

## A Red Thread to Post-Capitalist Economics: Gleb M. Krzhizhanovskii's 'Energetics and Socialist Reconstruction'

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When Gleb M. Krzhizhanovskii left the Soviet Union's State Planning Commission (Gosplan) in 1930, he was relieved and disappointed. The targets of the first Five-Year-Plan (*piatiletka*) had been raised repeatedly, until they ceased to make any sense. Not only were the norms for secondary resources widely off the mark, but also the more significant energy targets, which he saw as the very 'backbone' of the Socialist economy.<sup>1</sup> As head of the famous electrification commission (GOELRO)<sup>2</sup> and then Gosplan, Krzhizhanovskii had come to think of energy as a 'red thread' leading from Russia's early capitalist to a post-capitalist and socialist economy. In Russian, like in many other European languages, the metaphor of a red thread symbolizes orientation (as in Ariadne's thread) and identification (as in the red thread of the Royal Navy's ropes<sup>3</sup>). Krzhizhanovskii held that socialism and questions of energy were deeply entangled: Not only would energy politics guide economic development and socialist transformation, but socialist states could be recognized by their energy economy. That's why wrong energy targets would cripple the entire economic organism and threaten the building of socialism. For years Krzhizhanovskii had fought for a second 'general plan'—with GOELRO as the first—focusing on the technical-economic basis, which regulated the flows of energy and matter. But to no avail. The opposition against the scientific planning embodied by Gosplan was growing among the Bolsheviks; the struggle for the plan had already been lost. "We were born too early," commented Krzhizhanovskii his defeat to a fellow energy engineer.<sup>4</sup>

It is ironic that Russia is today indeed associated with its energy economy, but not in the way Krzhizhanovskii had hoped for it. Like many Soviet engineers of the 1920s and 1930s, he was wary of oil and supported a broad electrification based, first, on locally available sources such as peat, coal, and water, and then, eventually, on solar or nuclear power. Oil's imperial legacy and value on the world market made it only more suspicious to the Bolsheviks. This view only began to change when the Soviet Union was forced into a war against Germany, which it was unable to fight without kerosene-fueled airplanes and diesel-fueled tanks.<sup>5</sup> By the 1950s, the Soviet Union had embarked on the well-trodden path towards an oil-based economy. After the pipeline boom of the 1960s and 1970s, oil and gas flowed into the West in large volumes and hydrocarbon revenues became the vital syringe of a floundering Soviet economy.<sup>6</sup> Today, Russia is a rent-

based economy, where tax revenues from oil and gas made up around 50 percent of the state's annual budget over the last decade, making it extremely hard to decarbonize.<sup>7</sup>

Now that an electrified modernity is back on the table in the form of various 'Green New Deals', it seems a good time to remember Gleb M. Krzhizhanovskii's broader energy-economic thinking, which has so far received little attention. A convinced Bolshevik and broadly trained engineer, Krzhizhanovskii blended an international electro-technical discourse on conservation and efficiency with Lenin's theory of imperialism and Engel's nature-dialectics into a vision of how the Soviet Union could free itself economically. Historical scholarship on the Anthropocene has long focused on capitalist and imperialist expansion. Socialist and post-colonial appropriations of energy show that the building and expansion of the fossil economy was also part of a state-led project of economic emancipation.<sup>8</sup> While we view these projects differently from today's warming present, they can still remind us of the deeper meaning that was once attached to the collective organization of energy.

As a student at the prestigious Technological Institute in St. Petersburg in the 1890s, Krzhizhanovskii received a broad training in mathematics, engineering, physics, and chemistry, graduating as 'engineer-technolog' with a major in chemistry. At the time, the Institute's student body was infamous for its rebellious energy and well-known for its social-democratic (rather than 'narodnik') views.<sup>9</sup> Krzhizhanovskii was part of a leftist reading group, which was soon joined by Lenin and would later become one of the seeds of the Russian Social Democratic Party.<sup>10</sup> The schism of Russian Marxism occurred in the late nineteenth century, when Georgi Plekhanov and Lenin began to distinguish their own focus on large-scale industrialization along a Western ('social-democratic') path from other Russian Marxists (dubbed 'narodniki') searching for a distinctly Russian way to socialism based on the peasantry and village commune.<sup>11</sup> Krzhizhanovskii grew up in these debates before the party's memory politics made them into a question of dogma. While there are some indications that he was interested in how the Narodniki sought to improve small village economies in the 1890s,<sup>12</sup> by the 1920s, Krzhizhanovskii had become firmly convinced that the only way for the Soviet Union to survive was large-scale industrialization on the highest level of technology.

World War I proved crucial in that regard. In the view of many Bolsheviks, the war had smashed any remaining hopes to develop a viable Socialist state based on the rural craftsmanship that had developed in Imperial Russia. "The war taught us much," noted Lenin in 1918, "... but especially the fact that those who have the best technology, organisation, discipline and the best machines

emerge on top; it is this the war has taught us, and it is a good thing it has taught us. It is essential to learn that without machines, without discipline, it is impossible to live in modern society. It is necessary to master the highest technology or be crushed.”<sup>13</sup> Lenin’s attempt to win over the technical intelligentsia for the Bolshevik cause, his turn to Taylorism and scientific planning has to be seen in this context.<sup>14</sup> Working alongside non-Bolshevik technical experts in GOELRO and Gosplan, Krzhizhanovskii strongly supported this policy to include the ‘spetsy’ into the state apparatus, while Stalin was deeply sceptical of it. In 1930, he was sidelined into the Russian Academy of Science, where he became director of the Institute of Energetics.

Krzhizhanovskii was one of the last Bolsheviks ousted from power in the late 1920s, when Stalin tightened his rule over the entire state apparatus and curbed the influence of technical experts.<sup>15</sup> At a time when Gosplan’s authority was already waning, ‘Energetics and Socialist Reconstruction’ was Krzhizhanovskii’s response to Stalin’s and Molotov’s industrialization policy based on the development of heavy industry. Published in Gosplan’s monthly organ ‘Planning Economy’ in 1929, the text is carefully crafted to avoid direct confrontation, which was potentially deadly, and to summon Lenin and Engels as allies to Krzhizhanovskii’s side. Below the many qualifications and nuances, however, lies the argument that industrialization—that is, a focus on heavy industry alone—would not lead to a Socialist economy. For that it needed a full transformation of the ‘technical-economic basis,’ ie. the structures along which energy and matter flowed and were transformed.

It has rarely been noted that this conflicted was about more than electrification. Apart from a couple of energy engineers,<sup>16</sup> few observers saw much of a difference between the two proposals in terms of concrete policies—after all, Molotov never planned to give up on electrification.<sup>17</sup> But the point Krzhizhanovskii tried to make again and again was that an energetically optimized economy was not realized by any single measure, that not *all* electrification optimized production. What was needed was a perspective that would enable optimization in the first place. Accounting on the level of the material-energetic efficiency of the *entire economic organism* required an institutionalized place, a ‘commanding heights’ (7) from which the economy could be constantly energetically evaluated and organized.<sup>18</sup> It’s this idea that was really lost in Krzhizhanovskii’s defeat.

In the article, Krzhizhanovskii framed the question how the Soviet Union should industrialize in the schematic ‘Hegelian’ form typical for dialectical materialism: How could the *quantitative* economic processes (higher productivity, more powerful machinery, faster transport, etc.) be

transformed into *qualitative* changes, that is, a change in the structures of economic reproduction towards a Socialist economy? Conceding at the outset that his proposal of a ‘new technological basis’ and Molotov’s development of heavy industry were broadly aligned, he emphasized that industrial progress alone was an “insufficient condition for translating the quantitative economic changes into a socialist quality of the economy.” (2) At the critical juncture between economic restoration and socialist reconstruction, a more precise guidance was needed. In Krzhizhanovskii’s view, this required a historical consciousness, a scientific analysis of past developments and a sense for the current moment. Two entangled historical developments determine the present and its possibilities for him: the development of the energy relations within the productive forces and the concentration of productive capacity (as expressed by large trusts).

Like other Soviet engineers of the time, Krzhizhanovskii interpreted the contradiction between forces and relations of production in a distinctly energetic way. According to this understanding, the growth of the *productive forces*—the amount of labor and energy, as well as the kinds of technology employed in production—has in the early twentieth century primarily become determined by energy technology. Electricity functions as a prime mover, transmission device, and instrument of labor all at once. Drawing on Engel’s remarks on electricity,<sup>19</sup> Krzhizhanovskii conceived of it as a ‘rationalizing element’ of the productive forces, affecting all transformations taking place in production, as well as the metabolism between nature and society itself (8).<sup>20</sup> In Engels’ view, electricity’s capacity to convert forms of energy into each other contained the possibility to eliminate the metabolic rift between city and countryside, as industry (and thus human settlement) could be distributed more equally over space. In Krzhizhanovskii’s time, it had become obvious that electricity could affect the nature-society metabolism even more deeply. Electricity could transform matter, form chemical elements, and produce the minerals that had been robbed from the soil. With Socialist technology, and particularly with the Socialist use of electricity, “man finally senses [*nashchupyyvat*’<sup>21</sup>] the ways in which the powerful creation of his hands can be included in nature merely as an element that ennobles it.”<sup>22</sup>

The popular slogan among Soviet engineers that ‘capitalism is the age of the steam engine’ and ‘socialism the age of electricity’ expresses this energy-historical interpretation of the productive forces most succinctly. Hidden in this variation of Marx’s statement on the steam-mill was an argument about how these forms of society, defined by their *relations of production*, would emerge from a particular technology. Socialist engineers favored electricity for many reasons, but particularly for the fact that its most efficient organization was collective—in centralized, integrated power systems spanning a couple of hundred kilometers.<sup>23</sup> The complementary

character of power systems meant that the workers' households could be lighted *because* of the industry's demand for power. Unlike with petroleum-lamps and the automobile, the production of electricity for an individual use was extremely expensive and inefficient; electricity consumption was to be either conspicuous or collective. Whereas in the capitalist steam economy an "autocracy of engineers" directs an "aristocracy of machinery" to subordinate living labor, a socialized energetics based on electricity would mean "living labor standing above a machine not in the form of an individual creator of this machine—an engineer—but in the form of a conscious human collective armed with the creative thought of centuries." (3) In this materialist and somewhat techno-determinist thinking, energetic optimization, based on an economic coordination across sectors and industries, would mold a new subject, conscious of her powerful, collective control over the forces of nature.

The hypothesis of an energetic contradiction rested on a third element—an increasing economic concentration taking place under capitalism, as had been documented by Lenin and others. According to Krzhizhanovskii, the energetic contradiction consisted in the fact that the most progressive forces of production (electrification) demanded a collective organization that capitalist relations of production (relations of capital, property, and ownership) could only realize by undermining themselves. This could be seen from the anti-competitive forms, such as trusts and combines, shooting up amid 'free' competition. In 'Imperialism: The Highest Stage of Capitalism' (1916), Lenin measured the concentration of productive power not only in the number of enterprises and employees, but also in the share of the total steam and electric power employed. He found that in Germany, "[l]ess than one hundredth of the total enterprises utilize *more than three-fourth* of the steam and electric power!"<sup>24</sup> The control over working nature was thus even more concentrated than that over laboring bodies. Large electric or oil companies such as Standard Oil, General Electric, or the German Allgemeine Elektrizitätsgesellschaft (AEG) epitomized this concentration, as they reached across continents and industrial branches. By means of their size and power to suspend economic competition within their boundaries, these companies were capable to realize unseen levels of productivity.

Going beyond Lenin, Krzhizhanovskii saw these trusts as expressions of an underlying principle of energetic optimization. His concept of 'energy-industrial complexes' embraced this form of cross-industrial organization: Dneprostoi, the large waterpower plant under construction at the time of his writing, was only a first example of how the provision of power and heat could be dovetailed to industry, households, and agriculture to increase productivity and energy efficiency. This focus explains the relatively early adoption of cogeneration technology in the Soviet

Union.<sup>25</sup> Mechanization, electrification, Dneprostroi *can* be instances of energetic optimization in so far as they constitute qualitative changes, but whether they *really* improve the overall energy balance can only be determined from the perspective of energetic planning. His intervention fought not for a specific policy but for planning based on energetic principles and for a level of planning from which the material and energetic flows could be tracked and optimized. This energetic principle, not any single technology, was the truly ahistorical principle, which would still hold long after centralized planning would have given way to nuclear-powered ‘free economic communes’ (9).

Like today’s ecological economists, Krzhizhanovskii criticized capitalism by revealing its material basis and the waste and squandering taking place. At a time when (some kind of) industrialization was seen as the only way for a Socialist country to survive, however, the value of efficiency remained firmly embedded in an ideology of production. Even though Krzhizhanovskii saw electrification as a means to overcome the metabolic rift between city and countryside,<sup>26</sup> his energetic theory remained primarily directed at expanded reproduction. Thus, Krzhizhanovskii’s thinking also documents how tightly productivist and ecological thought are historically entangled.<sup>27</sup> His ecological insight follows from his understanding of the historical path of productive forces: Capitalist progress itself made it necessary to understand the energetic metabolism between nature and society, as “the evolution of [the capitalist] world comes to an end at this energetic stage of the productive forces.” (4) In envisioning the material basis of a Socialist economy, Krzhizhanovskii touched upon questions that are today of renewed interest in degrowth and ecological economics. At the center of his work lies an idea of material and energetic efficiency, around which the nature-society metabolism and social reproduction itself should be organized.

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<sup>1</sup> Gosplan, “Plenum Gosplana,” *Planovoe Khozjaistvo* 6–7 (1923): 46.

<sup>2</sup> Jonathan Coopersmith, *The Electrification of Russia, 1880-1926* (Ithaca, NY: Cornell University Press, 1992); Heiko Haumann, *Beginn Der Planwirtschaft; Elektrifizierung, Wirtschaftsplanung Und Gesellschaftliche Entwicklung Sowjetruslands 1917-1921* (Düsseldorf: Bertelsmann, 1974); Alex G. Cummins, *The Road to NEP, the State Commission for the Electrification of Russia (GOELRO): A Study in Technology, Mobilization, and Economic Planning* (Phd Thesis, University of Maryland, 1988). GOELRO stands for The State Commission for the Electrification of Russia.

<sup>3</sup> The origin of this is probably Goethe’s ‘Elective Affinities’, where one can read that the royal navy’s ropes “are so twisted that a red thread runs through them from end to end, which cannot be extracted without undoing the whole; and by which the smallest pieces may be recognized as belonging to the crown.” (Goethe 1885, 202)

<sup>4</sup> Iuri N. Flakserman, *Gleb Maksimilianovich Krzhizhanovskii* (Moskow: Izdatel’stvo Nauka, 1964), 245.

<sup>5</sup> Felix Rehschuh, *Aufstieg zur Energiemacht Der sowjetische Weg ins Erdölzeitalter, 1930er bis 1950er Jahre*, 2019, 12–13; Jeronim Perović, “The Soviet Union’s Rise as an International Energy Power: A Short History,” in *Cold War Energy: A Transnational History of Soviet Oil and Gas*, ed. Jeronim Perović (Cham: Palgrave MacMillan, 2017), 1–43.

<sup>6</sup> Oscar Sanchez-Sibony, *Red Globalization: The Political Economy of the Soviet Cold War from Stalin to Khrushchev*, New Studies in European History (New York: Cambridge University Press, 2014), 184–92; Per Högselius, *Red Gas: Russia and the Origins of European Energy Dependence*, 1st. ed, Palgrave Macmillan Transnational History Series (New York: Palgrave Macmillan, 2013).

- <sup>7</sup> Thane Gustafson, *Wheel of Fortune the Battle for Oil and Power in Russia* (Cambridge, MA: Belknap Press of Harvard University Press, 2017), 5.
- <sup>8</sup> Antoine Acker, “A Different Story in the Anthropocene: Brazil’s Post-Colonial Quest for Oil (1930–1975)\*,” *Past & Present* 249, no. 1 (November 1, 2020): 167–211, <https://doi.org/10.1093/pastj/gtz069>; Elizabeth Chatterjee, “The Asian Anthropocene: Electricity and Fossil Developmentalism,” *The Journal of Asian Studies* 79, no. 1 (2020): 3–24, <https://doi.org/10.1017/S0021911819000573>.
- <sup>9</sup> Natalia Krupskaiia, “O Krasine,” in *Leonid Borisovich Krasin: Gody Podpolia* (Moscow: Gosudarstvennoe izdatel’stvo, 1928), 137; Vladimir Karzev, *Krzhizhanovskii* (Moscow: Molodaia Gvardiia, 1980), 46.
- <sup>10</sup> A couple of later revolutionaries emerged from this reading group (Martov, Krasin, etc.), which later morphed into Lenin’s *League for the Emancipation of the Working Class*, a group engaged in worker agitation. The League, whose members were after a few years exiled to Siberia, was one of the predecessor organizations of the Russian Social Democratic Party, which Krzhizhanovskii shortly headed between 1903–1905.
- <sup>11</sup> James D. White, “The Development of Capitalism in Russia in the Works of Marx, Danielson, Vorontsov, and Lenin,” in *Class History and Class Practices in the Periphery of Capitalism*, ed. Paul Zarembka (Bingley: Emerald Publishing Limited, 2019), 3–31, <https://doi.org/10.1108/S0161-72302019000034003>.
- <sup>12</sup> Karzev, *Krzhizhanovskii*, 60–62.
- <sup>13</sup> Cited in Kendall E. Bailes, *Technology and Society under Lenin and Stalin: Origins of the Soviet Technical Intelligentsia, 1917–1941* (Princeton, NJ: Princeton University Press, 1978), 49.
- <sup>14</sup> Kendall E. Bailes, “Alexei Gastev and the Soviet Controversy over Taylorism, 1918–24,” *Soviet Studies* 29, no. 3 (1977): 373–94.
- <sup>15</sup> Nikolai Kremontsov, *Stalinist Science* (Princeton University Press, 1996); Bailes, *Technology and Society under Lenin and Stalin*.
- <sup>16</sup> Flakserman, *Gleb Maksimilianovich Krzhizhanovskii*.
- <sup>17</sup> Robert William Davies, *The Soviet Economy in Turmoil, 1929–1930* (Basingstoke: Macmillan Press, 1998).
- <sup>18</sup> To this end, the Central Statistical Administration had been working on an energy balance of the economy since 1923.
- <sup>19</sup> In a letter to Eduard Bernstein from 27 February 1883, Engels wrote: “The steam engine taught us to transform heat into mechanical motion, but the exploitation of electricity has opened the way to transforming all forms of energy – heat, mechanical motion, electricity, magnetism, light – one into the other and back again, as well as their exploitation in industry. The circle is complete. And Deprez’s latest discovery that electric currents of very high voltage can, with a comparatively small loss of energy, be conveyed by simple telegraph wire over hitherto undreamed of distances and be harnessed at the place of destination – the thing is still in embryo – this discovery frees industry for good from virtually all local limitations, enables the harnessing of even the most remote hydraulic power and, though it may benefit the towns at the outset, will in the end inevitably prove the most powerful of levers in eliminating [*Aufhebung*] the antagonism between city and countryside. Again, it is obvious that the productive forces will thereby acquire a range such that they will, with increasing rapidity, outstrip the control of the bourgeoisie.”
- <sup>20</sup> Gleb M. Krzhizhanovskii, *Sochineniia III: Socialisticheskoe Stroitel’stvo*, ed. Akademia Nauk SSSR (Russian Academy of Science) (Moscow: Gosudarstvennoe energeticheskoe izdatel’stvo, 1936), 6–8.
- <sup>21</sup> To find out something by touch.
- <sup>22</sup> Gleb M. Krzhizhanovskii, “Marks o Revolucionnom Progresse Tekhniki Pri Socializme,” in *Sochineniia, Vol. III: Socialisticheskogo Stroitel’stvo* (Moscow: Akademia Nauk, 1936), 346.
- <sup>23</sup> See for similar ideas among Socialists worldwide Charles Proteus Steinmetz, *America and the New Epoch* (New York, London: Harper & Brothers Publishers, 1916), <http://archive.org/details/americanewepoch00stei>; Fred Henderson, *The Economic Consequences of Power Production* (London: G. Allen & Unwin, Limited, 1931); Thomas P. Hughes, *Networks of Power: Electrification in Western Society, 1880–1930* (Baltimore, MD: Johns Hopkins University Press, 1993); Vincent Lagendijk, *Electrifying Europe: The Power of Europe in the Construction of Electricity Networks* (Amsterdam: Amsterdam University Press, 2008).
- <sup>24</sup> Vladimir Ilich Lenin, *Imperialism: The Highest Stage of Capitalism* (London: Penguin Books, 2010), 13–14.
- <sup>25</sup> Wolfgang Rüdiger, “Combined Heat and Power for District Heating,” *Physics in Technology* 17, no. 3 (May 1986): 125–31, <https://doi.org/10.1088/0305-4624/17/3/I03>; Anatole Boute and Sergey Seliverstov, *A Tortuous Path to Efficiency and Innovation in Heat Supply: Lessons from the Russian Experience with District Heating* (Oxford: Oxford University Press, 2018), <https://doi.org/10.1093/oso/9780198822080.003.0012>.
- <sup>26</sup> Mieka Erley, “Models of Soil and Society. The Legacy of Justus Liebig in Russia,” in *Eurasian Environments: Nature and Ecology in Imperial Russian and Soviet History*, ed. Nicholas Breyfogle (Pittsburgh, PA: University of Pittsburgh Press, 2018), See for the broader meaning of that rift—called ‘smychka’—in Russia.
- <sup>27</sup> Daniela Russ, “Energetika: Gleb Krzhizhanovskii’s Conception of the Nature–Society Metabolism,” *Historical Materialism* 29, no. 2 (2021): 188–218, <https://doi.org/10.1163/1569206X-12341887>.