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SOLVING THE PROBLEM OF POWER RESOURCES USE: I.H. ALEKSANDROV'S ENGINEER GENIUS (30-ies of the 20th century)

In the article the contribution of engineer and academician I.H. Aleksandrov (1875-1936) to the solution of the power providing problems in Eastern Siberia has been highlighted. Ivan Havrylovych Aleksandrov considered the problem of the Angara and the Yenisei basin not only as a scientist and an engineer but also as a statesman who took care of technical and economical country's strengthening. The article describes the role of the river Angara in the national USSR's economy forming as well. The Angara problem in I.H. Aleksandrov's scientific labours turned into the problem of radical transformations in the whole Eastern Siberia. Working out the Angara problem solutions I.H. Aleksandrov paid much attention to developing the Eastern Siberia population's culture due to its drastic changes after great power and industrial plants erecting. Being a scientist and an engineer, I.H. Aleksandrov, nevertheless, had been stressing the necessity of creating proper living conditions for people connected directly or indirectly with industrial advancing of the region.

Keywords: power engineering, hydraulic engineering, power plants, I.H. Aleksandrov, history of science and technique

Problem statement. As far as in the 1950-ies, in the documents of the 19th congress of the communist party of the USSR, concerning the priorities of the five-year development plan for the former USSR within 1951-1955, there was noted the task «to begin the works on use of power resources of the Angara river for developing aluminium, chemical, mining and other industries on the basis of cheap electric power and local raw materials' sources» [1, P. 3]. It should be noted that by then the huge territory of the Angara region owing to inaccessibility had been very poorly investigated. However, much earlier, yet in 1929 the Giprovod institute under the guidance of professor I.H. Aleksandrov (full name – Ivan Havrylovych Aleksandrov) started studying and preliminary research of a grandiose problem of power resources' use of the river Angara. Due to these preliminary researches the problem of the river Angara was included to the first five-year plan as a research problem of complex type. I.H. Aleksandrov was among the pioneers to study and develop the Siberian vast territories' power potential, but later his name as well as his engineering ideas and scientific contribution were undeservedly forgotten.

The purpose of this article is to highlight the contribution of I.H. Aleksandrov (1875-1936), Ukrainian engineer and academician of the soviet period, to the solution of the power resources use problem and to radical transformations in the whole Eastern Siberia.

The main research material presentation. Stating the importance of the problem of power resources' use of the river Angara I.H. Aleksandrov wrote: «The level of knowledge on natural richness of the region is absolutely insuffi-

cient. Even the cartographic materials are incomplete, and for a number of areas there are no maps in a large scale, not to mention the geological exploration ... there were no data on minerals, woods and other sources of raw materials which could form the base for huge industrialization of Near-Dnipro region» [2, P. 204].

Under such circumstances, at first, it was necessary to organize on a large scale the research works which results would become an important basis for development of the project to create hydropower structures on the Angara. Expressing the reasons on the organization of these works, I.H. Aleksandrov noted «for business success all the set of research works needs to be run in a complex, from the uniform strong-willed centre which will organize all types of works. An example of the Dnipro project which began with the complex research and development of engineering problems, and with the subsequent study of the project of Dnipro Industrial Combine have shown with a clearness such entire need» [2, P. 227-228].

By I.H. Aleksandrov words, carrying the complex researches was especially necessary in the conditions of the Angara where coordination was required both in terms of works performance and in degree of their deepening and in level of research and development resulting from almost total absence of scientifically and engineeringly reliable data. As for the organization of complex researches, required for development of the successful scientific and engineering decision, I.H. Aleksandrov claimed that «performance of separate types of research works by the special organizations, certainly, is necessary, but it is to be carried out on the basis of an assignment of each separate type of work or a number of works from uniform organizing group which establishes certain volumes of tasks and term of their delivery. Under such organization of researches we'll have some warranty of impossibility of separate works' delay because of departmental plans changes.

Thus, there is a necessity to create a special organization which conducts all set of research work on the Angara problem, all economic and schematic designing of the technical line. This special organization will involve in these works the necessary experts or transfer certain elements of the work to other specializing organizations.

The researches connected with field works are to be based on the place, in Irkutsk, as practice of researchers' departures from the large centres, especially to remote destination areas, in this case couldn't be justified. The project's work which directs all the totality of research works and the possibility of leading experts involved to different spheres is to be organized in Moscow. The research works of «in-a-study order» is to be carried in dependence on the availability of the skilled for its fulfilment organizations and forces in different centres (Moscow, Leningrad, Novosibirsk, Irkutsk etc.)» [2, P. 227-228].

In 1930 the VSNH-NKTP Special bureau which tasks covered further research and developments of the Angara problem was created, it was carrying its activities under the guidance of professor I.H. Aleksandrov. Huge territories in the basin of the great Siberian river Angara for many years drew I.H. Aleksandrov's attention. «The Angara-and-Baikal region, – he wrote, – is a whole country full of huge potential opportunities, but difficult for its being studied yet owing to the size, poor exploration, complexity and severity of climatic conditions» [3, P.67].

For the first-class researcher what I.H. Aleksandrov was, the Angara problem became an inexhaustible source for fascinating creative activities. Deep and comprehensive study of natural and power conditions of the Angara-and-Baikal region and the areas adjoining to it allowed I.H. Aleksandrov to draw a conclusion on the need of creation of a huge Angara complex. «The practical solution of the Angara problem, – Ivan Havrylovych wrote, – will mean the considerable achievement of socialism. It will turn the huge area, rather remote from the centre, into one of the largest industrial areas according to the sum of the natural riches and, first of all, power riches» [3, P. 68].

The great Siberian river Angara originates from the Lake of Baykal, the deepest one on the globe. It surpasses the capacity of four large rivers – the Volga, the Kama, the Dnipro and the Don taken together – in the potential of water energy stocks. The Angara differs in constancy of the water mode during the whole year. 330 big and small rivers flow into the Lake of Baikal and only one river – the Angara – flows out it. The abundance of water and the regulating influence of the Baikal are combined with some other features being important for power use of the river, geological and topographical structures of the Angara valley [4]. The basin of the Angara with numerous rough rapid streams was regarded by I.H. Aleksandrov as «... huge concentration of stocks of cheap «water» current» [5, P. 78]. To seize this energy, to place it at service to the Homeland, to subdue these huge Siberian open spaces, to take everything useful that it can give to the people from the nature, – I.H. Aleksandrov, the scientist, engineer and patriot, considered his tasks in such way.

Enormous stocks of water energy of the Angara pool were concentrated in sparsely populated and at that time remote region of the USSR. When Ivan Havrylovych started to design of the Angara power plants cascade with the world's largest hydro-power-and-heatplant as a part of this cascade, the region of the Angara seemed being poor on natural resources, mainly minerals, to many experts. Whether there was a sense to build huge power constructions under the absence of enough powerful consumers of the electric power there? However, Ivan Havrylovych was deeply convinced that the «theoretical» assessment of the area as poor in minerals had been caused by only its insufficient exploration. He

claimed that natural riches there were huge and their development would demand large volumes of the electric power in the closest years.

I.H. Aleksandrov's project provided preliminary creation of powerful combined heat and power plant which would use local coal and the power plant related large forest combines. Creation of such complex was considered by I.H. Aleksandrov as the major preparation of the area to grandiose power industrial construction. Further expansion of capacities of a forest combines in this area which had to become the main forest-wood reserve of the sovietunion was projected on the basis of hydraulic power use. In thisproject Ivan Havrylovych had considered in detail the huge forest richness of the region, having planned a number of the powerful woodworking enterprises.

Industrial combines which had to be developed on the energy of theAngara hydroelectric power plantswere to give to the country coal, steel, aluminium, non-ferrous metals, nitrogenous products, cars, cement, forest products, wood distillation products etc. Along with creation of hydro power plantsthe I.H. Aleksandrov's project allocated the important place to construction of large heat power plants which would burn local coal which extraction wasn't to cause serious difficulties. Concentration of powerful sources of hydraulic power near Eastern Siberia allowed I.H. Aleksandrov to plan the realization of a daring idea on creation of the huge power centre of future USSR electricity grid system here. Managing the development of theAngara problem, Ivan Havrylovych hot dreamed about fast implementation of grandiose hydropower construction on this Siberian river. «This area, – he wrote, – with its immense resources from an object to be researched turns... into an object of heroic activities of millions of workers who will turn strange lands into the advanced industrial area of the Union» [6, P. 3]. In the works devoted to the Angara problems, I.H. Aleksandrov emphasized that «...the leading core here, undoubtedly, would be the power engineering which, mainly, dictates the solutions on the scheme of Angara-Baikal industrial complex» [6].

While solving the main challenges connected with the development of the productive forces of the eastern Siberia Ivan Havrylovych proposed the idea of creating Baikal-Amur railway among important technical offers connected with the region exploration. He attached national level importance to this grand railway as to the principal transit connection of the Pacific Ocean with the centre of the country. I.H. Aleksandrov also elaborated the problem of production and application the construction of new cheap roofing material – wooden tile which could be produced of cedar and other coniferous trees, growing in wealthy Siberian forests, in huge number directly on the spot. At the same time Ivan Havrylovych proposed the industrial transfer to new technological process of synthetic rubber production.

I.H. Aleksandrov abided by his talent not only for creating well-scaled and integral pictures of composite transformation of the whole region in the sovietunion, but also for highlighting some main ideas-elements, developing them technically and making them practical heritage for economy. At the same time the versatility of his technical interests was revealed – the trait of all popular figures of the soviet technical science, and vice-versa the rarest one among illustrious western engineers, usually constrained with narrow monotonous interests of capitalistic firms. Creating an immense plan of the Angara power and industrial centre, I.H. Aleksandrov went beyond the Angara basin. He also was working out an important region of Eastern Siberia – Yenisei basin. Electric power from hydro power plants on the Yenisei designed by I.H. Aleksandrov was intended for feeding the mining and other factories, and also for Siberian electrified railway. Sharing I.H. Aleksandrov's views on the prospects of the power engineering development in the sovietunion, academician O.V. Winter pointed out, that «The largest rivers in the world – the Angara, the Yenisei, the Lena, the Amur – will become strong supporting centres of industrialization of the vast region. The main giant sections of this powerful economic system will be ...the metallurgical-ore Ural – metallurgical-coal Kuzbas – food and industrial Western Siberia – the power centre, non-ferrous metals, coal and wood chemistry of the Eastern Siberia» [7, P. 3].

The Angara problem in I.H. Aleksandrov's scientific studies was turned into the issue of the eradicated transformation of the whole Western Siberia. Working out this issue I.H. Aleksandrov didn't leave out of his attention the question connected with the development of the culture of Eastern Siberia, which was drastically changing its condition after the large power and industrial companies had been built. Nevertheless being a scientist and an engineer he claimed the necessity of creating favourable conditions of life for people which were directly or marginally connected with industrial progress of this region. Ivan Havrylovych considered the problem of the Angara-Yenisei not only as a scientist and an engineer but also as a statesman who takes care of technical and economic strengthening which will lead to the welfare and cultural increase.

Delivering one of his speech I.H. Aleksandrov said: «Of course we could build the plan, count up the investments, but actually money don't deal anything, the human labour deals it, and it is not the simple one but that being technically armed. So in the Eastern Siberia where the popularity is small, it's necessary to pay more attention than we do in these regions to the training of inhabitants who could fulfil the tasks. Here not only the general culture is needed but the specific one, which is built according to the particular type at that point of view which will enable the enterprises to rely on this human material in order to do this manufacture closer and enable them to cover it. From this point the development of scientific institutions and attraction of large forces, the develop-

ment of educational institutions, the establishment of large school system and their «politechnization», the development of specialized schools which could train the necessary specialists become unavoidable. According to this it's necessary to pay attention to one more circumstance. Siberian region is not similar to the European part of the union; this region is severe and demands nutritious food, appropriate clothes and dwelling for productive work. That's why naturally our attention and purposes should be focused on using available minimum of people and on their maximally proper public amenities providing» [8, P. 15].

Conclusions and suggestions. The above said about I.H. Aleksandrov brightly illustrates what significance was attached by the outstanding Ukrainian scientist of the soviet period to research works, always preceding the design, demonstrates the scientist's ability to combine scales of tasks with the rational clearness of their statement. All main ideas of I.H. Aleksandrov concerning the organization of research works on the Angara were introduced in practice later. I.H. Aleksandrov's scientific studies connected with the solution of this immense issue of using huge water energy supply of the Angara played an important role in the approach of the recent theoretical problem to the real building of the biggest hydropower constructions and to the attraction of the Eastern Siberia – a wide region with abundant natural resources – to the economy of the USSR.

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О.І. Ісаєнко, С.А. Ісаєнко *Вирішення проблеми використання енергетичних ресурсів: інженерний геній І. Г. Александрова (30-ті роки ХХ ст.).*

У статті висвітлюється внесок інженера і академіка І.Г. Александрова (1875-1936) у вирішення проблем енергетичного забезпечення Східного Сибіру. Іван Гаврилович розглядав проблему Ангара-Єнісею не тільки як учений та інженер, але і як державний діяч, який дбає про те, щоб посилення технічної і економічної могутності країни вело до зростання добробуту і культури населення. У розробках проблеми Ангари І.Г. Александров не залишав поза своєї уваги питання розвитку культури населення Східного Сибіру, який кардинально змінював свій вигляд після спорудження великих енергетичних і промислових підприємств. Науковець та інженер, він, тим не менше, наголошував на необхідності створення сприятливих побутових умов для людей, пов'язаних прямо чи опосередковано з індустріальним прогресуванням краю. Проблема Ангари в наукових працях І.Г. Александрова переросла у проблему докорінного перетворення усього Східного Сибіру.

Ключові слова: енергетика, гідроенергетика, електричні станції, І.Г. Александров, історія науки і техніки.

А.И. Исаенко, С.А. Исаенко *Решение проблемы использования энергетических ресурсов: инженерный гений И. Г. Александрова (30-е годы ХХ ст.).*

В статье освещается вклад инженера и академика И.Г. Александрова (1875-1936) в решение проблем энергетического обеспечения Восточной Сибири. Иван Гаврилович рассматривал проблему Ангара-Енисея не только как ученый и инженер, но и как государственный деятель, который заботится о том, чтобы усиление технического и экономического могущества страны вело к росту благосостояния и культуры населения. В разработках проблемы Ангари И.Г. Александров не выпускал из поля зрения вопросы развития культуры населения Восточной Сибири, которая кардинально изменяла свой вид после сооружения больших энергетических и промышленных предприятий. Научный работник и инженер, он, тем не менее, отмечал необходимость создания благоприятных бытовых условий для людей, связанных прямо или опосредовано с индустриальным прогрессом края. Проблема Ангари в научных трудах И.Г. Александрова переросла в проблему коренного преобразования всей Восточной Сибири.

Ключевые слова: энергетика, гидроэнергетика, электрические станции, И.Г. Александров, история науки и техники.

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С.Ю. ВІТТЕ ПРО ПРАЦЮ Я.М. ГОРДЕЄНКА «ОСНОВИ ЗАЛІЗНИЧНОЇ ЕКОНОМІЇ»

У статті розглядається рецензія С.Ю. Вітте на підручник професора Я.М. Гордеєнка «Основи залізничної економії» (1885). Власне С.Ю. Вітте не так багато написав наукових статей. Однак підручник Я.М. Гордеєнка настільки сподобався йому тими проблемами, яких торкнувся автор, що Сергій Юлійович сів за перо і висловив свої думки щодо вступної лекції автора, присвяченої залізничним тарифам, залізничним перевезенням. Думки С.Ю. Вітте актуальні і сьогодні.