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ENERGY

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ELECTRIC POWER

ECONOMICS OF USSR POWER INDUSTRY EXAMINED

Moscow EKONOMIKA ENERGETIKI SSSR: UCHEBNIK DLYA VUZOV (Economics of the USSR Power Industry: Textbook for Higher Schools) in Russian 1980 pp 2, 340-343

[Annotation and table of contents from book by A. A. Chernukhin and Yu. N. Flakserman, Energiya Press, 344 pages]

[Text] The book deals with ways of streamlining power output and problems of the economics of the construction and operation of electric power stations and networks. The second edition had been published in 1975. In this third edition new trends of scientific and technical progress in the industry and developmental prospects of coal, gas, and petroleum supplies are described.

This textbook is intended for students majoring in power engineering at higher schools. It may be used by engineers and technicians at power-system enterprises.

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ELECTRIC POWER

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TRENDS IN LOW POWER ELECTRICAL EQUIPMENT OUTPUT

Moscow ELEKTROTEKHNIKA in Russian No 3, 1980 pp 2-4

[Article by V. I. Nellin, deputy minister of the electrical equipment industry: "Development of Production of Low Power Electrical Machines Is the Most Important Task of the Electrical Equipment Industry"]

[Text] Low power electrical machines have become very widespread in the country's national economy. Household electrical appliances, medical equipment, communications devices, calculation equipment, systems of automatic control and regulation, aviation and space equipment--this is far from a complete list of the areas of application of electrical machines of the given class.

The consumption volumes of the low power electrical machines by different branches of the national economy are continually rising. In the area of household appliances, for example, comparatively recently, the number of these machines in one family was still counted in units. Today, it is increasing to several dozens. The number of machines of the given class among the electrical equipment of modern airplanes has almost tripled.

The decisions of the 25th CPSU Congress set before the electrical equipment industry an important national economic task of developing the production of low power electrical machines at fast rates. Their annual output must rise several times by the year 2000. Here an improvement in the technical parameters and characteristics of the machines, increase in the level of their reliability and durability must be guaranteed.

The complexity of the set task consists of the fact that the production of low power electrical machines is characterized by a considerable nomenclature due to the diversity of the areas of application of the items. The extreme nonuniformity in the volumes of production of individual type-designs of machines (from hundreds to millions of items per year) is linked to this same circumstance.

As the circle of tasks to be solved with the help of low power electrical machines expands, the demand for their expanded nomenclature rises, which

creates serious difficulties in organizing series production. Under these conditions, the haphazard approach to planning and producing low power electrical machines that occurred at the onset of the development of this branch is now quite inapplicable. It is necessary to conduct extensive scientific studies, and to have the correct technical policy in questions linked to a determination of the paths for the branch development.

The stated problem bears a complex nature, since it is linked to perfection of both the methods of planning, and the technology and organization of production. Organization of precise coordination of scientific research and developments done by the scientific research institutes and design offices of the branch acquires great importance. It is impossible not to consider the need for a close link with other branches of industry that guarantee supply of materials and parts that are necessary to ensure the assigned technical level of low power electrical machines.

Reduction in the nomenclature of the developed low power electrical machines with a simultaneous striving to satisfy to the maximum the requirements of the consumers is currently being attained by the introduction into production of single series of machines. With such an approach, the design and technological similarity of different types of machines is revealed and employed, and an extensive unification of both the electrical machines themselves and their assembly units and parts is carried out. A high level of item unification is guaranteed also by using preconstructed size and parameter series (grid tables) and branch standards for the type of standardization created on their basis during the development of unified series.

In recent years, in the branch a lot of work has been done in this direction and its result is the development of size-parameter grid tables for the overwhelming majority of the types of low power electrical machines. The grid tables that set an efficient correlation of output parameters of electrical machines with their overall and adjusting-connecting dimensions simultaneously determine the long-term nomenclature of the items to be developed. This nomenclature is the original for consumers in planning devices, objects or systems that use low power electrical machines.

By restricting the combinations of output parameters and dimensions, the standardizations promote an increase in the batch nature of the output of individual type-designs of electrical machines, which has a favorable effect on the organization of production, and promotes the introduction of the leading production processes.

The development of size-parameter series and standardizations of low power electrical machines is done on the basis of a thorough consideration of the trends of their development, detection of the long-term need for individual types of machines with regard for the required range of output parameters, as well as a set of long-term technical and operational requirements. In this respect, studies have become widespread in the branch

on scientific and technical forecasting, that at the same time provide calculation for the outlook for development of the technical foundation for creation of electrical machines with the assigned level of parameters and characteristics: electrical equipment steel and magnetic materials, winding wires, insulation materials, bearings and lubricants, design materials, etc.

A characteristic example of the efficient construction of a series of low power electrical machines is the series of one-phase asynchronous electric motors with power from 0.6 to 180 w that was developed to drive household appliances, medical equipment, and calculators and movie equipment. The series provides for sections that include capacitor electric motors with distributed and concentrated winding of the stator, as well as electric motors with asymmetrical magnetic circuit of the stator. Thorough preliminary study of the initial data for planning made it possible to create electric motors that are characterized by a high level of the parameters and characteristics. The development of the series made use of over 20 domestic inventions, a number of which have been patented in the leading foreign countries.

The results, obtained in the development of the series, are widely used in the process of conducting the corresponding research and development done in the framework of Interelektro.

The development of the series made extensive use of the system programming approach. The complex program for development and introduction of the series into industrial production provides for the broad participation of the related organizations and enterprises, in the first place, of technological profile. As a result, in parallel to the development of electrical machines that are included in the series, standard production processes are worked out, and advanced production equipment is devised. New materials and parts are formulated.

The introduction into production of the new series of asynchronous one-phase electric motors makes it possible to provide a saving of 8,200 T of electrical equipment steel, 1,300 T of winding copper. The total national economic effect is over 140 million rubles.

The series of low power electrical machines that have been developed in recent years for the automation systems are characterized by a high technical level. Here, in particular, a new, advanced solution was the creation of a system of series small-sized axial electric fans designed to cool the electronic and radio equipment. These items realize an efficient combination of parameters of the drive electric motor and the fan, that are united into a single design with regard for the conveniences of building into the object to be cooled.

Electric fans are successfully used in the cooling systems of electronic units of digital computers. For the unified computer system alone the

annual economic effect from their introduction surpassed 5 million rubles. Passenger seats of the new IL-86 airliner are equipped with individual small-sized electric fans with low noise level, which created noticeable conveniences for the passengers.

In evaluating as a whole the results of working to create unified series of low power electrical machines, one can note, that the adopted direction in planning provides a noticeable reduction in the necessary number of machine type-sizes, by preserving at the same time the possibility of creating on their basis the necessary nomenclature of the type designs. Analysis demonstrates that the introduction of new series of low power electrical machines makes it possible to almost reduce 2.5-fold the required number of their type sizes, and halve their net cost. Here, the developed electrical machines in their parameters and characteristics are on the level of the best foreign models.

It is necessary, however, to take into consideration that the work that has been done mainly permits a regulation of the nomenclature of the traditional types of electrical machines of low power, i.e., those that are currently manufactured in series by the branch enterprises. In addition to this, in order to solve the main task of satisfying the needs of the national economy for electrical machines of the given class it is necessary to pay attention also to the inevitable nomenclature shifts, that should be expected based on the results of analyzing the scientific and technical achievements both in the branch of small electrical machine construction itself, and in the related branches of industry.

One can indicate in this respect that in the near future technical solutions should become widely developed that are based on the principles of synthesizing electrical machines and semiconductor transformers. These solutions in the first place guarantee perfection of designs of the contactless direct current electric motors that can use modern achievements in the area of devising integrated hybrid designs of commutators on semiconductor instruments and microcircuits. As a result, potentialities are created for a significant reduction in the weight and overall dimensions of the contactless direct current electric motors, and their bringing to the level of collector machines. The indices of reliability and durability here rise significantly.

Achievements in the field of producing permanent magnets with high values of specific magnetic power also promote an expansion in the areas of application of the direct current contactless electric machines.

It is necessary to focus a lot of attention on the technical solutions that make it possible to guarantee simplification of the kinematic schemes of mechanisms and instruments that use low power electrical machines. Here design solutions to create slow-moving electric motors have already been realized in practice: with electromagnetic reduction, multipolar synchronous with rolling rotor, wave, step-type, etc. One can expect

considerable simplification in the kinematic schemes with the use of electric motor designs with open magnetic drive, for example, linear. Their use permits a reduction in the relative masses of movement, decrease in the overall dimensions of the system as a whole, and increase in its fast-response and reliability.

In evaluating the new design solutions, one can indicate the promising nature of using electrical machines of various types in a planar design, that in particular, are planned on the basis of using module designs and integrated technology. With regard for the rising requirements for reliability and durability, the designs of electrical motors of low power using gas, liquid and magnetic supports should become widespread.

Among the new technical solutions one can note the use of properties of piezo components to alter their linear dimensions under the influence of electrical voltage. Vibration drives have been developed on this basis for electric game devices of the first and highest classes. The developments use 11 domestic inventions, more than half of which have been patented abroad.

The great growth noted in the branch in the volumes of output of low power electrical machines determines the need to increase the level of their production technology in order to drastically reduce the labor intensity of making the machines, as well as to significantly cut the consumption of materials.

The main trend in perfecting the production processes should be the broad introduction into production of low power electrical machines of line methods. With the appropriate organization they can be used both in the production of mass products, and in the manufacture of electrical machines in comparatively small batches. The principles of design-technological similarity set up during the planning of the machine series promote this.

In the process of developing long-term production processes, and resources of automation and mechanization the experience of working on the technological support for the production of the new general-industrial series of asynchronous motors 4A can be extensively employed. A number of results of this work, in particular, on the creation of production processes and equipment for the winding-insulation work have already been realized in the process of introducing the new series of electric motors for household appliances into production.

A number of other promising production processes and equipment have been introduced into production of low power electrical machines: processing of parts on machines with programmed control, highly productive stamping equipment, automatic machines for assembly of packages of magnetic wires, automatic lines for producing a number of assembly units, and parts of asynchronous motors, etc. A number of enterprises are efficiently using

progressive technology of laser welding employed in different types of structural part connections of over 30 types of low power electrical machines.

On the whole, however, the modern level of production technology of low power electrical machines still lags behind the technical level of the developed machines, which predetermines the relatively high values for labor intensity for individual types of machines. In this respect, the tasks of perfecting technology remain among the primary ones.

Primary attention must be paid to questions of mechanizing and automating the most labor intensive operations. Here the principle of concentrating the operations of manufacturing parts and assembly units that makes it possible to reduce the interoperational transportation transfers and the number of parts that are in the flow must be placed at the foundation of equipment planning. It is also necessary to use the microcomputer and general-purpose computer in automating the tests.

Despite the progress made in the area of creating stator-winding equipment, the set task cannot be considered solved. It is necessary to conduct series scientific research on perfecting the plans of machines, both those designed for direct placement of the coils in the magnetic wire grooves, and those that use the principle of separate formation and laying of the turns in the grooves. The modern technical solutions do not yet guarantee the necessary values for the coefficients of filling of the grooves. The output of the machines designed for winding the two-layer loop coils is still low. The creation of winding machines with programmed control remains a serious task.

Due to the expanded introduction into the design of the electrical machines of permanent magnets with high values of the magnetic energy, the creation of equipment for winding grooveless designs acquires great importance. For a number of machines here it is necessary to satisfy additional high requirements for uniformity of the winding layer.

Of great importance is the broad introduction of long-term methods of metal-working, such as three-dimensional stamping, deep reduction, rolling, and electrical-erosion methods. Nontraditional designs and technology for producing magnetic wires (twisted, made of a ribbon of electrical equipment steel that is continually coiled on the edge, and others) deserve attention.

Among the long-term production trends one should classify the use of powder metallurgy. By the method of pressing from powder compositions one can make sliding bearings, design components, magnetic wires of low power electrical machines. In particular, the manufacture of bearing housings and housings made of sintered titanium permits a reduction in the weight of the parts 2-fold as compared to the parts made of stainless steel with higher anti-corrosion properties. At the same time there is a cut in the consumption

of metal due to the maximum convergence of the blank shape to the shape of the finished part, and the labor intensity is reduced as a consequence of the drop in the number of operations of machining. An advantage of using powder metallurgy is the possibility of obtaining materials with the properties required for the given component.

The listed problems and technical solutions do not exhaust the entire diversity of paths for perfecting the technology of producing low power electrical machines. On should, however, indicate, that this perfection can only be attained with a comprehensive approach to designing the machines with the use of the systems of automated planning, where the assigned levels of quality and technological effectiveness are guaranteed by the joint solutions of the designer and the production engineer. The total effect attained both in the sphere of production and in the sphere of operation of the low power electrical machines must become a criterion for quality.

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ELECTRIC POWER

NEW SYSTEM INTRODUCED INTO ELECTRICAL EQUIPMENT INDUSTRY

Moscow ELEKTROTEKHNIKA in Russian No 2, 1980 pp 2-4

[Article by V. Ye. Astaf'yev, head of planning and economic administration: "Electrical Equipment Industry under New Conditions of Planning and Economic Stimulation"]

[Text] In the set of tasks to be solved, the electrical equipment industry occupies a special place in the system of interrelationships with the branches of the national economy. The final results of economic and social development of the country's economy depend to a considerable degree on its balanced development. Being the technical and production base for electrification of the national economy, the electrical equipment industry provides all spheres of social production with the equipment to generate, transmit, transform and consume electricity. From here follows the special role of the electrical equipment industry in increasing the efficiency of social production.

This determines the orientation of all the links in the branch economy towards improving the final results of its operation with the least expenditures. The adopted decree of the CPSU Central Committee and the USSR Council of Ministers on perfecting the economic mechanism is a specific program for realizing this most important task.

Analysis of the work of the electrical equipment industry demonstrates that the branch has attained significant advances. In 1966-1979 the volume of industrial production rose more than 2.8-fold (on the average 7.9% per year). The output of electrical equipment consumer goods increased 5.4-fold (average annual growth rate was 12.9%). During this period the same scientific and production potential was created in the branch that was accumulated during all the previous years of development of electrical equipment. The level of satisfying the national economic needs for electrical equipment rose considerably.

Here the completeness of satisfying the needs was oriented on specific consumers. Whereas in 1977 the branch undersupplied about 10% of the products to the consumers, in 1979 the commitments for deliveries based on concluded contracts and orders were fulfilled by 96%.

The indicator for the final results of the branch 's work is not only the level of satisfaction of needs according to the quantity of products, but also according to the technical and economic level and the quality of the manufactured product. It is important to guarantee an increase in the consumer properties of the items, increase their durability, service life, operating life, etc. Analysis of the work of the branch under the new conditions of planning, financing and material incentive for new equipment showed the high final results. This is indicated by the results of testing the system for 10 years. The specific weight of items of the highest quality quality category in the volume of production of products subject to certification increased from 12.2% in 1968 to 55.9% in 1978. According to the results of work for 1979, the indicator of specific weight of products of the highest category of quality in the total volume of production was 45%.

The system of planning, financing and material stimulation of scientific and technical progress was oriented on saving not only of branch expenditures, but also a reduction in the national economic costs. The national economic effect from conducting scientific and technical measures in 1978 rose as compared to 1968 5.2-fold, and in 1969-1978 was about R 8 billion. There was a significant increase in the specific efficiency of new items. Thus, the economic effect for one new item increased from R 294,000 in 1968 to R 637,000 in 1978, and for 1 ruble of the unified fund for the development of science and technology--from 1 ruble 42 kopecks to 3 rubles 6 kopecks, and for 1 ruble of the volume of scientific research and experimental design work--from 1 ruble 15 kopecks to 2 rubles 77 kopecks.

In the Eighth Five-Year Plan, the increase in the volume of production due to a rise in labor productivity was 73%, in the Ninth--83%, and in the 10th Five-Year Plan the task was set of reaching 95-97%. In 1971-1978 the average annual rate of increase in the volumes of production of electrical equipment products was 7.8%, the consumption of rolled products of ferrous metals increased by 3%, of copper by 2.7%, lead by 1.6%, while the specific standards of these types of materials dropped respectively by 24.8, 30 and 35%. In the next 2 years, the increase in the volume of output of items of electrical equipment practically occurred without an increase in the rolled products of ferrous metals, copper and silver.

These are positive results of the work of the electrical equipment industry. At the same time, the conducted analysis also showed the negative aspects of the branch 's development.

Inefficient use of labor resources is still occurring. The needs of the national economy for electrical equipment are not satisfied completely. There are cases of censure of the consumers on the quality of the manufactured products. The efficiency of capital investments and the yield of newly introduced production facilities are insufficient.

The force of inertia has not been overcome at all the enterprises and associations, and a decisive turn has not been made to all work towards

increasing quality, labor productivity and attaining the best results. In the last years of the five-year plan, a final result was obtained that was smaller than the potentialities of the branch economy permit.

The decree of the CPSU Central Committee and the USSR Council of Ministers on perfecting the economic mechanism, and the decisions of the November (1979) Plenum of the CPSU Central Committee are oriented on improving the entire system of management and branch control.

The increased scales of production, complication in the economic ties, and the need for accelerating scientific and technical progress and intensifying production required a qualitatively new approach to the system of planning, in the first place, long-term.

Shortcomings in the branch work determined the formulation of a broad circle of measures directed towards increasing the production efficiency. They bear both a long-term and a current nature. In this respect it was required that the general trends and proportions of development of the electrical equipment industry be defined for a long term. The branch has developed a plan for development and arrangement of the electrical equipment industry for the period up to 2000. It starts from the maximum satisfaction of the needs of the national economy for electrical equipment products and the optimal arrangement of branch enterprises over the country's territory. It defines the main trends in scientific and technical progress, based on the outlook for development of science and technology. A lot of attention is focused on questions of a social plan.

The experience of planning the branch's economic and social development demonstrates, that the final results depend a lot on the close correlation of the planned development of the enterprises with the development of the corresponding rayon, city or region, the presence of labor resources, the facilities of the construction industry, etc. Therefore, the question on the need for closer combination of branch and territorial planning is raised with all acuteness. The branch is conducting systematic work in this direction jointly with the planning and economic organs of the union republics and the large industrial centers of concentration of the electrical equipment industry enterprises.

The trends in the development of the electrical equipment industry for the long range serve as a landmark in the formulation of plans for the average period. On their basis the branch has formulated several variants of economic development of the electrical equipment industry in the 11th and 12th Five-Year Plans. In the first place, they focus attention on providing for the needs of the fuel and energy complex, transportation, machine construction, agriculture, metallurgy and other branches.

It is known that the use of electricity in industry is one-third, and for transportation two-thirds more efficient than the use of mineral fuel. Therefore, measures have been worked out to significantly increase the

output of electrical equipment for nuclear power, superhigh voltage transmission lines (1500 kv of direct current and 1150 kv of alternating current), and hydropower. It is planned to increase the production facilities for manufacture of main and industrial electric locomotives, electric equipment for heavy-freight dump trucks, suburban trains, subways and trolleys. A considerable growth is envisaged in the production of submersible electric motors to extract oil at the fields with low pressure beds, unique electrical machines for gas and oil pipelines, and electrical equipment in an explosion-safe design for the needs of the coal industry.

The decree of the CPSU Central Committee and the USSR Council of Ministers on accelerated rates of electrification of agriculture requires that the branch implement a corresponding increase in the output of electric motors, power transformers, high-voltage and low-voltage electrical apparatus, resources of relay protection of the networks, electric heaters, special electrical lamps, illumination engineering equipment and many other electrical items. The total volume of deliveries of electrical equipment for agriculture in the 11th Five-Year Plan should be considerably increased.

These and other tasks are being solved on the basis of a further acceleration of the rates of scientific and technical progress. First, a considerable increase is planned for the quality and technical parameters of the manufactured products, and creation and mastery of production of electrical items with increased specific technical and economic indices and level of mechanization and automation. Second, a broad program is planned of saving material and labor resources. The branch has worked out and is implementing 18 major scientific and technical programs. They encompass the entire cycle "science-technology-production-consumption," are closely interrelated not only within the electrical equipment industry, but also with the related branches, and CEMA member countries. The complex plan for saving material and labor resources provides for the creation of new, more efficient items with reduced materials consumption, labor-intensity and energy consumption, light-weight structural parts with the optimal technical and operational characteristics. Measures are being planned that guarantee the replacement of deficit and expensive materials. Broad introduction of advanced technological processes, mechanization and automation of the production processes is planned.

Thus, the plan of economic development of the electrical equipment industry is oriented on high final results--more complete satisfaction of the social needs and all-possible saving not only of in-house resources, but also a considerable reduction in the national economic expenditures. An increase in the volumes of production at the active enterprises will be guaranteed by means of a growth in labor productivity. The measures worked out for saving of material resources make it possible to increase the output of products without a significant rise in the ferrous and nonferrous metals, chemical products and other types of raw materials and materials. From the production and use in the national economy of new types of electrical equipment and cable items it is planned to guarantee in the 11th Five-Year Plan

an economic effect of several billions of rubles. It will be obtained by our product consumers due to the increase in labor productivity and the service life of the electrical equipment, and saving of current operational expenditures and capital investments.

The formulation of long-range plans made it possible to plan the optimal paths of economic, scientific and technical, and social development of the branch, systematic implementation of the planned measures for saving labor, material and financial resources, and increase in the efficiency of the new equipment and capital investments. An important tool in the realization of the planned measures to improve production efficiency in the branch and at each enterprise is the five-year plan. It has been called upon to be the main economic activity of all links in the branch administration, and the branch institutes, associations and enterprises have been enlisted in its formulation. Their main task is a further search for reserves of production that can be discovered by counterplanning.

Perfection of the entire planning system rests in the branch on the more efficient use of economic levers and stimuli, and expansion of the sphere of application of cost accounting. In accordance with the decree of the CPSU Central Committee and the USSR Council of Ministers on perfection of the economic mechanism, the electrical equipment industry starting 1 January 1980 switched to new conditions of planning and economic stimulation.

New economic indicators, norms and standards were put into operation. Planning and evaluation of the activity of each enterprise, association and the branch as a whole for all technical and economic indicators are carried out by a cumulative sum from the beginning of the year. The branch has been transferred to full cost accounting. The indicator of realizable products serves to evaluate the fulfillment of the assignments for product deliveries in accordance with the concluded contracts and orders. The system of planning, financing and material stimulation of scientific and technical progress was further developed. The amount of resources allocated to the associations, enterprises and the branch as a whole was placed in direct dependence on the improved final results of cost accounting activity.

Among the measures that are directed towards improving the level of planning an important place is occupied by the economic indicators and standards. On the order of an experiment the branch is verifying the new economic indicator for the growth in the volume of commodity output in comparable prices with regard for the quality and efficiency of the new equipment. This means that with the manufacture of highly efficient products with the state sign of quality, the rates of growth in commodity output are determined by conversion of the commodity output volume of the base year into a coefficient that takes into consideration the efficiency of the new products as compared to the replaced. For each new item, according to the formulated standards, a percentage is set for the economic effect from the use of this product by the consumer. This effect percentage is totalled for all the new items, and the obtained sum is excluded from the volume of commodity output

of the base year. According to the technique developed in the branch, the percentage of economic effect excluded from the base is called upon to compensate for those losses in the growth of production, labor productivity and wages that the enterprise bears in transferring to the output of the new, highly efficient items.

The growth rate for the volume of commodity output with regard for efficiency is set for each enterprise and the branch as a whole for the planned period in quarters by the cumulative sum. The planned assignment for the growth in labor productivity and standards of wages are also determined on its basis. Indices for the growth rate in commodity output with regard for the effect, labor productivity and specific weight of the products of the highest category of quality are directive and fund-forming.

Economic conditions have been created that guarantee the interest of the enterprises in producing new products with lower materials consumption and labor-intensity. The wholesale prices for such products have been set with regard for preservation of the size of profit obtained from realizing the previously manufactured products. In order to determine the volumes of production and labor productivity, wholesale prices are used that were adopted in the plan for the replaced products.

The directive indicators include the economic effect from conducting scientific and technical measures. It combines into one the technical and economic planning with planning of scientific and technical progress and its stimulation. The economic effect obtained as a result of increasing the organizational and technical level of production serves as the real base for guaranteeing a reduction in the net cost of the products, rise in profit and fulfillment of all the cost accounting indicators. The given indicator makes it possible to introduce into the sphere of cost accounting relationships of material interest of the enterprises and associations in reducing the labor-intensity and materials-consumption of products, and raising labor productivity. It serves as the basis for planning and the actual deductions for the incentive fund to create and introduce new equipment.

Thus, the new economic indicators are directed towards guaranteeing high final results, saving not only of in-house, but also national economic expenditures. The advantage of the commodity output indicator with regard for the effect consists of the fact that on the one hand, it creates conditions for intensifying the economic interest of the enterprises in mastering new items, and on the other hand, nonfulfillment of the plan for output of the new product, or decrease in its efficiency results in nonfulfillment of all the indicators, and drop in the incentive funds. The use of the new indicators will promote the preservation of the growth rates in the volumes of production with a certain decrease in the first year in the quantity of manufactured products, but in favor of their quality. This is very important for the transition to the comprehensive increase in the quality of products from raw materials and materials to the finished items.

All of this will permit a strengthening of the link between the results of technical progress and the cost accounting indicators of work of the industrial enterprises, and guarantee of the combination of collective interests with national.

An important component in perfecting the system of planning provided for by the decree is the introduction into practice of long-term economic standards. They make it possible to intensify centralized control of production, and to increase the initiative and independence of the production collectives.

Among the economic norms and standards an important place is occupied by the standards for the fund of wages. They are established in the branch for each enterprise, based on the correlations between the growth in labor productivity and the average wages, increase in the volume of production due to a growth in labor productivity so that a drop in the specific consumption of wages for the volume of product production is guaranteed.

The definition of the planned fund of wages in the annual plan takes into consideration the conversion of the volume of commodity output from the previous year based on the coefficient of efficiency. If there is a deviation in the actual output of new products from the planned, the planned fund of wages is pinpointed by the cumulative sum since the beginning of the year. Consequently, both the planned and the actual sum of the wages fund are placed in dependence on the number of new items and the size of the economic effect obtained from the use of these items by the consumer.

Deduction standards from the profit at the disposal of the branch and the state budget were also set for 1980: to the unified fund of development of science and technology--in percentages of the planned volume of commodity output with regard for the effect; to the funds of economic stimulation.

Calculations with the state budget for deduction from the profit are made by the ministry in a centralized manner. Here the payments to the budget are guaranteed in a full amount, regardless of the results of the work of individual enterprises and the branch as a whole. This increases responsibility and interest of all the links of the branch in the growth of production efficiency and the adoption of more intensive plans. At the same time, the interests of the budget are completely guaranteed.

The branch has been equipped with other economic levers and stimuli that follow from the decree to perfect the economic mechanism. The use of long-term credit has been expanded as a source of financing of capital investments when there is a shortage of in-house resources of the branch. The role of incentive bonuses for the wholesale prices has been increased to stimulate the output of highly efficient items. Now they are set for the entire period of action of the state sign of quality. In the first 3 years of output of new items, 70% of the total incentive bonuses is sent to the incentive funds, and with repeated certification--up to 35%. Deductions from the wholesale prices of 10% are set for items of the second category of quality that are subject to removal from production.

In order to intensify the stimulating role of wages in increasing production efficiency, the use of wages conservation is expanded. The associations and enterprises of the branch have obtained the right to pay bonuses for the tariff rates of the workers for plurality of professions and fulfillment of the set volume of work with a lower number of workers from the saving for the wages fund obtained compared to the set standard. Fifty percent of the unused saving of the wages fund in the given year will be sent to the fund of material incentive, while permitted overconsumption is subject to compensation from the fund of material incentive.

The funds of economic stimulation will be formed according to stable standards. The branch has been given the right to set different fund-forming indicators with regard for the features and imminent tasks for individual associations and enterprises. The formation of the production development fund is based on the deduction standards from profit and amortization deductions. The role of this fund considerably rises in implementing measures for mechanization and automation, replacement and modernization of equipment, improvement in the organization of production and labor, as well as in conducting other measures for the technical re-equipping of the industry. These measures that were formulated by the associations and enterprises themselves, are included in the plan of capital construction in the full volume of outlays, and are guaranteed in primary order by the material resources and facilities of the construction-contract organizations.

Interrelated measures have been worked out for further improvement in the economic mechanism in construction, which will be introduced into the branch in the 11th Five-Year Plan. These measures are directed towards increasing the efficiency of capital investments, and accelerating the putting into production of production facilities and objects. The main factor for improving the construction business will be the transition to stable five-year plans of capital construction (with distribution of the assignments over the years). Intensification is envisaged of the balance with material, labor and financial resources, as well as the outputs of the construction-installation organizations. The allocation of capital investments will be made for the planned increase in products. The active production and the new construction now will be planned as a unit, with regard for the possibilities of increasing the output of products for the available production facilities.

It is planned to allocate resources for the reconstruction and technical re-equipping of the active enterprises in the primary order. Such order for formulating plans of capital investment is directed so that the construction of new enterprises begins only in that case where the needs of the national economy for specific types of products cannot be provided for by the active enterprises with regard for their reconstruction and technical re-equipping. An important stage will be the completion in 1981 of the transition to calculations between the customers and the contractors for

completely finished construction of and putting into operation of enterprises and facilities at the estimated cost of the construction commodity output. With the transition to a new order of calculations, the customers will no longer be given advances for the contracting organizations for expenditures for incomplete production of construction and installation work. These expenditures, all the way to putting the facilities into operation will be covered by bank credits.

Thus, the entire new system of indicators, standards and limits have the following inherent features: first, stablility, second, orientatinn on final results, and third, unity for all levels of control. The indicators, standards and limits are set for the five-year plan with breakdown into years. The plan fulfillment will be evaluated by the cumulative total from the beginning of the five-year plan. Depending on the fulfillment of the five-year plan, the economic stimulation will also be dependent. The specific putting into operation of the main funds, facilities, and objects will act as the final result of the association or enterprise activity. Economic stimulation of both the contractor and the customer will depend on it. The final result is also the growth in the total efficiency of production, the growth in profit, labor productivity, quality of products, and economic effect from conducting scientific and technical measures.

The branch has formulated and is realizing a complex system for organizational and economic measures. It has been called upon to implement reconstruction of the economic mechanism for the purpose of attaining the best final results. In all links of branch control extensive and tedious work remains. It must be directed towards overcoming inertia, a comprehensive search for production reserves, a successful battle against poor management in using material and labor resources, with losses of working time, and all-possible fulfillment of the contract commitments.

Orientation of all the links of branch control to the final results is the guarantee of increased production efficiency and deepening of planned development and dynamism of its development.

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UTILIZATION OF STEAM TURBINE UNITS IN CENTRAL HEATING

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[Article by Engineers Yu. A. Averbakh, V. A. Bonesko and M. L. Sheshelovskiy and Candidate of Technical Sciences Yu. P. Kosinov of the Kharkov affiliate of the Glavenergoremont Central Design Bureau]

[Text] At the present time, thermal loads are primarily being met with heat released from heat and electric power stations, regional boiler plants and from cross-coupled GRES's. At such GRES's the steam turbine units have been renovated in connection with the organization of regulated and unregulated central heating and industrial steam extraction and the conversion of the extracted steam into work energy by means of back pressure and reduced vacuum [1].

It will be expedient to examine the feasibility and future prospects of including steam turbine power units as practically unlimited sources of heat. The utilization of these units for a heat supply makes it possible to meet loads of several hundred megajoules per second for consumers located in the immediate vicinity of the GRES as well as loads of several thousand megajoules per second for the central heating needs of large cities.

The feasibility of meeting central heating loads by renovating the turbine units has been shown previously in [1,2].

The characteristics of renovated 160, 200 and 300 MW turbine units are cited in table 1. These characteristics testify to the units' considerable potential as possible powerful sources of heat. When investigating the problems associated with employing equipment having a total output of 25 to 30 million kW for heat supply, it is necessary to analyze thoroughly the effect such renovation has on changing the controllability characteristics of the power units as well as on the power balance of consolidated power systems. These questions have been examined previously [3]. Moreover, taking into consideration the fact that power units of 160 to 300 MW capacity began being installed at electric power stations in the 1960's and already have run over 100,000 hours or else are approaching that many hours of operation, it is necessary to evaluate the practical prospects of oper-

ating these units over the next 15 to 20 years from the point of view of both physical wear and obsolescence.

The experience in operating equipment having high parameters (9MPa and 500°C), some of which has logged about 200,000 hours, and 35 years of operating four power units of 150 MW capacity with parameters of 17 MPa and 540/540°C as well as the results of an inspection of the nonmoving parts and the rotors of several turbines have made it possible to predict with a known degree of approximation the sufficiently reliable operation of the types of equipment in question up to the year 2000. In addition, it is necessary to take into account the fact that several turbines may require a replacement of the stop valve housings, steam bypass tubes, cylinder housings and, in exceptional cases, the rotors. It is possible that some turbines from the first production runs will have to be dismantled.

With the constant improvement of power engineering, previously manufactured equipment becomes obsolete much sooner than it wears out physically. Questions regarding the effect of technical progress in power engineering upon the rate of obsolescence of thermal power stations are examined in [4]. A facility that is in operation is obsolete if the following condition is met: $Z_N \leq U_D$. In this case, Z_N are the quoted unit expenditures for a new facility and U_D are the unit operating expenditures (not taking into account renovation) of the existing facility. Both fossil-fuel and atomic electric power stations are examined as new facilities. For example, on the basis of comparison with a modern fossil-fueled electric power station with six 800 MW power units, one may say that units of 150 MW capacity and greater would not be obsolete (with the cost of fuel at 15 rubles per ton of conventional fuel, E=0.15 and the number of hours of operation from 5,500 to 7,000) if their design indicators are used as a basis. When the actual indicators of 150 MW power units are compared to the design indicators, they prove to be obsolete. The considerable increase in the number of AES's planned for introduction in the coming years and the trend toward increases in the prices for fossil fuels in the European portion of the USSR will lead to an accelerated obsolescence of even those electric power stations with 300 MW power units. In light of this, it is expedient to utilize the proposed renovation in order to reduce substantially or even eliminate temporarily the consequences of obsolescence of electric power station equipment which today puts out the major portion of the electric power produced.

The detailed development of the means to utilize power units for heat supply brought about the need to solve specific problems which had never before been encountered in the modernization of high-pressure equipment in connection with the following design features:

The presence of intermediate steam superheating;

A modular principle of operation (boiler-turbine) instead of a cross-coupled arrangement;

The crowded configuration;

The more complex design of high-pressure cylinders;

The use of noncombustible liquids and water in the K-300-240 turbine's regulating system;

The greater effort required in fitting the turbine blades;

The presence of rotor blades of great length in the low-pressure cylinder which are sensitive to decreases in the volumetric flow rate of steam;

The installation in 300 MW turbines of a back-pressure turbine drive for the feed pump, connected to the main turbine in series, etc.

In view of the installation in 160-300 MW turbines of 0.76 to 1.05 m rotor blades in the final stages, designed for operation in the basic condensation cycle, it is necessary to insure their reliable operation during the heating cycle with a reduced volumetric flow of steam. In connection with this, until sufficient operational experience is accumulated, the maximum values for the heat extracted depend upon the condition that, when the electric load is carried for an extended period of time, the expenditure of steam into the condenser he held to the minimum allowable level needed to satisfy the requirements of manufacturing plants. This condition requires that a considerable portion of the attached steam output be retained. Therefore, after the redesign the turbines may be referred to as the thermocontrolled type.

Since after renovation the power units should share in meeting the variable schedule of electric loads, the extracted heat must, as a rule, be derived from the regulated steam bleed or be combined with an unregulated bleed. The orientation toward the unregulated bleed, although it does simplify the reconstruction in the design sense, at the same time limits considerably the absolute values of the steam extraction and sharply reduces the controllability characteristics of the power units, except for the means of discharge. For this reason as well as for technical considerations, the adoption of certain proposals that provide for organizing multistage preheating of network water by steam from the unregulated bleeds in such a way that the entire volumetric flow of steam (aside from that which goes toward regeneration needs) is expended in this preheating is hardly practicable on the operating turbine installations of power units. In this case a condenser is used for the first preheating stage.

The organization of the regulated steam bleed requires the installation of special low-pressure steam-distributing units. Unfortunately, because of design considerations, it is not possible to make this steam-distribution sufficiently economical, since it is accomplished with hinged baffles or butterfly valves. In both versions a single throttle valve is used for steam distribution. The steam bleed is not always in a thermodynamically optimum location, since its position is determined by the turbine's design peculiarities. In connection with this, the unit output of the K-160-130 KhTGZ turbine unit is 105kW·h/GJ, for the K-200-130 LMZ the figure is

Table 1

Characteristics of the turbine units	K-160-130 KhTGZ		K-200-130 LMZ		K-300-240 KhTGZ	K-300-240 LMZ
Extraction of live steam G_0, kg/s	143	143	175/186	175/186	257.5	258
Heat load on power unit Q_T, MJ/s:						
Nominal	128	128	128	128	196	227
Maximum	198	198*	204/225	204/225	261	291
Unregulated bleed:						
Flow rate G_T^{UNR}, kg/s	-	0-26.4**	-	-	-	-
Pressure p_T^{UNR}, MPa	-	0.06-0.14	-	-	-	-
Regulated bleed:						
Nominal flow rate G_T^{REG}, kg/s	55.6	47.3	55.6	55.6	83.4	94.7
Maximum flow rate G_T^{REG}, kg/s	83.4	83.4	94.7	94.7	111.2	125.0
Pressure p_M^{REG}, MPa	0.25-0.54	0.25-0.54	0.12-0.25	0.06-0.25	0.2-0.25	0.2-0.25
Electric output of turbine N_E, MW (at minimum p_T^{REG}):						
At nominal heat load	142	143	193/206	200/211	255	246
At maximum heat load	123	123	176/189	191/206	237.5	227.5
Flow rate of network water W, m^3/s	0.68	0.68	1.33	1.33	1.21	1.21
Temperature of network water t_W, °C	115	115	93	93	108	108
Annual fuel savings while meeting nominal heat load over 4,500 hours ΔB, thousands of tons of conventional fuel per year	50	56	30	45-50	53	70
Cost of modernizing the turbine proper, thousands of rubles	300	360	250	300	200	200

* With unregulated steam bleed disconnected

** Maximum flow rate of steam with regulated bleed disconnected

129 kW·h/GJ and for the K-300-240 it is 126 kW·h/GJ. Naturally, these figures are inferior to the analogous indicators for the best domestic central-heating turbines.

In order to increase the efficiency of the renovation, it is expedient to examine the feasibility of using the turbine condenser as the first preheating stage. This eliminates the loss of heat with the circulating water. However, the practical realization of this potential is more complicated than for low-output turbine units and, to a considerable degree, is determined by the type of water-supply system (closed or open). In the closed water-supply system the temperature of the return network water may go to 70°C and the corresponding steam pressure in the condenser will amount to 0.06 to 0.08 MPa. This is not permissible from the point of view of reliable operation of both the rotor blades and the turbine itself. Moreover, because of the relatively small values for the preheating of network water in the condenser, an unusually high flow rate of water is required. Data are cited in table 2 which characterize the indicated operating conditions in the condenser (at a temperature head of $\delta t=4°C$ and with the rotor blades retained in the final stages). It follows from the table that, in order to recover all the heat usually lost with the circulating water, it is necessary to remove the rotor blades in one or two of the final stages (to reduce the temperature of the exhaust nozzles to 60°C) in view of the sharply increased pressure in the condenser. In this case the nominal condensing capacity of the turbine is not retained. It is theoretically possible to renovate the condenser in order to separate the specially built-in tube bundles which would have utilized only a portion of the heat released, while still keeping to the noted operational limitations.

It is more efficient to utilize the condenser to preheat the make-up water with an open water-supply system. Since the temperature of the water at the condenser input is only about 5°C, provisions are made to heat it considerably. The pressure of the steam in the condenser, the flow rate of the water and, consequently, the velocity of the water in the condenser tubes decrease noticeably (table 3).

From table 3 it can be seen that, when the water is heated to 35°C, the rotor blades in the final stages do not have to be removed. In this case, however, the flow rate of the make-up water fluctuates from 1.4 to 2.5 m^3/s. When it is heated to 70°C, the flow of water is reduced by half but the rotor blades in the final stage must be removed.

Separating the special make-up water tube bundles sharply reduces the effect of utilizing the heat released.

Thus, an analysis of the possible methods of utilizing the heat released reveals that the use of condensers in 160-300 MW turbine units for the first preheating stage of network or make-up water may probably be realized on a limited scale.

Table 2

Type of turbine unit	Flow rate of circulating water, m^3/s	Flow rate of steam into condenser, kg/s	Amount of heat entering condenser MJ/s	Flow rate of network water, m^3/s		Pressure in condenser, MPa (t_{BL}=70°C, δt=4°C)		Reduction in electric output, MW		Necessary expenditure of heat by consumers, MJ/s*		Temperature of exhaust nozzle, °C	
				Heating of water in condenser, °C									
				10	20	10	20	10	20	10	20	10	20
K-160-130	5.78	88.9	201.5	4.81	2.4	0.057	0.083	24	30	1631	815.5	105	145
K-200-130	6.94	108.9	245.8		2.89			38	42	1980.5	990.3	120	155
K-300-240	10.0	165.0	372.8		4.45			48	57	2970.8	1485.4	85	115

*Temperature schedule of the thermal network is 150/70°C

Table 3

Type of turbine unit	Amount of heat entering the condenser, MJ/s	Consumer heat load, MJ/s	Flow rate of water for hot-water supply, m^3/s		Pressure of steam in condenser, MPa (t_2^w=5°C, δt=4°C)		Reduction in electric output, MW		Reduction of water velocity in condenser tubes	
			Heating of water in condenser, °C							
			35	70	35	70	35	70	35	70
K-160-130	201.5	1002	1.39	-	0.009	0.046	3.7	-	By a factor of 4	By a factor of 8
K-200-130	245.8	1223	1.67	0.83			-	21		
K-300-240	372.8	1864	2.5	-			11.7	-		

In studies previously published [1,2], the design features of renovated 160 and 200 MW turbines are examined. In the K-300-240 turbines of the LMZ [Leningrad Metals Plant imeni 22nd CPSU Congress] and the KhTGZ [Kharkov Turbogenerator Plant imeni S. M. Kirov] there are essential design differences associated with the presence of three low-pressure steam flows. The first is in the intermediate-pressure cylinder, the other two in the low-pressure cylinder. When a regulated steam bleed is created, a hinged baffle is installed ahead of the first flow as a low-pressure steam-distribution element, while butterfly valves are incorporated ahead of the remaining two flows in two reserve tubes ahead of the steam input in the low-pressure cylinder [5]. The extraction of steam is carried out ahead of the first flow. In LMZ turbines the turbine exhaust is directed into the first low-pressure flow, that is, into the intermediate-pressure cylinder. During the renovation, three methods of feeding the exhaust steam to the main turbine were examined. In the first version, steam is fed into the first low-pressure flow. As a result of this, the pressure after the turbine drive and the pressure in the regulated bleed are equal. Steam at the rate of 111 to 125 kg/s arrives at the network preheaters from both the turbine and the turbine drive. This simplifies considerably the problem of extracting steam from the turbine. However, because of the constancy of the pressure after the turbine drive, it is possible to use the exhaust steam if the flow rate of live steam is not less than 166 kg/s. At greater rates of boiler discharge the output of the turbine drive is not sufficient to drive the feed pumps.

In the second version, the turbine drive's exhaust is fed into the low-pressure cylinder after the butterfly valves and, therefore, is not used for heat supply. In this case the controllability of the turbine unit is increased, but the maximum steam extraction is limited to 94.5 to 100 kg/s due to restrictions on the possible arrangement of steam-extraction pipes.

In the third version, the turbine drive's exhaust is completely isolated during the heat supply cycles from the turbine and all the steam is directed into separate network preheaters, the pressure in which for a given flow rate of network water depends upon the temperature of the water and the flow rate of steam through the turbine drive. In practice, the realization of such an arrangement is impossible because of the considerable overdriving of the final stages of the turbine drive when the temperature of the network water is low, as well as the unacceptable reduction in the drive's output at network-water temperatures above 55°C.

In the turbines manufactured by KhTGZ the turbine drive's exhaust is directed into the low-pressure cylinder. Two methods of discharging steam from the turbine drive were examined. In the first version the steam is discharged into the regulated bleed chamber. In this case the diameter of the pipe for the steam bleed from the turbine is reduced from 1.4 to 1.2 m, but the turbine drive's exhaust steam may be utilized if the flow rate of the live steam is not less than 195 kg/s. In the second version, the steam feed to the turbine drive is carried out past the butterfly valves. In both versions the maximum rate of steam extraction is 125 kg/s.

Table 4

Flow rate of live steam G_0, kg/s	Specific heat flow q, J/(kW·s)		Deviation		Average, %	Conditions
	According to thermal test data	According to data of KhF TsKB*	J/(kW·s)	%		
139	2534	2534	0	0		p_0=12.7 MPa t^0=540°C
111	2573.7	2531	43	1.67	1.81	p_K=3.4 kPa
83.4	2658.6	2559	100	3.76		t^{PP}=540°C G_{VPR}=0

* Kharkov affiliate of the Central Design Bureau

Table 5

Indicators	According to KhF TsKB* data			According to thermal test data		
Flow rate of live steam G_0, kg/s	139			139		
Flow rate into unregulated bleed, G^{BL}_{UNR}, kg/s	9.45	27.8	0	19.4	27.8	0
Flow rate into regulated bleed, G^{BL}_{REG}, kg/s	29.2	0	38.9	19.5	0	38.9
Heat flow Q, MJ/s	100	69.8	100	100	69.8	100
Electric output of turbine N_E, MW	137	148	134	140	150	137.5

* see table 4 above

Thus, it is theoretically possible to use exhaust steam from the turbine drive of 300 MW power units for heat supply. However, taking into account the recommendations of [3], it is expedient to limit the extraction to 70 kg/s (150 MJ/s). Thus, where it is possible, it is desirable not to complicate the layout of a heat supply installation that is limited to the steam extracted from the turbine alone. It should be noted that during operation at some electric power stations consumers are found to be using the steam for production purposes and for their own needs in connection with the changeover of KES's [condensing thermal electric power stations] over to a semipeak mode of operation (supplying deaerators, fuel oil conservation, peak boilers, etc.). For example, the feasibility of extracting steam at 14 to 16.5 kg/s at a pressure of 2.5 MPa from K-150-130 KhTGZ turbines has been examined, as well as design variants of K-200-130 LMZ turbines with a limited extraction of steam at a rate of 55 kg/s and a pressure of 1.5 MPa. Except for power stations with turbine units of 150-300 MW, more powerful fossil-fuel fired power units and turbine units for AES's with outputs of 220 to 1000 MW may be used in the future, depending upon the local conditions for meeting the considerable heat loads.

It is already possible at the present time to summarize the performance of the three K-150-130 KhTGZ turbine units at the Nazarovskaya GRES where the first modification of the renovation was carried out. A stepped preheat of the network water with steam from an unregulated bleed at a pressure of 0.06-0.12 MPa and with steam from a regulated bleed at a pressure of 0.54 MPa was created. Over the course of 5-6 years of turbine operation no fundamental difficulties were manifested in the start-up, condensation and heat-supply cycles.

While the renovated turbines were being set up, changes were introduced in the design of the turbine manifold and the low-pressure steam-distribution equipment. Free vibration in the baffle and some other small defects were eliminated.

Thermal tests of the turbine installation in power unit № 5 carried out by the Siberian branch of Soyuztekhenergo determined their physical indicators after the renovation.

In addition, it became necessary to expand considerably the pressure limits in the regulated bleed as a result of the pressure reduction to 0.25 MPa (see table 1). In view of this, a second modification was developed for all subsequent renovations of these turbines. This modification provides for the basic renovation of the stage cell between the hot intermediate-superheating and the regulated bleed, as well as for the replacement of the turbine manifold and the removal of the first stage of the low-pressure cylinder.

It is necessary to emphasize that the renovation of the equipment must coincide as much as possible with the modernization of all thermal engineering equipment (on the basis of developing manufacturing plants), with the re-

placement of parts that have outlived their calculated safe lif, as well as with the elimination of individual design defects that have arisen during operation.

Conclusions

1. One of the directions in improving the economic indicators of power engineering in the near future is the utilization of power units with turbines of 160-300 MW capacity both for heat supply and for satisfying the steam load of industry and the in-house needs of power stations operating in semipeak modes.

2. The conversion of 160-300 MW condensing power units into units of the central heating class substantially reduces the obsolescence of renovated equipment and should be matched by a considerable improvement in their physical condition.

3. Since GRES power units of 150-300 MW capacity take part in covering the variable portion of the electric load schedule, it would be worthwhile to consider as a preferred direction in turbine unit renovation the organization of regulated bleeds in conjunction with unregulated steam bleeds (when it is technically justified).

4. The utilization of condensers of turbine units of 150 MW capacity and greater for the first preheating stage of the network water reduces considerably the controllability characteristics of renovated power units and may find limited application, primarily with open water-supply systems.

5. The use of exhaust steam from the turbine drive of K-300-240 turbines for heat supply complicates considerably the operation of turbine units, imposes some limitations on the turbine's operational nature and is an unsound practice when the optimum amount of steam is bled from the turbine proper.

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ELECTRIC POWER

THERMAL POWER ENGINEERING INFORMATION IN 'REFERATIVNYY ZHURNAL'

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[Article by Engineer S. G. Dupleva: "Scientific and Technical Information in the Field of Thermal Power Engineering. In Commemoration of the 25th Anniversary of the Department of Electrical and Power Engineering of VINITI"]

[Text] In 1952 the Institute of Scientific Information was organized within the system of the USSR Academy of Sciences on the initiative of Academician A. N. Nesmeyanov. In 1955 it was reorganized into the All-Union Institute of Scientific and Technical Information (VINITI), the chief agency for scientific and technical information in the USSR. This agency publishes in Russian systematized information in particular specialties in the form of REFERATIVNYY ZHURNAL for the natural and applied sciences, as well as quick information (expanded abstracts), the review series "Itogi nauki i tekhniki" (INT) [Reviews of Science and Technology], various indexes, etc.

The VINITI REFERATIVNYY ZHURNAL is the main information publication of VINITI, and among similar publications is the largest in the world with regard to volume and the number of primary sources dealt with. In contrast to similar foreign publications, the VINITI REFERATIVNYY ZHURNAL is an illustrated journal. The names of over 22,000 journals, about 10,000 books and approximately 150,000 patents are used annually in its preparation. More than one million publications with an overall volume of 25,000 typographical units find a place in the VINITI REFERATIVNYY ZHURNAL yearly. This journal has received broad recognition not only in the USSR but also abroad. According to data for 1980, about 40,000 issues will go into circulation. Abstracts are published in the VINITI REFERATIVNYY ZHURNAL (about 85 percent) as well as annotations and bibliographical descriptions of articles, collections, proceedings of conferences and symposiums, textbooks, monographs, patents and standards published in 130 countries in 70 languages, including 20 languages of the peoples of the USSR. The material is published in an amount that is sufficient to obtain the necessary information about the contents of the publication, an evaluation of the primary source's importance and a determination of the expediency of referring to

the original. The topical orientation of the individual sections of REFERATIVNYY ZHURNAL and its divisions make it possible for the specialist to become familiar with practically all publications in a certain field in the least amount of time. To facilitate the search for material, various types of indexes are published (author, patent, subject, geographical, etc.) yearly or monthly.

There are 17 scientific-industrial departments and several scientific sections comprising VINITI. The scientific-industrial department of electrical and power engineering was formed in 1955. In its 25 years of existence the department has undergone much development in carrying out the complex tasks associated with creating a scientific and technical information service in the USSR in the field of electrical and power engineering. Scientific work and the preparation of the publications is carried out under the supervision of an editorial board. The REFERATIVNYY ZHURNAL section "Teploenergetika" [Thermal Power Engineering] has been in existence since 1955. At first it was published as a section of REFERATIVNYY ZHURNAL in a joint volume entitled "Elektrotekhnika." Later, starting in 1961, it was published in a joint volume entitled "Elektrotekhnika i energetika." Since 1963 the REFERATIVNYY ZHURNAL "Teploenergetika" has been a joint volume, consisting of 5 sections of REFERATIVNYY ZHURNAL which are also published in separate books. This is particularly convenient for specialists with specific interests.

REFERATIVNYY ZHURNAL is published annually in 12 numbers. An annual Subject Index (with a volume of about 40 typographical units) and an Authors Index (approximately 15 typographical units annually) are published for the joint volume of REFERATIVNYY ZHURNAL entitled "Teploenergetika."

Each section of REFERATIVNYY ZHURNAL and its divisions are printed in accordance with an accepted arrangement published in the first number of REFERATIVNYY ZHURNAL. On the whole, the order of headings in REFERATIVNYY ZHURNAL is a part of "Order of Headings for USSR Abstract Publications." The majority of sections begin with the heading "General Section." All headings are arranged according to the principle of linear classification from the general to the particular. The number of subheadings is determined by the structure of the section and the amount of information dealt with. The REFERATIVNYY ZHURNAL order of headings is constantly being improved and made more accurate. It is supplemented with new headings as new directions in science and technology arise. We will cite a brief description of the five books in the REFERATIVNYY ZHURNAL "Teploenergetika."

The REFERATIVNYY ZHURNAL section "Obshchiye i teoreticheskiye voprosy teploenergetiki. Gelioenergetika" [General and Theoretical Problems in Thermal Power Engineering. Solar Power Engineering] deals with the current state and future prospects for development of thermal power engineering, general and theoretical problems, terminology, as well as relevant papers on hydrogen power engineering, solar engineering and solar power engineering (about 300 publications monthly).

The REFERATIVNYY ZHURNAL section "Toplivnyy balans. Ispol'zovaniye gaza i mazuta" [The Fuel Balance. Utilization of Gas and Fuel Oil] cites relevant papers on the fuel balance in various countries of the world, the thermal engineering characteristics of fuel, combustion processes, gas burners and fuel nozzles, data on automating their operation, on monitoring the combustion processes, on the utilization of gas and fuel oil in industry and agriculture and on protecting the atmosphere from pollution with the products of incomplete combustion (about 200 publications monthly).

The REFERATIVNYY ZHURNAL section "Kotel'nyye ustanovki i vodopodgotovka" [Boiler Installations and Water Treatment] examines the configuration and arrangement of boiler installations, the design, operation, installation and repair of steam, water-heating and waste-heat boilers, their components and auxiliary equipment, problems of fuel preparation, dust preparation and fuel feed, furnace chambers and pulverized-coal combustion, installations for burning industrial and domestic wastes, water treatment, the water cycle and chemical control at TES's, AES's and in boiler rooms (about 200 publications).

The REFERATIVNYY ZHURNAL section "Teplovyye elektrostantsii. Teplosnabzheniye" [Thermal Power Stations. Heat Supply] cites configurations and arrangements for steam turbine, gas turbine, diesel and geothermal electric power stations (ES's), the design, construction, operation and repair of ES equipment, district-heating and hot-water supplies, heat-exchangers, thermal insulation and the control and automation of thermal processes at ES's (up to 350 publications monthly).

The section "Atomnaya energetika" examines general problems in atomic power engineering in the world and in various countries, the design, construction and operation of AES's and their equipment, the types and designs of reactors, questions of AES safety, automation and control at AES's, fuel, moderators, coolant and construction materials for AES equipment (up to 400 publications monthly).

In a separate REFERATIVNYY ZHURNAL section "Teplo- i massoobmen" [Heat and Mass Transfer] published since 1976, up to 300 relevant papers are published monthly on the current state and future prospects of the science of heat and mass transfer, on thermal conductivity, heat-exchange, two-phase currents, boiling, evaporation, condensation, etc. The section is furnished with a monthly authors index and an annual subject index.

In order to facilitate the search for materials, REFERATIVNYY ZHURNAL has reference and search aids (indexes, references, etc.). The volume of REFERATIVNYY ZHURNAL is constantly increasing, the scope of the primary sources is growing wider and the topics are expanding. The time needed to prepare the information, counting from the time the information arrives at VINITI to the time the abstract appears in REFERATIVNYY ZHURNAL, at present amounts to about three and a half months.

The department also prepares "Itogi nauki i tekhniki" collections for publication. These are information publications of the review type in which information about those achievements, basic trends and tendencies in the development of various fields of science and technology that had appeared in REFERATIVNYY ZHURNAL in the last one to three years is summarized and systematized. Since 1964, 85 volumes of INT have been published, including 16 volumes on thermal power engineering. In 1969 the volume entitled "Energeticheskiye gazoturbinnyye ustanovki" [Gas-Turbine Power Installations] was published.

The present and the future of the Scientific-Industrial Department of Electrical and Power Engineering of VINITI is linked to further work in improving the arrangement of the headings and raising the quality of the issues through the use of computers in the preparation and publishing of REFERATIVNYY ZHURNAL. Work is being conducted at VINITI on the creation of an automated information-search system called ASSISTENT [expansion not provided]. It has been proposed that, starting in 1981, information be published on machine-read carriers, for example, on magnetic tape, in addition to the traditional publication of REFERATIVNYY ZHURNAL on paper.

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ELECTRIC POWER

HEATING SUPPLY, VARIOUS MODES OF HEAT UTILIZATION

Moscow TEPLOSNABZHENIYE (Heating Supply) in Russian 1979 pp 2, 254-255

[Annotation and table of contents from the book by Z. Siraks, Energiya Press, 256 pages, translated from the Latvian to Russian]

[Text] The book describes heat users and the various modes of heat utilization. Technical-economic calculations of comparable variants of heating supply are presented along with procedures for selecting optimal heating systems (closed or open, associated or autonomous). Problems of the design, analysis, and operating adjustments of heating centers are considered, along with the siting of heating lines in horizontal and vertical urban plans.

The book is intended for heating engineers, technicians, designers, and repairmen dealing with the installation of central heating systems in cities and settlements. It will also be useful to students majoring in power engineering at higher schools.

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ELECTRIC POWER

BRIEFS

NUCLEAR POWER USE--In the West this would be considered a revolution. In the USSR it is a major project. In order to save on petroleum, the Soviets are studying the installation of nuclear power plants in the very heart of their metallurgical or chemical complexes. Here are their calculations: A 1,000 megawatt reactor would be sufficient for two chemical combines producing one million tons of ammonia per year. The same reactor would be able to power a unit producing two million tons of steel. It would be very clean! The only condition is to use "high temperature" (1,000 degrees Celsius) reactors. A demonstration power plant is already under construction but Moscow is refusing to identify its location. [Text] [Paris L'EXPRESS in French 28 Jun 80 p 69] 5157

CSO: 3100

FUELS

DEVELOPMENT OF PETROLEUM REFINING INDUSTRY IN 1980

Moscow KHIMIYA I TEKHNOLOGIYA TOPLIV I MASEL in Russian No 6, Jun 80 pp 3-6

[Article by Ya. G. Sorkin]

[Text] Speeches by Comrade L. I. Brezhnev and the proceedings of the November (1979) Plenum of the CPSU Central Committee spelled out the work results of the party and people following the 25th CPSU Congress, they deeply and thoroughly revealed the ways for further implementing the decisions of the congress, and they spelled out concrete tasks associated with fulfillment of the 1980 plan, which concludes the 10th Five-Year Plan for development of our country's national economy. In his speech at the plenum, L. I. Brezhnev said: "We can note with satisfaction that since the beginning of the five-year plan, implementing the decisions of the 25th CPSU Congress, we have made significant advances in developing the national economy, raising the material and cultural standard of living, and strengthening the defense capabilities of our motherland."

Implementing decisions of the 25th CPSU Congress, the laborers of petroleum refining and petrochemical industry are working successfully in the current five-year plan. In comparison with 1975, in 4 years of the 10th Five-Year Plan the country's petroleum refining volume grew by 15 percent, and motor oil production increased by 14 percent; production of raw materials for petrochemical and microbiological industry increased significantly; production of benzene for chemical industry more than doubled, and production of liquid paraffins, used to produce nutrient yeast, increased by 1.8 times. The output of other products made from petroleum grew as well.

The assortment of petroleum products widened, and the quality of the products climbed. Production of high-octane gasolines (72 and above) increased within the structure of total gasoline production from 79.5 percent in 1975 to 91 percent in 1979, while production of AI-93 gasoline grew by more than 65 percent. Almost all diesel fuel is now being produced with a low sulfur content. Electrode coke production grew to 45 percent (in relation to total production of common coke). The effectiveness with which petroleum is used was increased due to a decrease in losses of petroleum and petroleum products, and in fuel consumption.

The fixed capital possessed by petroleum refining industry increased significantly during the period under examination. The Lisichansk and Pavlodar petroleum refineries were put into operation. High-output and combined petroleum refining facilities were erected at the Mozyr', Kremenchug, Novobakinsk imeni V. I. Lenin, Moscow, and Nizhnekamsk petroleum refineries, and in the "Groznefteorgsintez" Production Association. The output capacities of secondary petroleum refining processes grew. A total of 28 new production facilities were put into operation during the fourth year of the 10th Five-Year Plan.

The increases in the sector's economic potential became possible owing to the selfless labor of all oil refiners, and their active and creative participation in the all-union socialist competition for completing and surpassing the assignments set by the annual plans.

The work of petroleum refining industry also suffered complexities that prevented us from fully reaching the goals of the five-year plan. They include undersupply of petroleum, interruptions in deliveries of finished products, delays in construction and commissioning of new output capacities, and some others. Not all enterprises are making use of advanced skills or working persistently to raise labor productivity, to economize on material resources, and to achieve the best possible end results of production. Other shortcomings in the work have included delays in commissioning and assimilating newly built output capacities and in preparing good quality raw material, especially for secondary petroleum refining processes, and failure to complete the plans for introducing new equipment and for re-equipping the production operations.

The 1980 plan for petroleum refining industry, which was written by planning agencies, enterprises, and collectives of the USSR Ministry of Petroleum Refining and Petrochemical Industry, is an important component of the five-year plan for 1976-1980. It was compiled with a consideration for the national economy's higher demand for petroleum products, and the petroleum processing volumes foreseen. Although the planned targets for 1980 are high in terms of the petroleum refining volumes and the technical-economic indicators, they are realistic, and it is the honor of every collective to insure that we reach and surpass them.

Guiding themselves by decisions of the November (1979) Plenum of the CPSU Central Committee and statements made at the plenum by CPSU Central Committee General Secretary, Chairman of the Presidium of the USSR Supreme Soviet, Comrade L. I. Brezhnev, this year all of the ministry's production collectives and administrative machinery will devote a great amount of attention to the following issues:

Revealing and utilizing all production reserves, and raising the output-capital ratio by making more-intensive use of the equipment, preparing raw material to be processed better, and reducing the materials-intensiveness and cost of production;

insuring unconditional fulfillment of the plan for introducing new production capacities, accelerating their assimilation, and minimizing the time construction is left uncompleted;

raising the effectiveness of production, intensifying it, accelerating introduction of new equipment, and improving the quality of products;

increasing the growth rate of labor productivity by introducing new equipment, improved forms of production organization, and labor automation and mechanization;

reinforcing labor and plan discipline, and increasing the scope of socialist competition at the enterprises;

supporting and disseminating advanced skills and progressive forms and methods of work promoting higher labor productivity;

consistently promoting an effort to economize on and make sensible use of materials and money.

During the writing of the 1980 plan, because of a lack of by-product output capacities a somewhat critical situation arose in the production of certain light petroleum products. It was necessary in this connection to find ways to intensify the work of existing secondary petroleum refining facilities (catalytic cracking, coking, catalytic reforming, alkylation, production of aromatic hydrocarbons and liquid paraffins, and so on).

A critical situation is also evolving this year in relation to primary petroleum refining processes.

This is associated both with delays in putting new plants into operation and with the fact that the output capacities of a number of plants cannot be fully utilized because the quantity of petroleum they need cannot be supplied to them. We must write up a very clear plan and schedule for supplying petroleum to the plants, ones insuring the most sensible use of petroleum for production of the planned volume and assortment of petroleum products. This plan must be meticulously coordinated with the USSR Ministry of Petroleum and Petrochemical Industry, the Ministry of Petroleum Industry, the Ministry of Railways, the RFSFR Ministry of the River Fleet, and the Ministry of Maritime Fleet. Efficient operation of rail, water, marine, and pipeline transportation to deliver petroleum and ship finished petroleum products is a mandatory prerequisite of this plan. We do not have such a coordinated plan today, and this is seriously hindering the rhythmic operation of petroleum refineries.

These tasks and the practical measures of their completion were thoroughly examined at a meeting of the governing board of the USSR Ministry of Petroleum and Petrochemical Industry and the presidium of the central committee of the trade union of workers in chemical industry, held at the beginning of this year. The governing board suggested writing up, for each enter-

prise, a concrete plan of measures aimed at increasing the output capacities of existing production operations and facilities through their intensification and reconstruction. Fulfillment of these measures by the enterprise collectives should insure that we not only complete the 1980 plan but also surpass it.

The creative initiative of efficiency experts and inventors, and the attention of business managers and of local party, trade union, and Komsomol organizations must be directed at implementing these measures. Sensible organization of the production of petroleum products and distribution of their production among the plants with the goal of reducing unsensible shipments of petroleum products is a very important task that must be completed by the administration of the ministry and the all-union production associations within its composition.

Augmentation of the output capacities of existing production facilities and operations, and introduction of new output capacities in 1980 should insure an increase in the gross output of enterprises of the "Soyuznefteorgsintez" All-Union Production Association by 5.3 percent in comparison with the actual volume for 1979. Automobile gasoline production volume should increase by 3 percent, and diesel fuel production should increase by 6 percent. The proportion of high-octane gasolines in the total volume of automobile gasoline produced must be increased to 65 percent.

Production of aromatic hydrocarbons, liquid paraffins, electrode coke, and raw materials for petrochemists is to be developed at a preferential rate in 1980. In comparison with 1979, production of liquid paraffins is to be increased by 52 percent, production of raw materials for petrochemistry is to be increased by 42 percent, electrode coke output is to be increased by 13 percent, and production of aromatic hydrocarbons is to be increased by 8 percent. We must also increase production of lubricating oils, bitumen, furnace and gas turbine fuel, naval boiler fuel oil, and other products.

The plan calls for achieving, through implementation of organizational and technical measures and intensification of production, a significant increase in the capacities for primary petroleum refining, coking, catalytic cracking, hydrorefining, and production of lubricating oils and their additives. The plan accounts for products that must be obtained with new output capacities to be introduced in the first quarters of the present year. Therefore it is especially important to insure completion of their construction by the deadlines set by the plan, and to prepare them well for assimilation of their planned output capacities.

The plan for capital construction in the current year will necessitate much hard work on the part of both the contracting ministries and the clients. The appropriate subdivisions of the USSR Ministry of Petroleum and Petrochemical Industry and the boards of the enterprises under construction must insure that the facilities under construction are promptly supplied with the technical documents and equipment they need.

Economization, reduction of the materials-intensiveness of products, and reduction of the losses of petroleum and petroleum products and of fuel consumption for the in-house needs of the petroleum refineries acquire special significance to attainment of the targets foreseen by the 1980 plan. In his speech at the November Plenum of the CPSU Central Committee, L. I. Brezhnev devoted a great deal of attention to economization of all forms of energy and fuel, and to reduction of their losses. He called conservation of heat and energy the most important national task. Petroleum refining and petrochemical industry is a high energy consumption sector of the national economy, requiring significant quantities of petroleum for its own needs. During the first 4 years of the five-year plan the oil refiners attained significant successes in reducing losses and economizing on fuel. In comparison with 1975, the losses of petroleum and petroleum products per ton of refined petroleum were decreased by 14 percent, while fuel consumption was kept at the 1975 level, even though the volume of secondary processes grew significantly.

Such a decrease in losses and such economization of fuel resulted in a savings on the order of 1 million tons of comparison fuel per year.

However, an inspection showed that the petroleum refineries still have significant reserves and possibilities for further economization of energy resources. Not all enterprises are implementing the recommendations approved by the ministry for reducing losses and economizing on fuel, wasteful expenditure of energy is continuing, large quantities of gas are still being burned away as waste products, and reservoir centers storing petroleum and petroleum products are being outfitted too slowly with devices that reduce losses of light petroleum products. Water heat exchangers and condensers are being replaced in air cooling units and barometric condensers are being replaced by surface condensers too slowly. The advanced skills of some enterprises are not always brought to the attention of others.

One important issue for the sector is to raise the effectiveness of petroleum utilization by improving preparation of crude oil and raising the potential of end product removal. This pertains especially to preparation of crude oil for catalytic cracking and catalytic reforming, and for acquisition of aromatic hydrocarbons, electrode coke, lubricating oils, and some other products. Because raw material for the production processes of these facilities is not being prepared well enough, the quantities of end products recovered are low, energy expenditures are excessive, and the capital-output ratio and effectiveness of the use of crude oil in refining processes are low. Due to imprecise fractionation, the petroleum products and semifinished products recovered by some enterprises do not meet the plant standards, and in order to raise their quality to the required level, the enterprises must expand additional energy and chemicals, and sometimes even condone shipment of products failing to satisfy the necessary quality indicators.

We can noticeably improve the quality of some products and raise the effectiveness of crude oil processing by initiating the use of new catalysts in a number of production facilities. However, such conversion is proceeding too slowly at a number of petroleum refineries. The proportion of products bearing the State Seal of Quality within the total volume of commercial production must be raised this year. This pertains to improving the quality of both motor fuels and lubricating materials on one hand, and petrochemical raw material and other products on the other.

1980 is not only the concluding year of the 10th Five-Year Plan, but it is also the sector's "launching pad" for the 11th Five-Year Plan. Because the growth rate of petroleum refining is to decrease in the 11th Five-Year Plan in comparison with the 10th, the direction in which petroleum refining industry is to develop will change significantly. In the 10th Five-Year Plan, it developed mainly owing to preferential increase in the volume of primary petroleum refining, while in the 11th the basic attention must be devoted to deepening its refining, meaning that fuel oils will have to undergo further refining as well. In order to do this, the scientific research and planning-design organizations of the USSR Ministry of Petroleum and Petrochemical Industry and associated sectors must hasten development of the new processes, and prepare the required planning and technical documents for manufacture of new petroleum refining apparatus and equipment that is to increase the output of light petroleum products.

The industry's results for the first quarter of the current year show that the oil refiners will do everything dependent upon them to insure the sector's successful work in the concluding year of the five-year plan. The plan for the first quarter for the sales and production of the most important types of products was completed by all of the main administrations and all-union associations of the USSR Ministry of Petroleum and Petrochemical Industry. The production plan was exceeded by 26.5 million rubles. The rate of growth of product sales volume is 6 percent in comparison with the first quarter of last year. The labor productivity growth plan has been met. Despite significant difficulties and interruptions in the deliveries of petroleum to the refineries and in shipment of finished products, the plan for delivery of the basic types of products has been completed. The oil refiners have managed to produce enough of the basic types of motor fuels, thus insuring the continued operation of the industry, and to create the necessary reserves of fuel for spring agricultural operations.

1980 is the year of preparations for the 26th Congress of the Communist Party of the Soviet Union. In honor of this noteworthy event, all of the sector's enterprises have initiated a major socialist competition; enterprise collectives are adopting counterplans and stiffer socialist pledges, and they are organizing shock labor watches. The task is to make the achievements of the best collectives the property of all workers in the sector.

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