 percent of the populated territory of the Soviet Union. Most of the RES's (more than 85 percent by capacity of the electric power stations) function within the 11 unified EES's (OES), nine of which are in turn joined together into the National Unified Electric Power System (YeES). The joint work of the power generating and power consuming units within the electric power systems, which is characterized by the generality of the process of production and consumption of power and its synchronism and continuity, is subject to known physical laws, which determine several technical limitations in the modes of using the electric power stations and electric networks. The observation of these limitations during each moment of time is necessary to ensure the qualitative and uninterrupted supply of electricity to consumers and the reliable operation of the EES.

This feature of the electric power industry as a technical system substantially complicates the management of the development of the sector, requiring that the conditions for the development and functioning of facilities in the EES both during the planning of the development of individual facilities and the designing of individual facilities be taken into consideration. The need to execute this requirement has led to the apportionment within the structure of the management of the development of the electric power industry of a very important independent link, which has come to be called the designing of the development of electric power systems, the task of which is to justify the solutions which determine the composition, basic parameters and sequence of the development of electric power stations and electric networks and the means for their operation and management based upon the conditions of the optimal development of the electric power system on the whole. These solutions serve as the basis for both the planning of the sector's development and the designing of individual facilities.

In accordance with the CPSU Central Committee and USSR Council of Ministers decree of 12 July 1979, which concerns "improving the planning and strengthening the influence of the economic mechanism upon increasing the efficiency of production and the quality of work", in present day conditions the drawing up of a set of measures aimed at ensuring the efficient use of capital investments in developing the sectors of the national economy and achieving high final national economic results becomes especially important. This applies fully to the electric power industry, where one of the ways to realize these requirements is to improve the methods and technology of designing the development of electric power systems, while considering the specific features of the power industry.

In the 1930's and 1940's V. I. Veyts, S. A. Kukel'-Krayevskiy, V. V. Bolotov, Ye. A. Russakovskiy and other Soviet scientists began the designing of the development of the EES's. These scientists were the first ever to do research on the principles and methods for justifying the development and joining together of electric power systems. They also laid the groundwork for the future development of the YeES. At this same time the foundations of the modern organization and technology of designing EES's were laid and the first drafts of the formation of power systems were drawn up.

The further development of methods for designing EES's came in the 1960's, when, on the one hand, the process of creating in the Soviet Union large power associations and the formation of the YeES was undertaken on an intensive basis. On the other hand, there was also an opportunity to make use of mathematical models and computers at this time. As a result the scientific collectives headed by D. A. Arzamastsev, A. A. Beschinskiy, V. A. Venikov, V. M. Gornshteyn, I. M. Markovich, L. A. Melent'yev, S. S. Rokotyan, L. V. Tsukernik, O. V. Shcherbachev and other scientists have in the past 10 to 15 years drawn up methods, algorithms and programs which make it possible with a high degree of accuracy to conduct a technical analysis and economic evaluation of variants, and in several instances to also accomplish a comprehensive optimization of the development and functioning of the EES's.

During this same period, L. A. Melent'yev and his school developed the basic concepts of the theory of large power systems, which can serve as the scientific basis for improving the overall methodology of designing EES's. They ensure the correct posing of the task of designing a system on the whole and the sound division of the task into a hierarchical series of sub-tasks, the selection of optimal methods for their solution and the rational organization of the entire process of designing EES's.

During the designing of the development of large power associations and the YeES the results of the listed scientific research were developed and firmly established. As a result it became possible to create common methodological bases for the formation and designing of the development of electric power systems as an independent field of power science and engineering practice.

This book represents an attempt to systematically outline from the abovementioned initial positions the technical-economic bases for the formation and designing of the development of electric power systems.

The book can be broken down into three basic sections.

Chapters 1 and 2 deal with the common methodological questions of designing EES's: the first chapter cites the characteristic of an EES as one of the large power industry systems which are incorporated into a general power system (a fuel-energy complex) on a national level; the first chapter also provides an analysis of the process of managing the development of the electric power industry and its role in this process of designing the development of EES's. The first chapter also researches the hierarchical structure of the tasks in designing EES's and examines a common technological diagram for their solution in conditions of initial information that is constantly being kept up to date. This includes questions dealing with the use during the designing stage of mathematical models and the creation of an automated designing system. The second chapter provides an outline of several questions regarding the methodology of technical-economic justifications, which are very important for the practice of designing EES's, but which have not been standardized or are inadequately understood in special literature. Included in such questions are the methods for considering the dynamics of the development of the system and the ambiguity of the intial information and reliability in conjunction with the technical-economic justifications.

Chapters 3 through 6 review the basic power and technical-economic tasks of designing EES's - determining the system's need for generating capacity, justifying the development of electric power stations and the basic networks, analyzing the power modes of the EESs' operation. Along with the sequential outline of modern methods and technology for solving these tasks, including questions having to do with the use for this purpose of mathematical models and computers, these chapters also list general recommendations on rational trends in the development of electric power stations within the EES's, the use of which makes it possible to limit the field of searching for optimal solutions during the designing of the development of specific OES's.

When considering that the technical-economic questions on selecting circuits and parameters of electric networks of 35 KV and higher, just as the purely technical problems connected with their formation and functioning, are adequately covered elsewhere, the basic content of the chapter devoted to electric networks in this book, apart from the analysis of the overall diagram of the management of the development of electric networks, consists of a review of certain specific questions on the justification of the development of electric networks, which are connected with the development of the system on the whole to a greater extent. This includes questions on determining the estimated power modes of loading networks, considering the system reliability when selecting their carrying capacity and configuration and several others.

Chapter 7 sheds light on the technical-economic questions that deal with the formation of the YeES. These questions augment, illustrate and make more specific the material in the preceding sections.

All of these questions are examined in the book as they apply to the level of future designing, on which the basic criterion for making decisions is to achieve a minimum of national economic expenditures. This does not include a review of the economic-organizational aspects of management, the organizational structures and cost accounting interconnections between the individual enterprises and associations.

The material of the book is based upon a generalization of the many years of experience that the authors have had in designing and performing scientific research in the Energoset'proyekt /electric power system network designing/ institute. The book also cites the results of research which the authors conducted together with their institute co-workers: Ye. A. Volkova (paragraphs 4.4, 5.2), O. N. Kuznetsova (paragraph 5.3), P. A. Malkin (paragraphs 3.4, 3.5, 6.2), V. S. Sharygin (paragraphs 4.4, 5.2, 5.4) and V. D. Shlimovich (paragraph 2.3).

In outlining thecommon methodological questions on designing EES's and the principles and methods of using a system of mathematical models for this purpose, research results were used, which were executed in cooperation with A. S. Makarova, L. S. Belyayev, V. A. Khanayev (from the Siberian Power Institute of the USSR Academy of Sciences) and A. I. Lazebnik (from the Power Institute imeni G. M. Krzhizhanovskiy).

The authors are indebted to candidate for the degree of doctor of Technical sciences A. S. Makarova for their careful review of the manuscript and their comments which were taken into consideration during the preparation of the manuscript for publication.

The introduction and Chapter 1 (except for paragraph 1.4) and paragraphs 2.3, 2.4, 3.4, 3.5, 5.1, 5.3 and 6.2 were written by A. N. Zeyliger, chapter 4 and paragraphs 3.1, 3.2, and 3.3 by L. D. Khabachev, paragraphs 1.4, 2.1, 2.2, 5.2, 5.4, 6.1 were written by A. N. Zeyliger and L. D. Khabachev, and chapter 7 by I. M. Vol'kenau.

All comments and requests regarding the book, which the authors will accept with gratitude, should be sent to the following address: 113114, Moscow, M-114, Shlyuzovaya Naberezhnaya, 10, Izdatel'stvo "Energiya".

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RECENT, FUTURE SEARCHES FOR TATARIA OIL, GAS DESCRIBED

Moscow GEOLOGIYA NEFTI I GAZA in Russian No 9, 1981 pp 1-7

[Article by Ye. D. Voytovich (Tatneftegazrazvedka [Trust for Gas and Oil Exploration in the Tatar ASSR]): "Results and Trends in Geological Exploration for Oil in Tataria"]

[Text] During the last five-year plan Tataria's oil explorers carried out the main technical and economic indicators for deep drilling and core drilling. In all, 445,000 meters of prospecting and exploratory hole and 1.2 million meters of cored hole were drilled, that is, 102.3 and 107.2 percent, respectively, of the plan task. The construction of 289 prospecting and exploratory holes was completed under a plan for 260. During this period 10 oilfields and 51 deposits were discovered. One hundred highs (109 percent of the plan) in Lower Permian sediments were prepared for core drilling.

During the 10th Five-Year Plan Tatneftegazrazvedka Trust continued to prospect and explore for oil in Devonian and Carboniferous rocks in the main promising areas of the east of Tataria--the western slope of the South Tataria arch and the eastern side of the Melekess depression. This is where 63 and 30 percent, respectively, of the total meterage was drilled during the five-year plan. In other areas, including the southeastern and northeastern slopes of the South Tataria arch, 20,148 and 5,585 meters were drilled. In the Udmurtskaya ASSR, there were 10,543 meters of exploratory drilling.

In explorational areas, 81 highs were introduced to deep prospecting drilling, and 58 of these were prepared by core drilling in the Lower Permian sediments and 23 by seismic exploration, using reflecting horizon V (the Lower Carboniferous). Successes in prospecting at Permian structures reached 96 percent, 78 percent based on seismic prospecting. New fields and deposits were discovered, as a rule, with the first prospecting hole. This testifies to the reliable preparation of the highs by core-drilling and seismic-exploration methods. Despite the high degree of study of the land, the general conversion to the mapping of areas with utilization of a denser network of core holes and of seismic logs indicates that the number of local highs observed increases as their dimensions decrease. So it can be presumed that the promising areas of East Tataria possess a definite reserve for the finding of new anticlinal traps.

Thanks to the use of more modern standard practices for prospecting, the pace of preparation of highs and the effectiveness of deep drilling were raised during the

10th Five-Year Plan. In comparison with the Ninth Five-Year Plan, the success rate for prospecting increased from 70 to 91 percent, and the percentage of productive holes rose from 58 to 74, which includes a rise from 54 to 89 percent for prospecting holes.

Important geological results and substantial increases in oil reserves were obtained on the western slope of the South Tataria arch and on the eastern side of the Melekess depression, thanks to a concentration of operations in the promising areas which are situated in the side zones of the Kama-Kinel' system of troughs. Small but sharply expressed high-amplitude reefogenic-type highs were distributed widely here in Carboniferous sediments. In practically all of them, oil deposits were confined in carbonaceous and terrigenous sediments of Lower and Middle Carboniferous complexes. A high degree of correspondence of the Lower Permian and the Carboniferous structural plans favored the finding of oil-bearing traps with core drilling. Highs that were submerged and sharply flattened upward in the cross-section were prospected successfully with seismological exploration by the OGT [common depth point] method. During prospecting for anticlinal traps, data about the propagation of Previsean and Vereya erosion breaches were considered. Of especially great signifiance for oil prospecting is the discovery and tracing of Previsean breaches, since the development of high-capacity sandy collectors is associated with them. Areas of intersection of the breaches and local highs are primary targets for siting prospecting drilling. Experience in prospecting and exploration at the Arkhangel'sk, Vishnevo-Polyanskoye, Stepnoozerskoye and other fields indicates that oil accumulation zones can be associated with such areas. Even the terrigenous Devonian sediments in the region being examined, especially its eastern part, are promising. But here, apparently, minor deposits basically of the lithologic and lithological-structure types have developed. The consistent confinement of most of the oil deposits to structurally uplifted elements of ancient Devonian terraces that are encircled along the strike by graben-shaped troughs is noted.

On the western slope of the South Tataria arch, 278,000 meters were driven, including prospecting drilling equal to 125,000 meters (45 percent), during the 10th Five-Year Plan. The construction of 180 holes was completed, and oil was obtained at 130. The success rate for deep drilling reached 72 percent. Under exploration were 48 highs, 42 of them in the Lower Permian, and 6 had been prepared by use of reflecting horizon V in seismic exploration. Positive results were obtained at 46 highs. Prospecting and exploratory drilling was performed at the Ul'yanovskoye, Yamashi, Urat'minskoye, Shegurchinskoye and Cheremshan areas, which are located within the zone of distribution of good-quality crude.

The Arkhangel'sk field is the most significant of those fields at which exploratory drilling has been conducted. It consists of several like-type oil-bearing local highs of common strike which form a single swell-shaped zone in Carboniferous sediments. The field intersects a deep Previsean erosion breach that has been filled up with Tula horizon sandstone of increased thickness. Petroliferousness has been established in the Turna, Tula, Aleksin, Bashkir and Vereya sediments. In all, 22 deposits were discovered. More than half of the industrial reserves of oil were concentrated in Tula horizon sandstone. The oil is of comparatively good quality, with a viscosity of 20-50 centistokes.

At the Krasnooktyabr' field, 22 holes were completed by drilling, 6 of which were prospecting holes. In the Carboniferous and Permian sediments, the structural plan of the field is presented in the form of a swell-shaped zone of northwest strike, which includes six isolated highs. In the center of it is the large Poselennoye

high, with an amplitude of 30-50 meters. The terrigenous Devonian layers have basically a gently sloping monoclinal deposition. An area of the Poselennoye high has been complicated along the Devonian complex by a small structural terrace. The presence of Previsean and Vereya erosional breaches has been established by drilling data. Industrial deposits of oil have been found in the Pashiyskaya and Kynovskiy horizons of the Devonian, in carbonate collectors of the Turna and Bashkir stages and Aleksin, Vereya and Kashira horizons, and in sandstones of the Bobriki and Tula horizons. Abundant oil shows have been recorded in the carbonate rocks of the Kashira and Podol'sk horizons. A highly productive deposit has been observed at a Poselennoye high in the Pashiyskaya horizon, which is confined to a sandy formation of increased thickness. As a result of short-term testing of it, an oil gusher with a flow of 100 tons per day, using a 9-millimeter flow bean, was obtained. Subsequent exploration showed that this deposit is small and belongs to the lithologic type.

The Dachnoye field includes a group of local carboniferous highs, to which deposits in the Turna, Bobriki, Bashkir and Vereya sediments have been confined. Oil shows have been noted also at domelike-structure areas in the Kashira horizon. A deposit in the Kynovskiy horizon has been found at the Kutemskiy high, which is weakly reflected in Devonian rocks. Oil has been discovered here that flows from a sandy formation at the rate of 35 tons per day, with the use of a 7-millimeter flow bean.

The multiple-formation Iskra field consists of three isolated highs, which were prepared during the prospecting stage by OGT-method exploration, using reflecting horizon V. In all, 11 holes have been drilled in the area and the presence of a sculptured high along Carboniferous sediments has been confirmed. In the Pashiyskaya horizon two formations of oil-bearing sandstone that total 7 meters in thickness have been discovered. When they were tested jointly, a gusher of high-quality oil with a flow of more than 100 tons per day on an 8-millimeter flow bean was obtained. The deposit was of the arched, bedded type. In the Bobriki horizon of the Carboniferous, a second formation of oil-bearing standstones 10.8 meters thick was discovered. As the result of a test, a gushing flow of oil was obtained. Industrial oil-bearing objects have been found also in the Turna and Vereya-Bashkir sediments. The occurrence of a basement at a depth of 496 meters was discovered by well 663. An analysis of the geological data enables the following conclusions to be drawn: the structural position of the well at the basement corresponds to the axial zone of the graben-shaped Bagan trough: the basement rocks are characterized by strong fracturing, but fluid-liberating permeable intervals are lacking among them; no oil or gas shows have been obtained in visual observations or the gas log.

At the Yamashi area, prospecting and exploration have been performed at the Tyugeyevskoye and Onbiyskoye fields. The multiple-formation Tyugeyevskoye field combines seven local highs with proved petroliferousness. Productive formations have been found in the Kynovskiy horizon, the Turna stage, the Bobriki and Tula horizons and the Vereya-Bashkir sediments. The main object of development is a highly productive deposit in Bobriki sandstone. The field has been put into industrial operation.

At the Onbiyskoye field the construction of 23 holes has been completed. The field has a complicated structure and includes 9 local Carboniferous highs with proved petroliferousness of the Turna, Tula-Bobriki and Vereya-Bashkir sediments. In the northern part of the field, in the Kynovskiy and Pashiyskaya horizons lithologic

type deposits have been found. Minor lithologic-type deposits which are complicated in structure and limited in reserves have been dispersed in the extensive Nizhneurat'minskoye structural terrace. Oil-bearing formations have been found also in the Turna and Bashkir stages and the Bobriki, Tula and Vereya horizons of the Carboniferous. Industrial reserves of oil are localized within Carboniferous highs. As a result of prospecting and exploration, the Butkamanskoye and Mel'ninskoye fields and 10 deposits were discovered.

On the whole, the degree of promise of the Urat'minskoye area, especially its northern part, have proved to be lower than what had been presumed. The development of highs, small in dimensions and extremely flattened, which form low-capacity traps with restricted oil reserves, turned out to be negative.

At the Shegurchinskoye area, as a result of the work done, two fields with highly productive deposits in carbonaceous collectors of the Turna stage and the Aleksin horizon at the Novotroiskoye high were discovered. The industrial petroliferousness of the new fields is linked with Carboniferous sediments. Of them, the more significant Krasnogorskoye field includes six like-type highs, which are grouped into one structural "knot." Oil-bearing formations have been confined to the Turna stage, the Tula and Bobrik horizons and the Verey-Bashkir sediments. The field has been prepared completely for development work.

At the Cheremshan area, prospecting and exploration drilling have been performed in small amounts. The work was concentrated in the Amal'chinskoye field region. A new oil deposit in the Bobriki horizon was discovered when a Sheshma Lower Permian high was introduced to drilling. To the south of the area, 16 local highs have been mapped. The presence of a stock of prepared structures will permit the amount of prospecting drilling in this definitely promising region to be sharply increased.

A zone of heavy and viscous crudes (Carboniferous deposits) are confined to the eastern side of the Melekess depression. During the 10th Five-Year Plan, 130,000 meters were drilled through. The construction of 91 wells was completed, oil has been obtained from 75 of them, and the success rate of deep drilling reached 83 percent. Work has been done at the Stepnoozerskoye and Kutushsko-Kadeyevskoye areas.

At the Stepnoozerskoye area, prospecting and exploration drilling has been oriented to Carboniferous sediments, but the first prospecting wells, which were located in the arches of highs, extended down to the crystalline basement. As drilling has proved, the terrigenous sediments of the Devonian are devoid of industrial accumulations of oil. A wide stratigraphic spectrum of oil shows has been established in rocks of the Lower and Middle Carboniferous, and eight productive horizons have been found. The deposits are confined to distinct local highs. A substantial portion of the oil-bearing targets, which are represented by carbonaceous rocks, are characterized by low productivity, which reduces the recovery potential of the fields. During the five-year plan, 25 highs at the Stepnoozerskoye area were introduced to deep drilling, of which 13 had been prepared by using horizon V seismic exploration. Positive results were obtained at 24 structures. As a result, 2 new oilfields (the Kamyshlina and Brodovskoye) and 15 deposits were discovered.

Important revisions have been introduced into notions about the petroliferousness of Carboniferous deposits. The presence of productive formations in the Kashira

and Podol'sk horizons, at arch sections of the structures, has been proved. High promise has been established for the Vishnevo-Polyanskoye and Akanskoye structural zones, where a favorable combination of local highs and Previsean breaches, which are filled with thick sandy formations, were noted. Along with prospecting for oil, a large amount of exploration drilling has been done at the Vishnevo-Polyanskoye, Zyuzeyevskoye, Kamyshla, Akanskoye, Gorsk, Stepnoozerskoye, Krivoozerinskoye, Pioner and Brodovskoye fields, with a view to preparing them for development. The flow rates of wells at the Stepnoozerskoye area are low, and the oil's viscosity is high. Because of this, prospecting and exploration in the area has been curtailed.

At the Kutushsko-Kadeyevskoye area, the construction of five wells, which recorded a distinct high in Carboniferous sediments, has been completed. Oil-bearing formations were found in the Turna stage and the Tula and Vereya horizons.

On the southeastern slope of the South Tataria arch, a limited amount of work has been done on the Azevo-Salaushskoye swell and at the Bakeyevskoye structural terrace. In all, 20,148 meters were drilled, the construction of 11 wells was completed, and oil was obtained from 6 of them. Two Lower Permian highs--the Arzamas and Urazayevskoye--were introduced to deep drilling. At the first the presence of a high-amplitude high of the reefogenic type was established for the Carboniferous rocks. The main oil deposit of large-scale type was associated with Carboniferous sediments of the Bashkir-Serpukhov series, and the petroliferous story is equal to 50 meters. For the Lower Carboniferous beds, the amplitude of the high reaches 80-130 meters, but the trap is devoid of industrial accumulations of crude. In the terrigenous Devonian sediments, a positive closed structure is lacking. The Arzamas high has an analogous structure, but the productivity of the deposits in the Middle Carboniferous is more limited.

Within the northeastern slope of the South Tataria arch (the Menzelinsk-Aktanysh area), the Karachevskoye, Severo-Baylyarskoye and Miyashevskoye highs, which had been prepared by seismic exploration, were introduced to deep drilling. In all, the construction of one well was drilled to 5,585 meters and completed. At the Karachevskoye high, the drilling of deep well 20005 with a designed depth of 4,500 meters continues, the goal of which includes a study of the Paleozoic and the more ancient Eocambrium reef sedimentary formations. On 1 August 1981 the face of the well reached a depth of 3,794 meters. According to geophysical data a formation of oil-saturated sandstone is singled out at the Tula horizon of the Carboniferous. Reef sediments were found at a depth of 1,890 meters. The upper part of the log was complicated by an 800-meter series of variegated-color sandstones and aleurolites, and then followed a clayey-sandy member 600 meters thick, which converts lower down to quartzitic sandstones. At a depth of 3,463 meters the hole entered a dike of crystalline rocks, which were represented by Congo diabases.

Simultaneously with the prospecting for oil, exploration was conducted to study bitumen-bearing Permian sediments. During the five-year plan, 417 special holes were drilled, 30 bitumen deposits were found, 9 deposits were explored in detail, and 10 deposits were prepared for the estimation of resources of categories C_2 and D. The new data confirms the high promise of Ufa's bitumen-bearing complex on the western slope of the South Tataria arch. The degree of promise of the Kazan' bitumen-bearing complex has proved to be much lower than presumed by the appraisals, because of the complex lithological facies structure of the formation's components.

An analysis of geological results for 1976-1980 permits the following conclusions of basic importance to be drawn:

1. Positive results of oil prospecting were achieved at all exploratory areas as a whole. The main discoveries were associated with fields and deposits in Lower Carboniferous sediments, which are of comparatively small size and contain heavy, viscous crudes. The flows of the crude from the wells have low flow rates.

2. An essential difference between modern methods of prospecting and exploring new fields and those applied in the past consists in the necessity to prospect for oil deposits that are small in area and in reserves and that require substantial amounts of drilling to prepare them for development. Prospecting and exploration were conducted more successfully in those areas where deep drilling was performed not at solitary highs but at several of them that were associated with Previsean breaches, which control the spacing of the higher capacity sandy collectors.

3. Highly productive deposits in nonanticlinal traps were discovered, along with the well-known traps of anticlinal type in the Devonian terrigenous complex. Traps of combined type were found in the Lower Carboniferous complex in zones of distribution of the Previsean erosional breaches.

4. Abundant oil shows that were established in a broad stratigraphic band--from the Kashira to the Myashkovo horizons of the Middle Carboniferous inclusively--in the Stepnoozerskoye, Ul'yanovskoye, and Shegurchinskoye areas--merit attention. The recovery potential of the deposits in these sediments and types of traps require further study.

5. In recent years seismic exploration has increased effectiveness in the preparation of highs for Carboniferous sediments. The experience of geophysical operations at the Yenoruskoye, Kutushskoye and other fields indicated that, in applying the OGT method, problems of exploring in detail oil deposits of complicated structure and of preparing them for development also can be solved successfully.

In accordance with the integrated plan for performing geological exploration during the 11th Five-Year Plan in the main areas, where more than 80 percent of all deep drilling will be concentrated, there remain the western and southeastern slopes of the South Tataria arch and the eastern side of the Melekess depression, which is restricted by a zone of distribution of relatively light crudes in Carboniferous sediments. The following are recommended for other directions of operations: the northern and northeastern slopes of South Tataria and the southeastern slopes of North Tataria arches. Prospecting for oil should be performed in Devonian and Carboniferous sediments, but the main promise for increasing oil reserves is linked with the Lower to Middle Carboniferous complex. Based upon an analysis of geological and geophysical data, prospecting and deep drilling on the southeastern slope of a North Tataria arch and in the Menzelinsk-Aktanysh region will require a considerable change, by way of an increase. In all, it is planned that during the 11th Five-Year Plan Tatneft' Association will drill 600,000 meters of prospecting and exploration holes, 500,000 meters of it by Tatneftegazrazvedka.

A further increase in prospecting effectiveness is being linked with the integration of core drilling and seismic exploration and with improvement of the quality of preparation of highs in Devonian sediments by the OGT method. A skillful combining of these methods will enable their potential for further increasing the

inventory of structures to be taken into account more completely, the tasks of detailed exploration and preparation of oilfields of complicated structure for development to be solved, the zones of distribution of higher-capacity sandy collectors to be forecast, and the arsenal of favorable geological prerequisites that are used for increasing deep-drilling effectiveness to be greatly expanded.

At the oil-prospecting stage, a most important measure for providing for an increase in the pace of preparing new reserves should be a systematic expansion of the front of prospecting drilling and an increase in its volume to 70-80 percent. The main task of oil prospecting is to find deposits in anticlinal traps in all exploration regions of Tataria where there are prepared highs. Substantial amounts of prospecting and exploratory drilling must be concentrated on those promising areas where a combining of several favorable geological prerequisites is presumed: the grouping of local highs and reefogenic-type structures, the presence of Previsean breaches and buried protrusions of basements, and so on. Such promising objects include the Yuzhno-Ul'yanovskaya, Mel'nikovskaya and Yuzhno-Cheremshan groups of local highs. In planning operations at objects with known reserves under categories C_2 and D, the degree of their "activeness" after transfer to industrial categories, that is, the possibility of rapid involvement in development, should also be considered.

Because of small sizes and limited reserves, it is recommended that lithologic traps in terrigenous sediments of the Devonian be explored, incidental to drilling at local highs. Combined-type traps, which are characteristic for side areas of the Previsean breaches, will be prospected for and mapped jointly with the main arch-type deposits in Carboniferous formations. A further concentration of prospecting and exploration at targets of complicated structure that are distinguished by small amplitudes of the highs and a predominance of traps of the nonanticlinal and combined types, is related to the development of new standard procedures. Decisive significance is attached here to seismic exploration.

At the detailed-exploration stage, the task of the accelerated preparation of a large number of minor oilfields (25 fields are planned for the 11th Five-Year Plan) for development should be solved by means of development and producer wells and the enlistment of a small amount of exploratory drilling.

In order to clarify fundamental questions of the deep structure, which will determine the prospects for further progress in prospecting work, a large set of studies is to be performed.

In the area of study of the Kocambrium reef formations at the Menzelinsk-Aktanysh area, the drilling of well No 20005 is to be completed, the hastily prepared geophysical description of the cross-section and the stratigraphic tie-in of the reflecting horizons is to be refined; and area seismic exploration by the MOV [reflected-wave method] and OGT method are to be restored with a view to obtaining a reliable geophysical foundation for putting down a second deep well, No 20002, in the zone of maximum thickness of Prepaleozoic rocks. At the edges of the lensing-out of ancient sediments it is recommended that the designed well No 183, which is confined to the Suranchan seismic high, be deepened to the basement. The indicated wells will be situated on the line of a profile that is oriented transversely to the strike of the monoclinal slope; this will provide maximum information on the area being studied. The data obtained should create the necessary base for further detailing work.

In order to study the crystalline basement, it is planned to place solitary prospecting wells on local highs and ledges and on places of presumed cleavage of rocks. The purpose of drilling these holes is to clarify the possibility of the accumulation and migration of UV's [hydrocarbons] into crystalline rocks from the sedimentary complex. Drilling into the basement is combined with prospecting for oil in Paleozoic sediments. The depth of uncovering of the Precambrium basement is 500-700 meters.

Fulfillment of the tasks posed for the 11th Five-Year Plan should provide for a further rise in the effectiveness and quality of geological exploration of Tataria.

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