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Research article

"Useless Fossils", Precious Waste, and Streams of Energy: Soviet Electrification and Natural Resources for the Socialist Future (1920s – 1930s)

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Abstract

The young Soviet state was captivated by the idea of technological development, and the vision of progress that centered around the possibilities of electrical energy. The vision of electricity was accompanied by utopian and futuristic connotations. Technological progress was associated with Socialist political order and a desirable social future, the key characteristics of which were material abundance and social equality. The possibilities of electrical energy and of the future energy grid determined the attitudes toward nature and natural resources formulated and popularized by engineers, economists, and politicians. Soviet electrification was based on two conceptual foundations. First, reliance on local fuels (peat, oil shale, low-grade coal, water) to remove the dependence on foreign fuel. Local fuel contained moisture, ash and sulfur and required specific technical solutions (German boilers often failed). A second aspect consisted in rational fuel use. This meant the combination principle and use of secondary energy resources. Combines were understood as enterprises where the waste from one production became a raw material for another production (ash from oil shale was used to make building materials). Mineralogist Alexander Fersman spoke of "non-useful fossils" – it was necessary to use all extracted raw materials, even seemingly useless. Economists called waste a treasure and urged enterprises to use them. It is possible to speak more broadly of the Soviet culture of reuse and careful treatment of waste. This conceptualization of resources affected the materiality of electrification.

Keywords: Electrification; GOELRO; Soviet unified energy system; Peat; Hydropower; Communism; Natural resources; Commodification of nature; Resourcefulness

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Научная статья

“Бесполезные окаменелости”, драгоценные отходы и потоки энергии: Советская электрификация и природные ресурсы для социалистического будущего (1920–1930-е гг.)

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Аннотация
Молодое советское государство было захвачено идеей технологического развития и видением прогресса, которое было сосредоточено вокруг возможностей электрической энергии. Представления об электричестве сопровождались утопическими и футуристическими коннотациями. Технологический прогресс ассоциировался с социалистическим политическим строем и желаемым социальным будущим, ключевыми характеристиками которого были материальное изобилие и социальное равенство. Возможности электрической энергии и будущей энергосистемы определяли отношение к природе и природным ресурсам, сформулированное и пропагандируемое инженерами, экономистами и политиками. Ресурсная политика советской электрификации базировалась на двух концептуальных основах. Во-первых, было принято решения опираться на местное топливо, чтобы снизить зависимость от дальнепривозного (торф, горючие сланцы, низкосортный уголь, вода). Эти виды топлива содержали влагу, золу и серу и требовали особых технических решений. Второй аспект заключался в рациональном использовании топлива, который предполагал принцип комбинирования и использование вторичных энергоресурсов. Под комбинатами понимались предприятия, где отходы одного производства становились сырьем для другого (например, выделяемая зола использовалась для производства строительных материалов, а тепло – для отопления). Минералог А. Ферсман использовал выражение “неполезные ископаемые”, имея в виду необходимость необходимо использовать все добытое сырье, даже то, что кажется бесполезным. Экономисты называли отходы сокровищем и призывали предприятия использовать их. В более широком смысле можно говорить о советской культуре повторного использования и бережного отношения к отходам. Такая концептуализация ресурсов влияла на материальность электрификации.

Ключевые слова: Электрификация; ГОЭЛРО; Советская объединенная энергетическая система; торф; гидроэнергетика; Коммунизм; Природные ресурсы; Коммодификация природы; Находчивость

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INTRODUCTION

The young Soviet state was captivated by the idea of technological development, and the vision of progress that centred around the possibilities of electrical energy. For Vladimir Lenin, who was one of the promoters of electrification, it constituted "the second program of our Party." It was critical to transforming Russia from a "small-peasant basis into a large-scale industrial basis," and quite literally would bring "enlightenment" to the masses. Thus, as he claimed, "Communism is Soviet power plus the electrification of the whole country." The vision of electricity was accompanied by utopian and futuristic connotations. Technological progress was associated with Socialist political order and a desirable social future, the key characteristics of which were material abundance and social equality. The possibilities of electrical energy and of the future energy grid determined the attitudes toward nature and natural resources formulated and popularized by engineers, economists, and politicians. This paper examines how the view of nature and technological progress was conceptualized by Soviet engineers and authorities. I observe the coexistence of two major trends in expert and cultural discourses – the extensive use of resources and the commodification of nature together with resourcefulness, and a careful treatment of waste and seemingly useless substances. This vision made the imaginary map of the USSR complex and multi-layered – not only coal and mineral ores organized space and industrial locations, but also peat, water, oil shale and various types of waste. Usage of natural resources for energy production, and inclusion of waste products in the production of energy and manufacturing procedures stimulated the idea of industrial combines and a transformation of the country into a huge technosocial factory.

The totalizing vision of technology by Soviet technocrats resonates with Nikolai Berdyaev's idea of technology as dominating over and defining human existence, albeit these two positions differ in possible consequences of such domination. In Berdyaev's view technology displaces culture and creativity, becomes opposed to them and acts destructively. Berdyaev criticized the socialist project for its "technical eschatology" and the fetishization of technology: "Communism has entirely adopted this hyper-machinism and technologism from capitalist civilisation and has created a real religion of the machine, which it worships as a totem" (Berdyaev, 2023, p. 24). The unprecedented enthusiasm with which the Soviet state took up technology, in Berdyaev's vision is associated with the death of wisdom, spirituality and human nature. Berdyaev's view is as determinist as the ideas of electrification by Lenin and Gleb Krzhizhanovsky, but where he saw destruction and dehumanization, Soviet technocrats saw perfect technosocial coordination and new order.

THE GOELRO PLAN AND THE MYTH OF PROGRESS

The starting point of Soviet electrification was the GOELRO Plan (Plan of the State Commission for the Electrification of Russia), adopted by the Council of People's Commissars in 1920. The plan envisaged the development of the energy sector, as well as of the entire economy. The vision of natural forces in the USSR at the dawn of industrialization was based on the idea of electricity as a flexible energy, capable of

transforming virtually any natural phenomenon into a useful force. As Alexander Bogdanov (1919), philosopher and scientist, pointed out in his course on political economy: “Electricity can easily be obtained from any forces of nature by their scientific and technical transformation – from the energy of chemically burned coal, waterfalls, the force of sea tides, the force of the wind ... electricity is easily transformed into other forms of energy, easily divided into small parts. It is the most flexible form of energy” (p. 163). It was as if socialism could be realized only through electricity, which by its very nature produced the transformation and connection of heterogeneous forces and energies, both social and material. Electricity, associated with constant transformations of energy, was consonant with the spirit of the political revolution (Kalinin, 2022, pp. 403 – 407). Soviet purveyors of electrification saw electricity not only as an infrastructure, but also as a means of cultural and anthropological transformation.

Electrification was not limited to infrastructure, electricity was also associated with the creation of the “new Soviet man” and literal renewal of human nature. Communism required not only new technology, but also this new man, born of the revolutionary environment and capable of generating a new society. This idea had no strict concept, it was developed by a variety of thinkers (Alexander Bogdanov, Alexei Gastev, Maxim Gorky, Anatoly Lunacharsky, Anton Makarenko). It was about a new cultural hero – physically and intellectually developed, able to create, a collectivist, a conscious and independent moral actor.

The movement of scientific organization of labor, whose theorist was Gastev, was also associated with technological transformation. Gastev was sure that electrification was supposed to find its resonance in the biology of the modern human being, calling for the creation of a “master plan of popular energetics” (Gastev, 1923). In one of his works he declared: “Our first task is to take up that magnificent machine which is so close to us, the human organism. This machine has the luxury of mechanics – automatism and rapidity of activation. The human organism has a motor, there are “gears,” there are shock absorbers, there are advanced brakes, there are fine regulators, there are even manometers” (Gastev, 1972, p. 45). Gastev’s concept implied the transformation of human subjectivity and the formation of a mutual connection between humans and machines. Moreover, Gastev believed that humans needed to change and develop themselves in order to stand on the same level as electrification:

“Electrification of Russia means the transformation of a Russia-village into a vast Russia-city. The people, for whom electrification is intended, must be straightened: their psychology must be urbanized. It is not about literacy, it is not about enlightenment” (Gastev, 1923, p. 21). And another quote: “The new citizen of Russia only then will be worthy of electrification, only then he will not distort it, if his eye will act as a real mechanism of photographic camera” (Gastev, 1923, p. 50).

In addition to rational and economic perspectives, energy industry was laden with utopian meanings. Electricity was associated with material abundance, industrial progress and social equality. In the public discourse and propaganda of technology, the key motif was the prospective man’s total triumph over nature. In such a manner, Vsevolod Borisovich Veinberg (physicist and researcher of solar engineering) in his popular science brochure *Conquering Power* (1928), wrote that unused natural power was

"organically unpleasant to see" and that it was difficult to admire a waterfall, wistfully wondering how many kilowatts it could provide (Veinberg, 1928). The commodification of nature was the guiding idea in the interpretation of fuel resources throughout the first half of the twentieth century. At the same time, the geographical distribution of resources in the USSR was referred to as a "natural injustice", "nature's mistake" or "nature's curse," since deposits of coal and powerful water sources were located far from the most important industrial centers. Creation of the electrification infrastructure was seen as a way to resolve the existing natural imbalance.

UNIFIED ENERGY GRID

The theme of overcoming nature and conquering space became particularly relevant after the adoption of the new energy program (referred to as the second GOELRO) at a special All-Union conference in 1932 (Lomov, 1932). The new program was designed for the next 15 years and was based on a fundamentally new conceptual model – the creation of a unified high-voltage power grid, that would be controlled from a single center (whereas the original GOELRO plan gravitated towards a more decentralized distribution of energy facilities and the creation of regional systems). The future electricity network was seen as the great "equalizer," with wires and electric lines stretching through towns and cities, making even the remotest periphery equal to the center. On a symbolic level, power lines and railways created a metaphorical skeleton for the vastness of the backward country.

The concept of a unified network was created and presented by academician Alexander Chernyshev in 1931. A unified network was not just a sum of mechanically connected regional grids of neighboring districts. This system was supposed to have a high-voltage backbone – a set of nodes with switching devices, allowing to connect or disconnect individual large units and even regional power systems. Thus, it would be possible to change the total power capacity in the overall system in case of an accident by switching on or off the necessary units. Such a system allowed uninterrupted power supply, could eliminate accidents and allow for transfer of reserves (Kukel-Kraevskiy , 1936, p. 6). For 1930s it was a futuristic idea, that nevertheless directed engineering imagination. This conception started to be implemented in practice starting from 1950s.

The new electrification program suggested novel principle of spatial location of power plants. With the development of electricity transmission, it was not necessary to fully reckon with the geological and geographical circumstances and place energy facilities at a distance from industrial factories. This is how engineer Yu. Flakserman put it about the new possibilities in his report at the conference on the second GOELRO plan: "If previously there was a requirement to build power-intensive industries in areas close to power plants, now we can develop these industries at a distance of 300 to 400 kilometers from the central district station. Energy transmission itself is so much cheaper that this aspect ceases to play a decisive role in determining the location of enterprises...Thus we gain a certain economic freedom of maneuvering" (Lomov, 1932, p. 31). This idea of conquering space was embodied later in projects of superpower electricity lines that connected regional energy sectors.

RESOURCE POLICY OF ELECTRIFICATION

Coal accounted for more than 60% of the fuel balance of the USSR throughout the twentieth century, and coal was also used in the metallurgical industry to melt cast iron needed for the development of machine tools and industry. During the First Five Year Plan initiated in 1928, the exploration of new deposits in the east of the country was actively pursued. At the same time, methods were developed for burning coal in a pulverised state, which allowed the use of low-caloric, so-called "lean coals" as energy fuels. The importance of coal for industry and power generation in the USSR was accompanied by crises and coal shortages – industrial production all over the country was developing rapidly and required more electricity, the transport of coal was complicated and expensive and was not able to cover the needs throughout the USSR.

In these circumstances, it was decided to base the resource policy for electrification on two conceptual pillars – the use of local fuels (instead of using coal for example from Donetsk or Kuzbass) as well as their rational application (i.e. chemical treatment and maximum use of waste products). These provisions were outlined in the GOELRO plan and were refined in subsequent planning documents.

New local fuels had to be discovered, researched, and created – in the sense that many substances that were literally lying underfoot could prove to be a valuable resource. Time, effort, and scientific work had to be invested in order to turn an ordinary substance into a fuel. Ivan Alexandrov (electric and hydraulic engineer, one of the authors of the Dneproges hydroelectric power plant project), commented on the ignorance of the country's resources: "Is our country rich in resources? To such a question, I would answer that it is not about our country, but about our culture. If our culture is raised to a sufficient height, we will have inexhaustible riches" (*Geograficheskie century,* 1931, p. 12).

The very understanding of resources was formulated by engineers, economists and geologists in connection with the principles of interrelated production chains and processes. Soviet mineralogist Alexander Fersman used the expression "useless fossils," referring to the combined use of resources, which meant full usage of the entire extracted rock mass (*Geograficheskie century*, 1931, p. 22). In his opinion, it was necessary to learn how to combine production processes so as to use both useful and useless minerals. According to Fersman, what previously seemed unnecessary in the light of new advances in science and technology could become precious, and "geologist-prospector of the new type should not search, but has to create minerals" *Geograficheskie century*, 1931, p. 23). Fersman gave the example of nepheline, a by-product of apatite mining. Nepheline was considered a useless and extremely dangerous substance, but research showed that it could be used to produce aluminum and create new technological chains. Thus, nepheline turned from a waste product into an asset.

Rational use of a substance meant the maximum use of all properties and forms of a given natural resource. For this purpose, a system of technological combination and use of secondary energy resources was proposed (Gleb Krzhizhanovsky, Ivan Alexandrov). Combines were understood as enterprises which encompassed various manufacturing units for the complex processing of the same raw material. Waste from one production process became raw material for another manufacturing process (for example, ash from oil shale was used to make building materials, exhaust heat was used for heating, coke

was used for chemical production, etc.). According to Soviet economists, combines were possible only in a socialist economy, because they could transcend the boundaries of a single capitalist enterprise. This principle also relied on the idea of the universality of electricity and its transformations into heat and movement.

Rational use of fuels was also inscribed in the project of "chemicalization" of the national economy, that involved enriching local fuels (gasification and carbonization of coal and peat), as well as treating fuels as raw materials for producing new substances. Possible waste-products that appeared as a result of chemical and physical enrichment of fuels were represented as valuable matter. For example, as it was stated in the Report on Rational use of Soviet Fuels (1930), it became possible to use the gas from coke oven (that previously was just burnt under the ovens) to produce ammonia, methanol and artificial gasoline (*SSSR. Komitet po khimizacii*, p. 39).

In the light of the conceptions of the combine (a set of manufacturing plants under one management, treating the same resource), chemicalization of fuels and the development of electric transmission, the understanding of waste underwent considerable transformations and got new cultural connotations. Waste was not something useless anymore, but rather a resource waiting for adequate application. In this vein the theme of waste was represented in popular texts (Lazarev, 1931) and children's literature (Mikoni, 1934).

Figure 1. Poster "Where Electricity Comes from and What's the Use of It" (Skharov, 1921)

GOLD UNDER THE FEET. PEAT AS A FUEL SOVIET ELECTRIFICATION

So called high-caloric fuels (coal and oil) were seen as useful for metallurgy and machine building, while smaller industries (textiles, paper, chemicals, public utility services) were reoriented towards local fuels. It was peat that Lenin and Krzhizhanovsky mentioned at the dawn of GOELRO as a rational alternative that could support industry. Peat, spongy material formed by the partial decomposition of plants accumulated in bogs, is a substance not ideal as a fuel and requiring hard manual labor for extraction. But in the Soviet energy system it was incorporated into the discourse of modernization and put at the forefront of scientific and technological development (Bruisch, 2020).Peat gradually began to play a more prominent role in the energy sector of certain regions – in Moscow, Leningrad, the Belarusian Republic, the share of peat in the fuel balance reached 50%.

Research on the localization of peat deposits, mechanization of peat extraction, analysis of its properties and methods of use were actively supported by the authorities. This works were initiated under the Main Peat Committee, and in 1926 the Research Institute of Peat Industry was founded. It had an experimental station, chemical laboratories, factory of construction materials and an experimental field on a drained peatland nearby Moscow (Radchenko, 1929).

In 1929 the Museum of the Institute of Peat Industry was established. The exposition demonstrated that peat was an advanced and valuable resource for the socialist economy. The exhibition opened with a political-economic section. The central exhibit of the hall was a world map with peat reserves, where the USSR was clearly marked as possessing 70% of the existing peatlands. The department on the use of peat in the national economy focused on the theme of chemicalization and methods for processing peat – carbonization, gasification, processing of peat tar, production of insulating plates for housing construction. Gas obtained from peat was capable of replacing oil, according to Soviet scientists. Peat could also be used to produce liquid fuels, gasoline, paraffin and wax for leather and paper industry. The realization of all the possibilities of peat, according to the museum exposition, was possible in the socialist economy through the principle of technological combination (Rufin, 1935, pp. 19 – 20).

The extraction and use of peat was widely promoted in visual culture, popular science books, fiction, and children's literature. One of the key motifs was the transformation of peat into energy, emphasizing the results that this substance could bring into being. For instance, in the poster “Where Electricity Comes from and What's the Use of It” (1921), peat is called “underfoot gold” (Polonsky, 1925, p. 166, see Fig. 1). The poster demonstrates the possibilities of electricity to transform the industry and everyday life of the village, and also presents the process of electrification as a form of energy exchange between nature and humanity (the starting point of the entire composition is the sun – “the source of all work and life”).

Similarly, Alexander Peregudov's novel The *Sun Treasure* shows peat as a resource for transforming the country and workers themselves. The main character, peatmeister Kopnov, talks about the potencies of peat, that arrived from the depths of centuries.

People discovered peat and transformed this dirty substance into electric energy. And the word "peat" meant for Kopnov not only the substance itself, but also what it could do, releasing the energy of the sun embedded in it (Peregudov, 1932). The campaign for the mechanization of peat extraction (hydraulic method of peat extraction, milling, elevator method) was widely covered. A series of short movies were made and distributed around the country by direct order of Lenin in 1921. This narrative fused the idea of the bog as a bleak and useless space with the most modern technology of the future.

Peat was an easily accessible and cheap substance – it was possible to extract and use it as fuel, fertilizer, or household commodity even without complicated machinery. The ways of using peat were known before the October Revolution. However, the use of this "treasure close at hand" was limited because of the low dissemination of information and lack of demonstration facilities (Vagin, 1913). Soviet authorities deployed a large-scale propaganda of peat, and highlighted the need for the population, including children and peasants, to get involved in the work on its search and use. The topic of peat extraction and the opportunities to use and process peat were covered in the school program and political education in villages. Compared to coal or oil, peat was accessible – peat deposits can be found at a depth of 1 meter. This proximity of the resource suggested not just informational familiarity of the masses with this raw material, but also individual and bodily encounter with it.

The theme of citizens' involvement in the theme of energy production from local fuels can be observed in the history of local studies (kraevedenie). The study of the native land, its resources, its bogs, forests and soils allowed to correlate individual experience and local practices with the problem of the country's fuel crisis and the creation of a national energy system. By 1931 the goals of kraevedenie were officially formulated as having national importance and associated with the discovery of local natural resources necessary for the strengthening of socialist economy (Kozlov, 2012). Manuals on kraevedenie contained advice on how to describe the region and its natural resources (productive forces in Marxist language). For example, a handbook for schools of Novozybkovo in Moscow region contained a section on how and why bogs should be described, how to assemble a collection of peat specimens, how to create a school exhibition of peat (Eremenko, 1925, p. 23 – 25). An article by the Pskov Society of Local Historians described the experience of a rural school, that organized a peat patch on clay and bricks and cultivated peat vegetation in the school nature corner (Poznai svoi krai, 1929). Pupils had to describe peat samples using scientific methodology and were urged to refer to specialized texts. For example, the "Methodology for the Field Study of Vegetation and Flora" by Vasiliy Alekhin (with two editions in 1932 and 1938) taught the method of estimating the age of sphagnum moss, which was the basis of peat, by counting the rosettes of the Drosera plant (Alekhin & Syreischikov, 1926). In 1920s and 1930s within the campaign of bringing science to the masses and establishing relations between experts and the lay public, numerous village and *kolkhoz* laboratories (so called hut-laboratories) were organized in the USSR. These labs involved peasants in experiments with fertilization, stimulation of plant growth and research of local natural resources. The manual for conducting field experiments with peat for hut laboratories describes the method of compiling a peat cadaster. Villagers were supposed to determine

botanical composition of peat, the degree of decomposition of plants, the level of ash content. The brochure gave guidelines on how to do that – by looking carefully at the color of peat layers, squeezing peat to feel its texture, and see whether it smears and stains one's hand. Plants should be examined through a microscope and compared with the Atlas of Plant Remains in Peat (Istomina et al., 1938).

The development of peat industry embodied main principles of resource management policy for electrification. It stimulated the use of local fuels instead of relying on Donetsk coal. Archaic and infertile swamps acquired the status of the advanced technological facilities on the Soviet imaginary map of energy distribution. Transformative capabilities of electrical energy together with the chemicalization project exemplified peat as a substance with high potency that only waited to be released (see fig. 2). The proximity of peat to the earth surface and to the peasants' dwellings made peat a good training item that a non-expert public could see, touch, feel and study in order to relate the local landscape and their individual experience to the national scale.

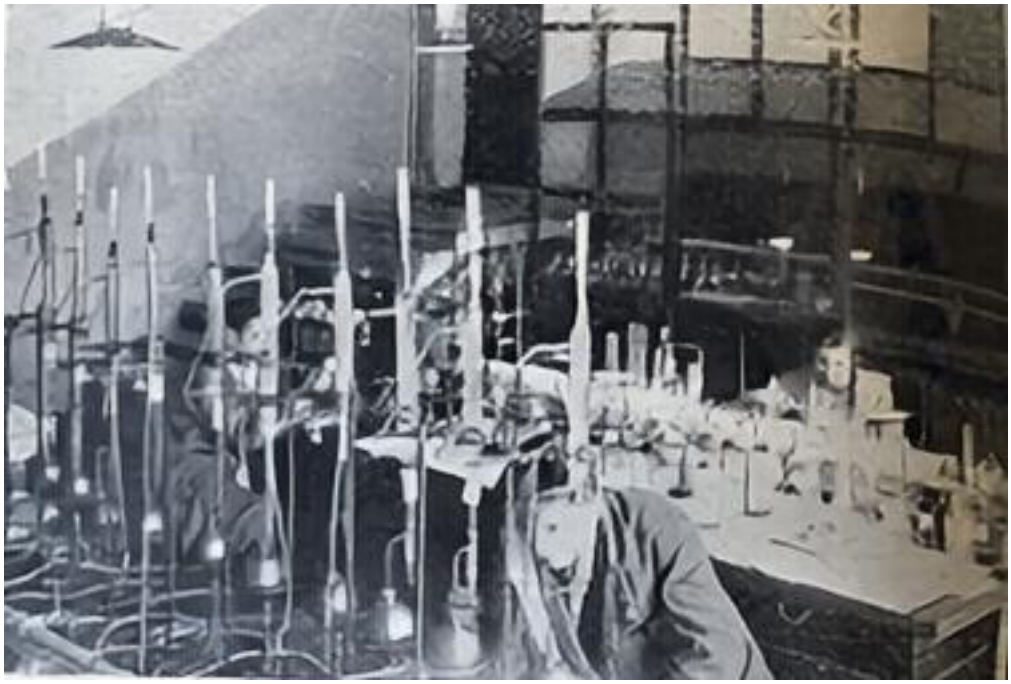

Figure 2. Chemical Laboratory of the Institute of Peat Industry (Rufin, 1935).

WATER AS A SYMBOLIC AND ENERGY RESOURCE

The importance of hydropower was outlined in the GOELRO plan already in 1920. However, the authors of the program attributed large hydropower plants to a distant perspective, focusing on smaller local power plants for the initial stage. It was assumed that during the construction of the first hydroelectric stations, professional experts would grow, scientific institutions would be established. But most importantly, the theme of water as a source of electric power would be understood and supported by the masses,

who would be able to "feel the importance and all the significance of using the living force of water streams" (Elektrifikaciya i vodnaya energiya, 1920). Not only gigantic power plants will boggle the imagination, even small-scale hydroelectric stations, that peasants would build with their own efforts in villages will perform important work – they will show the possibilities of electricity to the lay public and engage the entire population in the agenda of electrification (Elektrifikaciya i vodnaya energiya, 1920).

The GOELRO included 8 hydroelectric complexes on the Volkhov, Svir rivers, Belaya River in the Caucasus, Chusovaya in the Urals, Katun in Altai, and Chirik in Turkestan. By the end of the first two five-year plans 32 major stations were built (Nesteruk, 1963, p. 71). The emblematic and significant object of the first Five Year Plan was the Dneproges station, launched in 1932. It was the most powerful at that time in the USSR and in Europe. It became a major energy center, which shaped a large-scale industrial complex with aluminum, ferroalloy, magnesium plants. Dneproges, designed by Ivan Alexandrov and Alexander Vinter, became a research center and engineering school for the whole country (Nesteruk, 1963, pp. 74 – 76).

The period of the first and second five-year plans was also accompanied by a detailed study of water resources. A water cadaster was created, and the mountain regions, Central Asia, and Siberia were studied in details. The "primacy of coal" in the energy sector was associated with underinvestigation of other energy sources. Water was seen as a potential and inexhaustible source of energy due to its constant renewal by nature itself (*Trudy Pervogo kraevogo*, 1932). Water power, driven by nature itself, required no labor or expense for operation, transportation, or fuel preparation. Powerful plants supplied high-tech industrial industries, thus freeing up fossil fuel for thermal plants and technological processes in other parts of the country, relieving the burden on railroads. Water energy and the rivers themselves were compared to the blood circulatory system that gave life to an industrial organism (Beshenib, 1932).

As the concept of a unified power grid evolved, hydropower plants began to be viewed not as separate regional power centers, but as complex nodes linked to the overall industrial system. In the 1920s it was common to design separate unconnected hydroelectric facilities as isolated regional energy centers. In 1925, the State Planning Committee (Gosplan, the agency responsible for central economic planning in the Soviet Union) established a water sector to design the basic principles of water management. In 1929 the All-Union Committee of Water Management was created, it was responsible for the coordination of needs and plans for water use between different industrial branches and regions. In the 1930s, planning principles of water management switched to interconnected "basin schemes" that took into account energy production and water use on large adjoining territories.

Engineer Alexey Miller-Shulga noted in a complex description of Soviet energy resources that the concept of basin development and inter-basin relations became the foundation of water management development by the end of the 1930s. The conceptual framework of water management acquired the idea of "spatial redistribution of water resources" and withdrawal of water from natural streams and reservoirs. The golden standard of hydraulic engineering design became the concept of river flow regulation. The regulated river flows and artificial water reservoirs were seen as a universal

technological fix since they promised to solve a set of issues simultaneously – to create deep waterbodies for navigation, provide controllable energy resources not dependent on seasonal fluctuations, construction of high-pressure dams for irrigation. For example, in 1932 a large-scale conference of engineers, scientists and economists was held to discuss the program of complex development of the Volga river. The basic principles of the project included the creation of interconnected hydroelectric facilities, which would be included in a unified power system, as well as the creation of a system of canals, locks and reservoirs to maintain the depth of the Caspian Sea, ensure navigation and fish farming (*Problemy Volgo-Kaspiya*, 1934). In this framework river and its adjoining territories was seen as a nature-industrial combine.

Energy demands were a priority in the planning of water use. Asynchronous water regimes in rivers allowed for transfer of electricity and compensation for power shortages through the so called "inter-basin regulation" (Shimelmits & Rubinshtein, 1958, p. 4). Interconnection of numerous hydroelectric plants and their integration into the unified national power grid made it possible to eliminate breakdowns, produce cheap electric power and save on keeping less reserves. This became possible because hydropower stations located in different time zones and regions with diverse seasonal conditions allowed for maneuvering resources (water or electric power). Besides that, it was much easier to stop, launch or change the regime of functioning of a hydroturbine, in comparison to a thermal power plant. Thus, interconnection of power plants using fuel and water ensured stable and steady functioning of the whole system.

Cultural representations of hydropower promoted the motif of modernization, the transformation of traditional spaces and practices, and the renewal of society associated with hydropower construction. The power of natural and constructed waterfalls, grandiose dams controlling powerful flows of water and water energy, produced a wide repertoire of images of renewal, transformation and aspiration for the future. In Marietta Shaginyan's (1931) novel *Hydrocentral*, built around the construction of hydroelectric power stations in Armenia, water, organized into canals and hydro stations, is a symbol of the future modernized Armenian Republic. Shaginyan paid attention to the contrast between the green, water-soaked north and the arid south of Armenia. The future hydroelectric power plant will connect, level out and balance differences and the natural unjustness between the regions.

Images of powerful water streams resonated with labor enthusiasm. The new Soviet power plants produced not only electric energy, but also a cultural identity – they became megaprojects, capturing the imagination, organizing people around them and molding the "new Soviet man" – a collectivist, techno-optimist, responsible for his own future. In the novel *Energy* (1932-1938) by Feodor Gladkov (1934), that narrated about the construction of the Dneproges, the inexhaustible power of the future hydroelectric power plant is linked to the "inexhaustible energy of the people" (p. 63). In his notes on the creation of the novel, Gladkov, who visited the construction site, wrote about the "energy of the masses" creating the world's greatest hydroelectric plant (Gladkov, 1934, p. 502). Similarly, Arnaud Arevian, the hero of Shaginyan's *Hydrocentral*, was striving for real work and "real existence," spoke of himself: "Now under the Soviet system ... I have the right to work happily, I am not ashamed of loving labor passionately, I dare to waste

myself as much as I can. And in me all the floodgates are up, the power is flowing" (Shaginyan, 1931). The power plant itself is called in the novel "a spring of new energy" – not only electrical, but also a source of new challenges for the technical intelligentsia, new plans and labor achievements. Collectivism, joint participation in labor and creation were fundamentally important here. The engineer in *Hydrocentral* compared human being and hydropower plant: both were insignificant alone, but mattered in a collective (mutually feeding each other, as in an energy system) (Shaginyan, 1931).

Approaches to the development of water resources during the 1920s and 1930s were technocratic, seeking to subordinate natural and climatic regimes to economic and industrial goals. This period was characterized by a modernizing discourse that praised growth of capacity of machinery, as well as the utilization of as many resources as possible. In literature and culture, water was represented as an inexhaustible and cheap source of energy, capable not only of producing energy, but also of stimulating socialist consciousness and producing regional and national identity based on techno-natural harmony.

CONCLUSION

The structure of fuel consumption changed throughout the 1920s and 1930s. This was due to the discovery of new deposits and types of fuel, the development of new forms of fuel processing, as well as the restructuring of the energy industry. The GOELRO plan emphasized the importance of large power plants located near water sources or large fossil fuel deposits. In this scheme, power plants were to become regional energy centers, that would organically generate energy-intensive industrial facilities around them. This "organic generation" of new industries and so to say new modes of life was characteristic of both large-scale and small power plants. For example, the role of dwarf rural hydroelectric stations was seen primarily as symbolic. These novel technological objects were supposed to impress the peasants, to engage them in the theme and agenda of electrification. The use of local fuels such as peat and low-carbon coal was actively promoted and supported by the program of chemicalization, that suggested transformation of previously useless substances into valuable resources.

After 1931, the unified power system of the USSR became the core idea of electrification. New model of energy system was supposed to eliminate injustices and errors of nature in the territorial location of resources through a system of high-voltage networks and control centers. In this new concept, local fuels continued to play a role, but in a different way, more as tools for stabilizing the system and maneuvering capacity between areas. Thus, water resources began to be considered not as a substrate of large regional energy centers attracting industries to them, but as complex facilities or even as service structures for the maintenance and development of a unified power system.

For the 1920s and 1930s, peat extraction, as well as the creation of hydroelectric complexes, were imbued with a utopian impulse and technological optimism. The projects of artificial large water reservoirs, as well as bog drainage did not anticipate future environmental or sociocultural problems that would only become present in the public discourse later, in the 1960s – such as the problems of drained bogs and ecosystem

disruption, fires, agricultural and ecological problems on the immersed lands, as well as tragedies of people and loss of cultural memory in the submerged villages. In the period of early electrification and industrialization, environmental and cultural issues became subordinated to the primacy of technology – at this stage, nature had to be subjugated, transformed to conform to the contours of the energy system, making the country one big energy-industrial combine.

In the romantic post-revolutionary period, ideas about progress and its development were inseparable from the vision of the new forthcoming society and the "new man." The conceptualization of electric energy and natural resources, providing the transformation of matter and capturing collective imagination, assumed a techno-natural harmony subordinated to the logic of industrial production.

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