THE BASIS OF THE TECHNOLOGICAL ECONOMIC PLAN OF RECONSTRUCTION OF THE U.S.S.R.

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THE BASIS OF THE TECHNOLOGICAL ECONOMIC PLAN OF RECONSTRUCTION OF THE U.S.S.R.

Technical and Economic Reconstruction in the Present Stage of Economic Construction

The economic plan of the third, decisive year of the Five-Year Plan shows with particular clarity why we consider the whole Five-Year Plan a plan of great work and socialist offensive along the whole line. The imposing character of this programme is best of all indicated by the fear which has struck the world of our class enemies at the sight of the immense work which we are developing in our economic and political construction, particularly in this third year of the Five-Year Plan of socialist construction.

We are able to carry on the work on the present immense scale because of the radical reconstruction in technique and economies which we have brought about in our country, in spite of the obstacles which have stood in our way for the past ten years. Only after we surpassed the pre-war economic level and considerably changed the very structure of our economy, were we able to approach this definite five-year period of reconstruction. Thus, the plan of the technical and economic reconstruction of the U.S.S.R. is in fact one of development of our economy in its concrete conditions. In speaking about the basis of this technical and economic plan of reconstruction, we must in fact revert to the topics which are closely bound up with the principles of planning of socialist economy, in conditions when this planning is
becoming an increasingly strong and decisive force in the process of socialist construction itself. Wherein does our main strength lie? We are surrounded by a host of enemies; the elements of nature are not yet subjected to our will by a long way. It is not surprising that Vladimir Ilyich (Lenin), when weighing our chances of success in our great struggle, visualised our main strength in our being organised. Our plan of socialist construction in itself is a powerful organising force. The more closely this plan is linked up with scientific knowledge, the more effective will its influence on the will and mind of the human masses which accept it.

The progress of the reconstruction period shows us how closely our planning work is bound up with operative economic activities. We have occasion to emphasise repeatedly that our plan must, in fact, be the result of the amalgamation of scientific theory with the experience of the millions of toilers. Now we can see how this unity is created by the merging of the direct plans and counter-plans. That in itself creates the conditions which very effectively forge our state of organisation. At the last world conference on energetics, one of the reporters, in estimating machine power as a cultural factor, emphasised that the growing contact of the new generation with the machine age naturally awakens mental curiosity and creates particular modes and methods of thought. Among our youth we observe not only those positive changes which must come from the closer and closer unity between study and industrial practice, not only the changes which accompany industrialisation, but also those changes which come as a direct result of millions of our youth being at the same time fighters for the socialist plan of economy.

Our progress in the construction period itself is the best propaganda by action, because commensurate with this progress, which is a school of struggle, not only do the warriors in our camp become hardened in struggle but they also at the same time witness record achievements, which the world has never known before. Nevertheless we must not have any illusions about easiness of further progress. We see more clearly that the whole world is splitting up into two definite camps—fighters of the Soviet camp and of the anti-Soviet camp. Hence, the great historical responsibility that falls on our shoulders; hence our particular anxiety to rally all those elements which help to strengthen our socialist organisation and the integrity and unity of our Soviet camp, and particularly those elements which are the foundation of the plan of socialist construction itself—or, what is the same thing, the foundation of the plan of our technical and economic construction. Hence, the necessity of the greatest care in selecting the basis, the necessity of fighting on two fronts—against those who distort our principles from the right and the left, the necessity of combating the eclecticis and opportunists.

The Triune Formula of Communist Construction

The ruthless struggle which the champions of the capitalist system are waging against the Communist Parties throughout the world indicates that our enemies clearly understand the historical significance of the Communist Party as the champion and organiser of a new world.

We are engaged in building the first socialist economy in the history of the world, under the direct leadership of the Communist Party, along those well defined and varied guide posts which represent the conception of the general line of the Communist Party.

The broadest generalisation of the general line of our socialist construction programme is expressed in Lenin's

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8 The plans of production of a given enterprise are submitted for discussion to the workers, who, weighing all the possibilities, come to the conclusion that the official plans can be exceeded. They make their proposals accordingly and put forward a "counter-plan" to the official plan.—Ed.
well-known formula: “Communism is Soviet government plus electrification of the whole country.”

Not without reason was this formula bitterly attacked by various representatives of the opportunists' camp. Trotsky went so far as to deny that this was formulated by Lenin. Indeed, can communism in its developed form, which repudiates all authority as a form of violence and coercion, contain within itself, as one of its component elements, a direct appeal to the Soviet government, a government which, as we know, paved its historical road under a stern proletarian dictatorship?

But if we approach the three elements of Lenin's formula, not in their static state, but in their motion, all the contradictions immediately disappear, and the profound historical principles of Lenin's conception immediately become clear.

In analysing the principles of our plan of technical and economic reconstruction of the U.S.S.R., we inevitably revert to the three basic elements of Lenin's formula, to the principles which are closely found up with the conception of communism—Soviet government and electrification. It should be quite clear that only by taking these three co-ordinates into account can we find the necessary magnitudes from which to start such an analysis.

In defining the type of our construction programme, we describe it as socialistic. However, Marx in his Communist Manifesto was obliged to dissociate himself from falsifications of the slogan of socialism. To us, socialist construction is inseparable from the struggle for a planned regime of economy, under which the will of the proletariat becomes the supreme law. The actual course of the struggle for planned economy in the U.S.S.R. is the best historical document that could be produced in proof of the soundness of the forecasts of the different stages of the revolutionary struggle made by Marx and Engels. The stages of our socialist construction are the stages of the tortuous road of humanity through the proletarian dictatorship to classless society, which will function on the basis of the familiar formula of Fourier: “From each according to his abilities; to each according to his needs.”

Thus, communism is the last stage of a whole historical process. The battles in which we have participated, are participating now and will participate in the future, prove to us what a tremendous effort is required to secure such victories as enable us to change society from an organisation of dictatorship to classless unity, from the most rigid regime of economy and struggle against waste to practically unlimited material abundance.

At any rate, the beacon of communism is first of all a beacon of colossal progress, in the course of which a change takes place, not only in the social forms, not only in the material conditions which constitute the basis for these social forms, but also in the bearer of this man himself. Thus, the very conception of communism excludes a static approach to it.

The second element of the formula—the Soviet government, in its historical manifestation, is not by any means a fixed quantity. What did Lenin have in mind when he emphasised that one of the premises of communist progress is the Soviet government? Obviously, the fact that the Soviet government is the government of the toilers, and that in order to clear the way for communism, every nation, every country would have to go through its own victorious October. But in our analysis we must take another step forward. In speaking of the energetic base for industrialisation we must keep in view the energy which is supplied by the living power of the toilers themselves, as well as that predominant part which is supplied by nature. Of course, our comparison between these two sources of energy is extremely arbitrary. We can assert approximately that the mechanical equivalent of an average worker is equal to about 1/25 h. p. But what about the expenditure of mental energy? Can this be expressed in terms of calories, in the
same way as we calculate the expenditure of energy in general? To do so would be to take the slippery slope which will land us in mechanist swamps. When speaking of the energetics of living labour power within the scope of the state national-economic plan, we must first of all take into consideration the peculiar indices of this living energy, which are determined by the existence of the Soviet government.

We cannot complain that the various schools of political economy have underestimated the role of organizing living labour power. Nevertheless, until now all quests in this direction have been limited to seeking for the most effective forms of the various types of compulsory labour. The workers themselves were rather the objects, and not the subjects of these researches. That in capitalist economy, the worker, drawn into the process of production by the so-called voluntary system of hiring, comes under the category of things that are entirely subjected to the absolute authority of capital, requires no proof. This principle of compulsion can be traced in the teachings of Taylor and other bourgeois economists engaged in the quest for methods of so-called scientific organisation of labour. We may recollect that Taylor’s rationalisation system encountered such bitter opposition from the workers that at times his life was in danger. Picture to yourself the environment of the endless belt in the conditions of capitalist exploitation. It is the environment of the sweating system equal to that which prevailed in the gloomy past when capitalism was still in the stage of primitive accumulation. Hence, it is not an accident that in contemporary America, the average age limit of a worker is forty years. This enables one to judge the value of the howls of indignation raised by the apologists of capitalism against alleged compulsory labour in the U.S.S.R.? The existence of a Soviet government, i.e., the government of the workers themselves, once and for all breaks the vicious circle of the quest for such new forms of organisation of living labour, under which the sum of positive quantitative changes will yield a new quality of labour. In a complicated and difficult manner, after going through a peculiar crisis of cadres, caused by the desertion from socialist construction of a considerable stratum of qualified forces, the Soviet government is bringing about a colossal change, not only in the structure of material productive processes, but also in the organisation and in the profile of the workers themselves. Above all, the organisation of the workers is the task of the workers themselves. The ploughs of self-criticism and socialist competition are turning historically virgin soil. Before our very eyes entirely new and unusual forms of labour organisation are springing up which ultimately will convert the workers of town and country into one great collective chain brigade of socialist competition. The multiple shift system of labour in conjunction with a shortened working day, uninterrupted production, counter-plans, the social tow-rope, worker’s nuclei of rationalisation and invention, and lastly the rapidly increasing participation of workers in the administrative and executive organisations—all this upsets previous production relations, which converted the relations between men into relations between things.

Simultaneously the cells, in which scientific knowledge is inevitably confined in the exploiting social process of labour, will be broken up. Scientific creative genius is being more and more absorbed in the socialist plan of construction, which in its victorious progress sweeps away the boundary line between physical and mental labour.

* Shock-brigades to accelerate output are formed in each shop for each job. The shock-brigades in the respective shops join together to see that the job passes through the various shops in the process of production with the greatest dispatch. These latter brigades are called “chain brigades.” The brigades challenge each other to fulfill the plan in the shortest time; this is called socialist competition.—Ed.

** i.e., a brigade that is more advanced in its work will help one that is lagging behind.—Ed.
Marx in his profound analysis scientifically revealed and deciphered the mystery, which he characterised as the secret of surplus value. The great display which the Soviet government is making in economic and political construction reveals secrets which will safeguard future world economy from crises, in conditions of majestic progress towards greater and greater material abundance, towards greater and greater subordination of the anarchy of things to a scientifically worked out socialist plan.

The working class, before our very eyes, is throwing up from its vanguard a greater and greater number of fighters for the socialist plan. Our factories are to an increasing degree becoming not only an arena of productive labour, but also arena of intensive study. Behind this vanguard the masses follow. The relations between science and the toiling masses are entering a new and higher phase, which guarantees the expansion of science as well as the unprecedented effectiveness of labour. The Soviet government is not only revolutionising the forms of organisation of labour in its simplest categories, but it also necessarily assigns a leading role to technical and scientific workers, and with stern consistency replaces the heroism of individuals by the heroic accomplishments and creative genius of millions of workers.

It is self-evident that this work of the Soviet government is necessarily a peculiar and prolonged process. Hence, a static approach in the study of those elements of our work which guarantee new and higher forms of living energy is absolutely useless.

Now we shall take up the third element of Lenin's formula, "the electrification of the whole country."

Regardless of the forms or the length of time required to achieve that progress which will cause the "fountain of material abundance" to flow, it is clear that William Petty's postulate: "Labour is the father of all wealth, and the earth is its mother," will hold good all the time.

However, even this formula is correct only in motion. The teachings of the physiocrats corresponded to the correlation of forces between industry and agriculture prevailing in their time. The victorious onslaught of capitalist industrialisation produced its own revaluation of values, and with greater and greater force is limiting that absolute principle, which is bound up with the conception of the "earth." But progress does not stop there. The fact that Henry Ford, the recognised representative of the capitalistic reign of machinery, stated that we are wrong in characterising our age as the machine age was not an accident. "In reality," he said, "our age is an age of energy. Behind the machine there is energy, particularly hydroelectrical energy."

Mr. Ford in this instance hits the nail on the head. In the conditions of the twentieth century the production of energy is the base which guarantees the maximum possibility of possessing the "earth." Of course, this term is to be interpreted in the broad sense of natural elements.

The most rational utilisation of the forces of nature at our command, the most advantageous transformation of the natural forms of energy into more effective forms, the most economical transportation of these forms of energy to the points of utilisation, and lastly, the rational utilisation of these forms of energy in the processes of production—all this is the fundamental basis of energetic economy. Relying on the postulates of this economy, the sum total of which guarantee maximum results in productive activity at a minimum expenditure of energy, we must in a new way demonstrate our attitude to the fundamental functional and departmental division of social labour according to the grand divisions like industry, transport and agriculture, including also the land with all its natural resources according to territorial deviations. Hence, our approach to the task of defining the economic-geographical divisions of the country on the basis of energetics, and our approach to the task of
determining the basic, urgent units of our socialist construction, of our economic regions. Counting on the millions considerably facilitates this. And only when we have mastered this calculation will we be able to cope with the colossal organisational tasks of our socialist construction.

It is obvious that electrification must play a tremendous role in the solution of these problems of energetics.

This brief outline shows that the proper understanding as to why Lenin staked everything on the electrification of the whole country can be reached only by analysing the true dialectics of the events on the economic field of labour, which represent the specific feature of the twentieth century.

We have dealt at such great length with Lenin's postulate, because the clear understanding of it is a safeguard against any distortion of our line of economic reconstruction and guarantees the most effective fulfilment of the orders arising out of the socialist plan which will be given to scientific research work. Further on we will deal with the changes that have taken place in world ideas on energetics, which bear out the correctness of the guide posts staked out by Lenin's triumphant formula of communism. But before we come to this subject, I consider it worth while to recall some lines of a letter of instruction which Lenin addressed to the Academy of Science, which with striking clarity reveal the fundamental principles of his great plan for the technical and economical reconstruction of our country. Owing to the great importance of this historical document, I will quote it verbatim. The instructions bear the following title: "Outline of Scientific and Technical Work. April 6, 1918," and read as follows:

"The Academy of Science, which has commenced on the systematic study and investigation of the natural productive forces*

* All efforts must be made to accelerate the publication of these materials. Communicate with the Commissariat of Education, with the printers' union and the Commissariat of Labour.

of Russia, must immediately be instructed by the Supreme Council of National Economy to set up a number of committees, composed of specialists, for the purpose of drawing up a plan for the speediest possible reorganisation of industry and the economic revival of Russia.

"This plan must provide for a rational distribution of industries in Russia from the standpoint of the proximity to raw materials and the least possible loss of labour in all the consecutive stages of converting raw materials into semi-finished products, and finally into finished products.

"A most rational plan from the standpoint of the latest and the largest industries and particular trusts, for the amalgamation and concentration of production in a few very large enterprises.

"A plan that will guarantee to the widest possible extent the Russian Soviet Republic in its present state (without Ukraine and without the territory occupied by the Germans), the ability independently to supply itself with all the most important items of raw materials and industry.

"To devote particular attention to the electrification of industry and transport and the application of electrification in agriculture. The utilisation of the lower grades of fuel (peat, poorer grades of coal) for the production of electrical energy with the least expenditure on the extraction and transportation of fuel.

"Water power and wind motive power should be utilised in general and also in agriculture."

Thus, this document gives the main outline, and in a purposeful form, of the conception of economic reconstruction, or, rather, the basis of it, which later, in a more expanded form, but along the same lines was developed in the plan of "KOELRO" and in our Five-Year Plan. It is beyond doubt that the further development of our prospective plans of reconstruction will follow the same lines.

To sum up. We have tried to prove that the basis of the plan of technical and economic reconstruction of the U.S.S.R. is simultaneously the basis of our plan of socialist construction as a whole. Only by tracing the line of scientific research work according to the heads of our socialist planning will we be able to maintain in this field the basic postulate of energetics: maximum results at a minimum expenditure.

* State Electrification Plan.—Ed.
The working class has already moved its vanguard along the road of counter-planning. We expect the scientific and technical workers to do the same. Only in this way can the alliance between science and labour, which has been the dream of the best human minds for ages, be accomplished in the most effective way.

While creating great socialist unity of energetics in our country, we must not forget for a moment that such unity is most of all secured by the red constructive line of electrification. This is the foundation of foundations of our plan of technical and economic reconstruction.

Following world events in the field of economic labour, tracing the creative road of modern scientific thought, at every stage of our reconstruction we become more and more convinced that the tremendous forces of world scientific thought and experience are with us in this struggle under the banner of Lenin for the communist transformation of the world.

The Latest Developments in Energetics

At the Berlin world conference on energetics figures were quoted showing that if the present population of the United States of America had to procure the energy required to satisfy its needs by methods of the remote past, it would require not less than 125 slaves per capita of the population. The speaker Engstrom stated at the same time that if we calculated the total energy annually produced by all the stationary and mobile machinery and motors in the world, we would get a number of kilowatt-hours approximately equal to the number of kilogrammes of the world’s harvest of grain. Thus, for every kilogramme of grain used, modern man spends one kilowatt-hour of mechanical or electrical energy in parallel production processes. Is this not striking proof that our age is primarily an age of energy?

However, we would search in vain through the 20-volume report of proceedings of the Second Conference on Energetics, and the reports of the speeches of the foreign scientists, for direct references to the deep contradictions that exist between contemporary energetics and the social and political structure that exists in the advanced capitalist countries. Only a socialist analysis can show a way out of the deadlock in which the contemporary mind, even of the most advanced bourgeois technicians and economists, finds itself. In this respect our technicians and economists are working at a tremendous advantage, which is to be expected, by virtue of the premises created by our October Revolution.

I will take advantage of this opportunity to remind the scientific and technical workers of the brilliant analysis which Comrade Joseph Ivanov, who unfortunately met with an untimely death, made on the basic problems of energetics. I will mention only two of his articles. One is entitled: “The Material Basis of Communist Society” and was published in Vol. 4 of the Vestnik Sotsialisticheskoy Akademii (1923), and the other on the subject of: “World Economy as a Single Productive Organism” published in the same journal, Vol. 6 (1923). Comrade Ivanov first of all stated that so far there is no accurate scientific answer to the question: what is communist society? The reason for this, he said, was given by Marx in his Critique of the Gotha Programme, in which he drew a line of demarcation between communist society in the stages of immediate transformation from the capitalist system, and communist society which develops “on its own basis.” Only after we have established what is meant by communist society’s “own basis,” said Comrade Ivanov, can we scientifically approach the question of the meaning of the term: “communist society.” Further, Ivanov emphasised the passage from Marx’s Capital which states that “Darwin concentrated his interest on the history of natural technology, i. e., on the formation of plant and animal

* Journal of the Socialist Academy.
organs, which play the part of the means of production in the life of plants and animals." Further, he asks in Marx's words:

"Does not the history of the formation of the productive organs of the social man, the history of this material basis of each separate social organisation, deserve the same attention?"

In what way does the material basis of communist society differ from the material basis of capitalist society?

"From the monistic viewpoint of economic systems," says Comrade Ivanov, "we have to reason in the following manner: at the basis of diffused management of economic life there are diffused means of labour, and at the basis of more concentrated forms of economic life there are more concentrated implements of labour. Consequently, at the basis of unified management of economic life and a unified system of implements of labour there must be a technically unified material basis; in other words, a single machine, which embraces the whole economic life of society."

Comrade Ivanov emphasises that this idea is not so utopian as it would seem at first sight. Already in 1914 Rathenau said that technically, it was possible to produce all the necessary electrical energy for the whole of Europe in one place and distribute this electrical current through the whole of Europe and even further. To this we would like to add that the most sensational paper read at the last conference on energetics was that read by the engineer Oliven on the construction of an all-European system of electrical transmission. This system was to cover an area from Lisbon to Rostov latitudinally and from the waterfalls of Norway to Southern Dalmatia and Italy longitudinally. According to the calculation of the author, the cost of erecting ten thousand kilometres of such an electrical transmission system would be approximately two milliard marks and it could be based on a voltage of about 400 kilovolts.

The author very vividly described how highly profitable this system would be and how it would enable Europe to increase its utilisation of electrical energy from the present 80 milliard kilowatt-hours to 100 milliard kilowatt-hours, i.e., to the level of the present production of electrical energy in the United States. This huge electrical unit, crossing national boundaries and uniting the water-power of Norway and Italy, the lignite of Germany, the coal of Poland, the coal of the Donetz Basin, the water-power of the Dnieper, and the power stations in Portugal and Spain, would provide a number of important advantages. In spite of the fact that the capitalist system places tremendous obstacles in the way of carrying out such a project the very fact that such a project is advanced is highly instructive: it deals not with the fantastic but with the real potentialities of contemporary electro-energetics. But let us proceed further with the analysis given by Comrade Ivanov. He reminds us that in the Marxian analysis of machines there is a characteristic division of the machine into three component parts: the driving mechanism, the transmission mechanism, and the operating mechanism, or the working part of the machine, and Marx emphasises the point that "...in a dismembered system of working machines, which receive their driving power by means of a transmitting mechanism only from one central automat, machine production acquires the most developed form."

We cannot deny that in the struggle for the concentration of production and enlargement of the existing aggregates, capitalism has accomplished enormous work. But after a continuous process of centralisation during a period of 150 years, factories can still be counted in tens of thousands. Agriculture is on a much lower level; it is still in the stage of manufacture. However, the process of concentration is in full swing. But quantity changes into quality only as a result of the revolution that is brought about by the electrification of the transmitting mechanism. If, with the old transmitting mechanism, a machine can be separated from its driving power by tens of metres, then with electric transmission it can be separated from it by tens and hundreds of kilometres. In Prussia in 1914 the average power of stationary steam engines was about 75 h. p., but now we
have motors which exceed 200,000 h.p. The new methods take the motors and electric transmission out of the factory and convert the truncated factory into its own working organ in the same way as the tool became the organ of the working machine and the working machine became the organ of the fully developed machine. The new method is universal. It embraces enterprises not only in one branch of industry but in all branches, and not only industry, but also commerce, transportation, agriculture and domestic economy. Thus the electrified communist form of means of labour is becoming the basis of the economic life of districts, provinces, and states, and it is preparing to embrace whole continents. It main tendencies are towards technical unity of the whole of economic life, the abolition of pluralism and diffusion in the removal of individual limitedness of enterprises, and towards universalism.

In his very schematic outline, Ivanov asserts that whereas the capitalist form represents a factory with a dismembered system of working machines which receive motive power from a central automat through the medium of a transmitting mechanism, the communist form represents a district, province or whole state in which the dismembered system of working machines receives its energy through a single transmitting mechanism covering the whole territory from one centralised system of automats.

The old system of plants, even the most world renowned, covered an area of only about five square kilometres, while the new type, even in capitalist countries reaches up to 500,000 square kilometres, an area equal to that of Germany. In the United States, in North and South Carolina, Georgia, Alabama and Tennessee, seven electrical companies covering an area of about 500,000 square kilometres, with central stations having an aggregate power of over one million horsepower, have merged into one system. However, the further process of socialisation runs up against the boundaries of the capitalist system, which have to be torn down by the proletarian revolution.

Ivanov calculates that contemporary Germany, with her aggregate power apparatus of 30 million h.p. and with an average size of her motors of 100 h.p., would require 300,000 motors. If the average power of the central power stations were 100,000 h.p. only 300 stations would be required. It could be very easily proven that with the power of modern district power stations, Germany could manage with only 50 stations.

What is accomplished by such developments? asks Comrade Ivanov, and he replies that we replace muscular labour by the machine.

"The cheapening of energy, its accessibility and flexibility are the principal factors in the development of the new forms, which at the same time revolutionise the processes of labour and stimulate the vertical migration of the working class to the higher spheres of machine and mental labour..."

Comrade Ivanov’s ideas on the fundamental problems of world economy are equally interesting. His figures are now out of date, but the main line of his argument still holds good. He considers the growth of the world power apparatus to be the greatest universal indicator of the condition of technique. By his analysis of the world fuel balance, he proves that coal is in reality the world's mighty ruler of energetics. The history of metallurgy, in his opinion, bears evidence to the fact that ore goes to coal, and not vice-versa. Therefore the increase in the production of metal cannot keep pace with the immense rise in the extraction of coal, for the reason that year by year the amount of manufactured iron that is completely thrown out of the production field is decreasing. In the course of time only relatively small amounts of new metal will be required to replenish the stores of scrap that is used in industry. The demand for fibrous materials, leather, and other raw materials, is not nearly so universal as the demand for coal and iron ore.
With the growth of industry and cultural needs, said Ivanov, the shortage of raw materials becomes greater, but the enormous area of unexploited free land keeps this shortage within certain limits. The industrialisation of agriculture and the supplanting of draft cattle by machines would save about one-third of all the grain products and about one-half of all the hay produced and thereby considerably augment the food resources of mankind and lessen the pressure of this factor. He vividly describes the stupendous rise of the United States of America, which is secured by her overwhelming superiority in material resources of power supply. Here he predicts there will be an extremely accelerated industrial rise, the accumulation of fixed capital and also, by iron necessity, an inevitable acceleration of the diminution of variable capital.

"In the clutches of capitalism there is no escape from this law. Communism or—death!"

It is extremely interesting to compare what Comrade Ivanov wrote in 1923 with an article written by Comrade Rubinstein, which appeared in No. 4 of the Bolshevik this year. The latter article deals with the problems of technical reconstruction in the prospective plan. In his analysis of the achievements in the field of electrification and energetics during the last decade, Comrade Rubinstein treats the subject in exactly the same manner as does Ivanov, i. e., he refers to Marx's division of the machine into three component elements. He consistently examines the successes accomplished during the corresponding division of world production into three parts: (1) production of electrical energy, (2) transmission of electrical current, (3) utilisation of electricity in the various branches of economy.

What new and enormous changes in world energetics are revealed by this analysis!

Solid fuel is still the principal source of electrical energy, but we have learned to burn effectively the lowest grades of coal in pulverised form. Simultaneously we have perfected chain circuit grates and stokers. The screening of furnaces is at the same time a basis for the reconstruction of the modern boilers, which work under a pressure of 100 or more atmospheres and develop into colossal units. This method enables us to accomplish the task: one powerful turbine, one powerful boiler. Meanwhile, multicylinder turbo-generators are now exceeding 200 thousand h. p. and the capacity of electrical station ranges from half a million to a million kilowatts. The growing mechanisation and automatization of control correspond to the quest for new types of steam boilers and steam turbines. The utilisation of the so-called mercurial turbines and the application of new, marvelous alloys of light metals for the construction of turbines do not surprise any one now.

Comrade Rubinstein quotes very interesting examples to illustrate the new achievements in the field of electro-transmission and also in the application of electrification to production processes. While Comrade Ivanov could quote only one example of an electrical network in the United States of America covering an area of 500,000 square kilometres, now Comrade Rubinstein can state that the merging of power lines in the United States has reached such proportions that all the principal stations, situated from the Mississippi River on the west to the Atlantic Ocean on the east and from the Gulf of Mexico on the south to the frontiers of Canada on the north, are able to exchange electrical energy. This territory covers about 900,000 square miles, i. e., an area twice as the size of Germany, France and England put together. Comrades M. Sitnikov and A. Chernyshev, in their paper on the present state of transmitting energy by means of continuous current and on the perspectives of further development in this field, introduced detailed calculations proving that:

"At an expenditure of an equal amount of copper with a three-phase current and continuous returning underground current, the distance to which power could be transmitted with a continuous
current is four times greater than with a three-phase current. Within an equal space it is obvious that the transmitted power will be four times greater.

"From the standpoint of insulation, etc., the transmission of energy by means of continuous current with a tension up to 600 kilovolts does not present any serious technical difficulties and is very economical in comparison with the transmission of energy by means of a three-phase current."

I recall the great interest Lenin displayed in problems of centralised control by means of electrification in a wide field of labour. But the modern technique of automatization of control, the role of modern dispatchers, who by pressing buttons control leviathans of electrical energy covering areas of hundreds of square kilometres, has certainly surpassed all expectations of even the comparatively recent past.

The electro-energetic unity of immense economic complexes—that unity which our late Comrade Ivanov correctly regarded as the deciding material basis of a communist society—is being realised with an impetuous rapidity before our very eyes.

Comrade Alexandrov, in a paper he read at the conference, unfolded the picture of socialist construction by combining it in immense units covering an area from Dnieprostroy to the border of our Far East, i.e., energetic units. Academician Joffe boldly raises the curtain which has concealed from us the new wonders of electro-energetics. The realisation of his forecasts will undoubtedly lead us to the surmounting of obstacles to power development which will mark a great positive change in the whole of human culture. Joffe is by no means a fantastic dreamer. Besides, we have heard similar opinions expressed by a number of other scientists and technicians who participated in recent world conferences on energetics. None other than the celebrated chemist Ostwald has spoken very definitely of the decisive potentialities of the photo-chemical processes, in the realm of energetics. And the following, for example, was said by

Prof. Valauri at the Berlin conference in his paper on "Electricity and Energy."

"The other method of obtaining electrical energy is the method invented by Volt, which precedes the present methods of converting mechanical energy into electrical energy, and today is regarded as being of secondary importance, although it is still a factor in the world of technique. Here we have the conversion of chemical-energetical potentials by means of reactions which take place in the so-called voltage batteries. The character of these reactions does not enable the batteries to compete with modern electro-mechanical production, but matters would have been different if the electro-chemical conversions could have been obtained in a practical way and on a large scale through the utilisation of the chemical potential energy of other substances, particularly fuel."

Thus Prof. Valauri introduced, as he expressed it, "the dream of the coal and oxygen battery." At the same time he remarks that this dream will come true in the not distant future. In the same paper he says:

"Nobody can deny that the day may come when all that which is considered a utopia at present will come true, i.e., space inhabited by human beings will become one huge electro-magnetic field, from which everybody will draw as much energy as he needs, in exactly the same way as we lungs draw the necessary amount of air from the surrounding atmosphere."

We can see that in this instance the celebrated Italian professor is our fellow-traveler on the road towards the unification of world energetics. And he is not the only one among foreign scientific workers in the realm of energetics. At the second conference on energetics, by the way, the recommendations of the Hungarian engineer Haidegger, relative to the statistical methods of preparing energetical balances, were adopted, in which a prominent place is allotted to the coefficients of energification and electrification. We have frequently referred to the importance of these coefficients as an index of national economy. According to Haidegger's method, the coefficient of electrification for each country is determined by

* Die Energiewirtschaft Mittteleuropas, by Dipl. Ing. Ernst Haidegger, Vienna, 1939.
the correlation between the quantity of electrical energy produced by that country, computed in calories, and the quantity of energy necessary for all its needs, also expressed in calories.

It is worth while mentioning the interesting deductions which Haidegger arrived at from the comparison of different indices of world energetics. He divides energetical expenditure into two groups: (1) the group which compensates for the expenditure of organic energy, i.e., human muscular and mental energy, and (2) the group which balances the expenditure of all forms of energy absorbed by the sum total of technological processes which condition the entire mechanism of social production, i.e., inorganic energy. Haidegger gives the following calculations:

### General World Consumption of Energy

**Annual Consumption of a Population of 1,864 Millions**

<table>
<thead>
<tr>
<th></th>
<th>Daily per capita 2,000 calories, total 1,830 billion calories (10^3 cal.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Organic energy</td>
<td>Daily per capita about 2,000 calories, total 1,830 billion calories (10^3 cal.)</td>
</tr>
<tr>
<td>b) Inorganic energy</td>
<td>1,400 million tons of coal, containing energy 8,400 bill. cal.</td>
</tr>
<tr>
<td></td>
<td>170 &quot; petrol &quot; 1,700 &quot;</td>
</tr>
<tr>
<td></td>
<td>35,000 &quot; cub. metres natural gas &quot; 350 &quot;</td>
</tr>
<tr>
<td></td>
<td>400 &quot; tons wood &quot; 1,600 &quot;</td>
</tr>
<tr>
<td></td>
<td>28.8 &quot; h. p. water-power &quot; 4,200 &quot;</td>
</tr>
</tbody>
</table>

Therefore the annual consumption per capita is:

<table>
<thead>
<tr>
<th></th>
<th>0.73 mill. (10^3 cal.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Organic energy</td>
<td>0.73 mill. (10^3 cal.)</td>
</tr>
<tr>
<td>b) Inorganic</td>
<td>8.72</td>
</tr>
</tbody>
</table>

Total . . 9.45 mill. x (10^3 cal.)

Thus, according to Haidegger's calculations the whole population of the world, numbering 1,864 million, expends 1,360 billion calories of "organic energy" and 16,250 billion calories of inorganic energy. The annual consumption of organic energy per head is 0.73 million calories and inorganic energy 8.72 million calories.
### Source of Energy

<table>
<thead>
<tr>
<th>Source of Energy</th>
<th>Consumption</th>
<th>Production</th>
<th>Deficit (import)</th>
<th>Imp.</th>
<th>Exp.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>In thousands of tons</td>
<td>$10^12$ cal.</td>
<td>In thousands of tons</td>
<td>$10^12$ cal.</td>
<td>In thousands of tons</td>
</tr>
<tr>
<td>Anthracite</td>
<td>106,697.5</td>
<td>767.88</td>
<td>145,363.0</td>
<td>1,017.54</td>
<td>35,665.5</td>
</tr>
<tr>
<td>Lignite</td>
<td>141,814.6</td>
<td>496.35</td>
<td>139,877.5</td>
<td>489.57</td>
<td>1,938.6</td>
</tr>
<tr>
<td>Coke</td>
<td>680.0</td>
<td>1.36</td>
<td>700.0</td>
<td>1.40</td>
<td>20.0</td>
</tr>
<tr>
<td>Coal</td>
<td>11,242.4</td>
<td>78.76</td>
<td>-</td>
<td>-</td>
<td>11,242.4</td>
</tr>
<tr>
<td>Wood</td>
<td>12,163.0</td>
<td>48.65</td>
<td>12,283.0</td>
<td>49.17</td>
<td>130.0</td>
</tr>
<tr>
<td>Charcoal</td>
<td>2.0</td>
<td>0.01</td>
<td>-</td>
<td>-</td>
<td>2.0</td>
</tr>
<tr>
<td>Fuel oil</td>
<td>306.7</td>
<td>9.64</td>
<td>-</td>
<td>-</td>
<td>211.3</td>
</tr>
<tr>
<td>Coal tar</td>
<td>306.9</td>
<td>13.0</td>
<td>-</td>
<td>-</td>
<td>399.5</td>
</tr>
<tr>
<td>steam</td>
<td>437.2</td>
<td>4.27</td>
<td>-</td>
<td>-</td>
<td>427.2</td>
</tr>
<tr>
<td>Electricity</td>
<td>1,530</td>
<td>13.77</td>
<td>1,530</td>
<td>13.75</td>
<td>-</td>
</tr>
<tr>
<td>(kwh)</td>
<td>230</td>
<td>2.07</td>
<td>-</td>
<td>-</td>
<td>230</td>
</tr>
<tr>
<td>Total electricity produced</td>
<td>-</td>
<td>1,261.81</td>
<td>-</td>
<td>1,572.40</td>
<td>-</td>
</tr>
<tr>
<td>%</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

20,500 million kilowatt hours per annum = 184.50 x $10^9$ cal.

% of electrification = 14.64.

Consumption of energy = 19.90 x $10^6$ cal per capita.
That the energetical base is becoming more and more a deciding factor is admitted even by bourgeois technicians and economists. As an illustration, I will quote the following credo of Haidegger:

"The economic development, not only of separate nations and states, but also of whole continents, depends upon the rise and rationalisation of production. From the political and economic viewpoint the following are factors in production: nature, labour and capital. Nature participates in production in two ways or as two factors — as material and as power, or energy. After investigating these four production factors from the point of view of the present economic regime, we can establish the following facts:

(1) Referring to labour, by which we mean all conscious human activity directed towards production, everywhere, and particularly on the European continent, there is a surplus of supply. Unemployment, in substance, is the negative index of the rational economic policy in different states.

(2) Capital possesses practically unlimited possibilities of transfer, finds its own place in conditions of rational production, and is by its nature an investigator of economic situations. Over and above that it must be regarded only as a secondary production factor, because capital itself arises only from other production factors.

(3) Material is one of the most important production factors, but its significance has diminished considerably since the economic crisis which followed the World War. The replacement of some raw materials by others is a common occurrence, as a result of the rapid development of technique, the further limits of which are hardly conceivable.

(4) Power, the combination of natural forces, is thus the most important decisive and indispensable production factor in the modern economic structure as a whole."

If in addition to these arguments, we recall those developed in the report of the Hoover Committee on "Recent Economic Changes" in the United States of America, where the point was stressed that machine culture itself is directly dependent on its energetical base, the position of the modern bourgeois scientists in energetics becomes very clear.

It is not difficult to prove that only the complete socialisation of all the means of production paves the way for a wide front of energetics and solves all the deadlocks into which modern technicians are drifting. Their thoughts and ideas are restricted by the limits of the capitalist system. In this respect the attempts of certain scientific workers in Western Europe to find a solution for the economic crisis in Central Europe by establishing an international exchange of electrical energy are particularly interesting. Haidegger refers to the dominating role of the United States in the world market, illustrated by a grain harvest of 12 million carloads; 57 per cent of the world cotton production; petroleum, 73 per cent; copper, 57 per cent; lead, 42 per cent, and iron and steel, 61 per cent of world production. This domination of the United States, according to Haidegger, is a direct menace to Central Europe, which is submerged in chaos by the Versailles Treaty. But he also admits the impotence of the remedy he suggests, namely, the removal of the customs barriers to the exchange of electrical energy. However, he has not taken into account the changes in world energetics brought about by the work of socialist construction proceeding in the U.S.S.R.

According to the data compiled by the engineer N. Kellen, the world production of electrical energy, computed in million k. w. hours, is as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>Production (in million k. w. hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1925</td>
<td>186,565</td>
</tr>
<tr>
<td>1926</td>
<td>204,536</td>
</tr>
<tr>
<td>1927</td>
<td>233,407</td>
</tr>
<tr>
<td>1928</td>
<td>255,622</td>
</tr>
</tbody>
</table>

We see a considerable annual increase in world electrification. Scientific investigators are forced to admit that progress has not yet reached its zenith in this field by a long way. There are four factors which are particularly bound to force this movement, namely: (1) the production of nitrates for artificial fertilisers; (2) production of aluminium; (3) production of electro-steel; (4) electrification of railroads.

It is not difficult to prove that in socialist economy all these four elements must become very active factors.
The table opposite shows very definitely, however, what a wide margin there is between the level of electrification in our country and that of the advanced capitalist states.

It is beyond doubt that a unified plan of national economy must contain, in any given variant, an enormous diversity of construction lines. In seeking for the basis of such a plan, we are actually and really seeking unity in this multiplicity. What we have said shows, what decisive importance the factors of energetics will have in our future planning researches.

We are inevitably faced, as it were, with two stages of such researches. The new ripens in the old. We must thoroughly investigate that elementary zenith of the social technique which we are able to master by means of the present accomplishments of technique under the capitalist mode of production. That is, so to speak, the first stage. Here, there is no room for guessing. The field of investigation is limited by what is already accomplished by world technological practice. Every branch of technology flows in its own special stream, and we have to limit ourselves to choosing the most important and proper channel for this stream. The economics of social production are in the same position. This also has its first stage of elementary rationalisation. It is accomplished through the evident unquestionable advantages of mass production, specialisation of production and standardisation.

The socialist “gues” begins with the combination of technological processes, with new groupings, with the new economic unity of organisation of production.

Hence the specific role of those divisions of our construction which constitute the communication services.

The analysis of the work of Joseph Ivanov, GOELRO, and the outlines given in the project of our Five-Year Plan, already enable us to indicate the specific peculiarities of our socialist unification of technique and economics, which guarantee record tempo of quantitative and qualitative progress on the basis of electrification.
The combination of industries on the basis of the most advantageous energetical balance, the division of the whole country into special energetical regions, unification of electro-transmission by means of an all-state network, modernisation of industry through electrification, technico-economic reconstruction of agriculture by means of tractors, with the simultaneous introduction of electrification in this field, and lastly, the reconstruction of transport on the basis of electrification—such are the lines towards which the further technico-economic reconstruction of the U.S.S.R. must inevitably proceed on the basis of the husbanding of our energetical resources to the utmost and the realisation of our socialist tasks.

The bourgeois world is marking out its own road of industrialisation and electrification. But the rise of machine culture on an electrical basis can be achieved in the most perfect and unfolded form only in conditions of socialist economy.

To alter Lenin's tried guide-posts in the sphere of electrification in the slightest degree is out of the question.

On an enormous front we will rise to the struggle for the new general plan of national economy, which with the strength of the heroic collective of our country, a collection united by unprecedented unity between physical and mental workers, will in a new way disintegrate the multiplicity of the grand labour processes that stand ahead in the leading, purposeful, socialist unity of new energetic series.

Only in this way can the unfinished design of my paper be completed.