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# Ecological reconceptualization of the Ukrainian philosophy of physical economy

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**Abstract.** Ecological approach gives new meaning to the original concept of economic rationality that was created by representatives of the Ukrainian school of physical economy – Serhii Podolinskyi (1850-1891), Volodymyr Vernadskyi (1863-1945) and Mykola Rudenko (1920-2004). It propose a theory of the sustainable development of mankind, which included an original version of thermodynamics, in which labor energy is the result of the transformation of solar energy. Humanity is gradually taking control of the changes in the balance of energy exchange between humanity and the rest of nature, and physical economics is a tool for discovering the limits of such control. The cycles of global energy transformation include cosmic, biological, social and spiritual stages, and the economy acts as the material basis and the place of concentration of these transformations. The threat of technogenic self-destruction of humanity actualizes the need to establish a dynamic and harmonious self-reproduction by humanity of these cycles.

**Keywords:** Ukrainian philosophy of physical economy, ecological approach, global energy transformation, energy balance in the economy, economic rationality.

## **Introduction. Environmental demand and economic supply**

The last decades have seen an increase in integration processes in the world, and the development of trends towards joint solutions by countries to their economic and social problems. The globalization moves inevitably and cannot be destroyed or “cancelled”, since this is an imperative requirement of postmodern society and scientific and technological progress. Global integration and internationalization make national economies gradually more and more interdependent. A kind of “compression” of the world space has taken place, which requires new forms of relationships (Schweitzer and Silverberg 1998). The collapse of the Soviet Union created the prerequisites for the revolutionary formation of independent post-Soviet states and, in particular, the independent entry of Ukraine into the global economic system. At the same time, such entry should take into account the patterns of the evolutionary course of world economic processes and the deep interdependence of national economies in the modern world (Axtell et al. 2016). Therefore, knowledge based on the natural laws of economic existence will be closest to socio-economic reality. One of the understudied philosophical and economic concepts that appeal to the understanding of natural laws as their basis is the school of physical economy, which has stable traditions in Ukrainian science. The original philosophical concept of economic rationality was created by representatives of the Ukrainian school of physical economy – first of all by economist and philosopher Serhii Podolinskyi, philosopher, founder of geochemistry and original cosmology theory Volodymyr Vernadskyi and writer, human rights defender and Soviet dissident Mykola Rudenko. Today, the ecological significance of this concept appears on a larger scale and more convincingly. The original ecological concept as a part of physical economy becomes new economic rationality, based on the scientific – physical and cosmological principles. In addition, the Ukrainian concept of the

physical economy can become an option for a successful combination of ethical motivation and economic rationality in modern conditions.

In this respect, the concept of physical economy can be a European counterpart to the concept of Buddhist economy, which we explored earlier (Zinchenko & Boichenko 2022). In Ukraine the issues of physical economy as possible methodological basis of contemporary economic research were considered by Viktor Zinchenko (Zinchenko 2012; Zinchenko et al. 2024). Philosophical search of the methodological ways out of crisis of modern economic theory was conducted in Ukraine by Mykhailo Boichenko (Boichenko 2021).

### **Serhiy Podolynskiy's ideas regarding the energy balance in the economy**

Serhiy Podolynskiy (1850-1891) developed the concept of physical economy as a subject of the theory of sustainable development of mankind, which included an original version of the theory of thermodynamics, which took into account both exogenous energy sources for mankind and endogenous energy of a labor. On these theoretical bases, he determined the equivalent between physical and mental work, which in the integral sum give the successive accumulation of energy by mankind in its evolution. Humanity is gradually taking under its control the changes in the balance in the exchange of energy between humanity and the rest of nature, but the question is that such control cannot be unlimited and for it, external and internal limitations for humanity should be defined.

For Podolynskiy, economic problems acquire a literally natural meaning, and his economic theory is the economy of nature. Thus, his teaching is a criticism of Marxism from the point of view of materialism and natural sciences: for Podolynskiy, Marxism is insufficiently consistent materialism, because it does not sufficiently take into account the fundamental natural laws of energy transformation. It will be correct to formulate Podolynskiy's position as the economy of nature, which he raises to the philosophical level of generalizations. Even added value, which Marx writes about, Podolynskiy interprets in the tradition of François Quesnay: just as Quesnay believes that any value of labor is a transformation of the value extracted from the earth, Podolynskiy considers any added value to be a special transformation of solar energy.

American researcher of Ukrainian origin Peter Baley draws attention to the fact that Karl Marx and Friedrich Engels in their correspondence comment on Serhiy Podolynskiy's teaching and consider it insufficient to explain economic progress: for Marx and Engels, human labor is something additional to solar energy, and a very essential supplement and a real source of additional value, while for Podolynskiy all human activity is in one way or another the transformation of solar energy itself (Baley 1992a, p. 207-209). Engels, followed by Baley, compares Podolynskiy's ideas with the ideas of the French economists-physiocrats, primarily François Quesnay (Baley 1992a, p. 209-210). As was declared by Quesnay:

Natural laws are either physical or moral. By physical law, we here mean, the regular course of every physical event of the natural order evidently most advantageous to mankind. By moral law we mean, the tide of every human action of the moral order conformable to the physical order, evidently most advantageous to mankind. These laws form together what we call natural law: all men and all human powers ought to be controlled by these sovereign rules, instituted by the supreme being. They are immutable, irrefragable, and the best laws possible (Quesnay 1765/2024).

Podolynskiy's ideas were a rethinking of the basic provisions of the philosophical and economic concept of the physiocrats, who considered nature as the main source of economic value. Podolynskiy significantly expands the physiocrats' understanding of natural sources of economic, social and human capital. Thus, Podolynskiy refuted the thesis of the English priest, economist and

philosopher Thomas Malthus (1766-1834) about the inevitable decline of humanity due to the exhaustion of its non-renewable resources. In contrast to Malthus, Podolynskiy do not take death into economic account:

...the word "labor" is understood as a positive action of the organism, resulting in an increase in the energy saved, and therefore the passive fact of death from hunger, associated with the cessation of the existence of the organism, cannot in any way be included in the category of labor (Podolynskiy 1990, p. 170-171).

Podolynskiy analyzes in detail the foundations of acquiring and preserving the health of the people on the example of Ukraine and shows that it is not natural resources as such that matter more, but the way people connect with nature as a whole: "Human life is in close connection with the nature in which man lives" (Podolynskiy 1878, p. 6). Marx's emphasis on capital as self-increasing value is reinterpreted by Podolynskiy in the categories of transformed energy, which is concentrated in human activity: "Labor is such a consumption of mechanical and mental work accumulated in the organism, which results in an increase in the amount of convertible energy on the earth's surface" (Podolynskiy 1990, p. 168). So, Podolynskiy introduces the term "labor energeticism" and sees the purpose of humanity in the redistribution of energy on Earth in order to reduce the dispersion of energy and its theft and waste (Podolynskiy 1990, p. 188).

In his thermodynamics, Podolynskiy followed the ideas of Julius Robert von Mayer, William Thomson (1st Baron Kelvin) and Hermann von Helmholtz, who succinctly but clearly pointed out the clear differences between the energy of living organisms and the energy in non-living nature. Podolynskiy went further and substantiated the difference between economic energy and the energy of living organisms. On this basis, all human activity can be evaluated from the point of view of the transformation of physical and mental energy, which gives ecological significance to the whole culture in general and to certain types of human activity. Today, it gives a new look at those ideas, values and symbols that direct human activity, and therefore direct the accumulated energy of humanity to new tasks. Thus, theories, ideologies and works of art are able to change not only humanity itself, but also its environment.

One of Podolynskiy's main achievements was the understanding of human labor as the transformation of solar energy and its subsequent accumulation in the form of economic mass as a resource that enables man to resist entropy, creating new, potentially inexhaustible resources for economic development. Expanding the boundaries of understanding the process of human existence and proposing the concept of energy balance, Podolynskiy considered the basis for comparing goods not labor itself, but energy, as the material substance of the goods, and its quantity accumulated in the goods thanks to labor. Thus, he considered the economic activity of mankind in the broader context of the ecological approach, and the ecological approach itself as the key to solving economic crises. In particular, Podolynskiy revealed the possibilities of a fundamentally new application of the concept of "distribution" to the processes and phenomena that occur in the energetic existence of the inhabitants of the Earth. The most significant thing in his work is the discovery of the anti-entropic functions of individuals and social institutions, whose work ensures, on the one hand, the accumulation of energy, and on the other, its protection from dissipation. Podolynskiy's ideas were later developed in the concept of the noosphere of the famous Ukrainian scientist Volodymyr Vernadskyi (1863-1945) – in his understanding of the accumulation and transformation of living matter by mankind into a substance controlled by the mind, which gradually covers not only an increasing part of the Earth's biosphere, but also turns mind into a real factor of planetary development: according to him, the biosphere is a huge and powerful geological force that influenced the Earth and transformed its geochemistry in a quite rational way. In his work

“The Biosphere”, Vernadskyi devoted a chapter to the topic “The Biosphere as a Region of Transformation of Cosmic Energy”, where he followed Podolynskyi:

The action of solar radiation on earth-processes provides a precise basis for viewing the biosphere as both a terrestrial and a cosmic mechanism. The sun has completely transformed the face of the Earth by penetrating the biosphere, which has changed the history and destiny of our planet by converting rays from the sun into new and varied forms of energy (Vernadsky 1997, p. 48).

Having introduced into scientific circulation the categories of living matter, biosphere and noosphere, having created the newest worldview system, paradigm of content and structure of knowledge, Vernadskyi, as a modern thinker, raised Podolynskyi’s ideas on the next level of their conceptualization. Volodymyr Vernadskyi proposed a new concept of the noosphere as a new state of the biosphere, denoting the all-encompassing role of the era in the history of mankind and its influence on the world – it is the era of Anthropocene:

Thus, according to A. Krogh’s calculations, the quantity of carbonic acid released by the consumption of coal reached  $7 \times 10^8$  tons in 1904, and rose to  $1 \times 10^9$  tons in 1919 (F. Clarke). This amounts to as much as 0.05% of the entire mass of carbonic acid existing in the atmosphere. Such an increase acquires the status of an important geochemical phenomenon. In this way, civilized Man breaks the established terrestrial balance. With the civilization of *Homo sapiens*, a new geological power has appeared (Vernadsky 2007, p. 185-186).

Although Vernadskyi was not an economist, his research on soil, climate change, his assessment of nuclear energy, as well as his deep analysis of the entire ecosystem of the Earth under the influence of human activity indicated both favorable prospects for the development of the economy and threatening side effects that could be avoided and should be taken into account in economic planning.

Nowadays, leading economists and politicians in Ukraine are analyzing the economic development of Ukraine and building a strategy for such economic development based on the ideas of Serhiy Podolynsky (Fokin 2024a; Fokin 2024b). This is a factual confirmation of the adequacy and perspective of these ideas.

In the UN program document “Transforming our world: the 2030 Agenda for Sustainable Development”, which defines the desired perspective of the development of humanity until 2030, we find provisions that fully correspond to the ideas of Serhii Podolynskyi and Volodymyr Vernadskyi:

We are determined to protect the planet from degradation, including through sustainable consumption and production, sustainably managing its natural resources and taking urgent action on climate change, so that it can support the needs of the present and future generations (UN General Assembly 2015, p. 2).

Also, in the Sustainable Development Goals of the UN, which are presented in this document, we meet ecological ideas that are consistent with their ideas: “12.2 By 2030, achieve the sustainable management and efficient use of natural resources... 12.8 By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature” (UN General Assembly 2015, p. 22-23).

Thus, the ideas of the Ukrainian economist Serhii Podolynskyi are based on the previous works of the physiocrats and the theory of Karl Marx and at the same time lay the foundations for the modern ecological approach in economic theory, the key ideas of which are labor energeticism and energy balance. These ideas fit economic tasks into a broader and perspective program of extraction, concentration and redistribution of energy available to humanity on planet Earth.

## **Mykola Rudenko's cosmology as a basis for his ecological approach to economy**

Mykola Rudenko (1920-2004) builds his concept of the energy of society based on a synthesis of scientific knowledge, including philosophy, economics, cosmology, physics, mathematics, etc. Cycles of global energy transformation include cosmic, biological, social and spiritual stages, and the economy acts as a material basis and a place of concentration of these transformations. The threat of man-made self-destruction of humanity actualizes the need to establish a dynamic and harmonious self-reproduction of these cycles by humanity. Physical economy appears as a science that takes care of the problems of human survival and preservation of life on Earth. At the same time, Rudenko's study of energy transformation cycles covers not only physical and economic processes, but also cultural and spiritual ones.

In 1977, Mykola Rudenko published his work "Economic Monologues" (Rudenko 1978) in the magazine "Suchasnist" in the USA, which had previously been self-published illegally by readers in the USSR. Already in independent Ukraine, in 2015, a collection of Rudenko's philosophical and economic works was published, which highlight the integrity of his teaching as a kind of cosmology, in which economic processes are only a separate case of the large-scale transformation of energy in the universe as a whole (Rudenko 2015). Paradoxically, it was the appeal to cosmology that helped Rudenko break the inherent slavish subordination of Soviet economic science to Marxist ideology. According to Peter Baley, Mykola Rudenko's most important contribution to economic science is the requirement

to see the solution of economic problems not from the point of view of political antagonisms in society, but rather in the physical processes of production of ever-increasing capital – in Rudenko's 'energy of progress' – for ever-increasing growth population... Rudenko proposes to replace the political economy with a physical one, based on the co-dependence and cooperation of the classes called by nature in a sovereign society (Baley 1992a, p. 214).

However, in fact, the physical economy of Mykola Rudenko does not so much reject ideology and politics as it justifies another ideology and politics: Ukrainian patriotism and cosmism replace communism and Marxism in Rudenko's physical economy.

Mykola Rudenko made an original application of the basic ideas of the concept of physical economy to rethink the theory of communism on non-Marxist principles. For some of his Ukrainian colleagues abroad, this was evidence of his anti-Marxism (Logvynenko et al 2024) or anti-communism, about which Rudenko allegedly cannot express himself directly and allegedly follows the path of "understatement" (Baley 1992a, p. 200-202). However, Rudenko was really not against communism – but not at all of the Soviet model. For Rudenko himself, his humanistic understanding of communism was primarily a challenge to the inhumane Soviet system. Rudenko himself led the human rights movement in Ukraine and made efforts to create the Ukrainian Helsinki Group (Rapp and Ovsienko 2005). Rudenko became widely known in Ukraine and in the West not only as a Ukrainian writer, but also as a Soviet dissident.

However, judging by the analysis of Mykola Rudenko's artistic works (Rudenko 1987), his strategic vision was more far-sighted than just a criticism of the Soviet totalitarian system. He sought to identify the strategic directions of the development of mankind, and the ideas of the physical economy became for him the basis for the development of his own ideas about the promising ways of the development of the economy as a component of the general further evolution of mankind. As Ukrainian literary experts testify, the literary work of Mykola Rudenko was characterized by the inclusion in his works of very real economic, political, and natural issues: an alternative economic concept to Marxism (Logvynenko et al. 2024), patriotic (Rencka 2019), natural questions of the world structure (Logvynenko et al. 2023; Mazurenko & Logvynenko 2020), military (Logvynenko 2020). As a writer, Mykola Rudenko subordinates his creativity to his vision of Ukraine's place in

the global economy and the economy of nature: the mission of humanity in the universe acquires its concrete embodiment in the mission of Ukrainians.

On the other hand, Rudenko seeks to justify economic processes from the standpoint of philosophy and a peculiar religion of nature. If Vernadskyi drew attention to photosynthesis as a mechanism for the biochemical transformation of solar energy into an organic form, then Rudenko considers solar energy itself to be only a variety of the World Monad spread throughout the universe as world spirit-matter, which is the First Creator of all that exists: “We derived the energy of progress from photosynthesis... Now we are looking for that cosmic source that is at the basis of photosynthesis itself, that is, at the basis of Life. This is the Monad” (Rudenko 2001, p. 53).

Such scaling borders on mysticism, and the very activity of Mykola Rudenko was perceived by many as the activity of a prophet. However, Mykola Rudenko’s case justified itself in many respects – in any case, he made a notable contribution to Ukraine's gaining state independence. Perhaps that is why all manifestations of Mykola Rudenko’s artistic creativity are harmoniously combined with his economic pursuits and his political program – moreover, all this is combined into a single teaching, which was designed to contribute to the revival of Ukrainian statehood and the full development of the Ukrainian people. Rudenko fights against Soviet totalitarianism by all possible methods and on all platforms available to him – political, economic, artistic. However, above all, Mykola Rudenko is a great patriot of his homeland – Ukraine. It is for the revival of its state sovereignty that Rudenko fights against the USSR, seeks the resurrection of Ukraine as a sovereign state.

Providence sends to Ukraine a serf's son ‘without lineage and without destiny’, a dilettante in history, politics, sociology, economics, and even a dilettante in matters of classical poetics, and that dilettante defiantly tears the cover from his mother's coffin, revives history, determines the political course, outlines a socio-economic program, refines the language to the highest level of poetic expression, and orders his peasant nation to ‘rise up and break the shackles’... (Baley 1992a, p. 215-216).

As a “professional dilettante”, Mykola Rudenko can be compared with the self-taught British sociologist Herbert Spencer, who also achieved his impressive scientific results thanks to a large-scale synthesis of the results of various natural and humanities available at the time. Such a synthesis would hardly be possible for an academic scientist who went through a long school of mastering a narrowly targeted methodology, an autonomous professional terminological apparatus and a clearly limited subject of research of his science. However, Mykola Rudenko, like Herbert Spencer (Spencer 1967), proceeded from the needs and considerations not of cabinet science, but of real life tasks.

## **Conclusion**

The new paradigm of civilization development proposed by Serhii Podolynskyi and its current ecological awareness through the recognition by most countries of the world of the need for the existence of humanity based on the concepts of sustainable development within the framework of a single system of “nature-society-man” require a separate understanding of the issue of the organic structure of the economic mass indicator and its place in the reproduction process of redistribution of labor energy, which determines the direction of subsequent research. Podolynskyi should be considered the founder of the newest Ukrainian scientific school of physical economy. The scientist’s conception significantly developed the ideas of his foreign predecessors, such as François Quesnay and Karl Marx, and later found continuation in the works of modern Ukrainian economists and philosophers.

Synthetic teaching of Mykola Rudenko appears as the ecology of a specific society, namely as the ecology of Ukraine – economic, political, cultural and spiritual ecology. Such an integral ecology of Ukraine in Rudenko is a direct consequence not only of his economic teaching, but also an indirect consequence of his cosmology, because Rudenko's economy of nature is the central part of his general cosmology of energy transformations.

Economic rationality cannot be built without taking into account its ecological basis. Cognition of human socio-economic activity based on the provisions of the theory of physical social economy creates additional opportunities for qualitative and quantitative measurement of the results of human activity as a process of transformation and accumulation of energy, identification of new patterns and modeling of the entire social process on the path to sustainable development.

## References

Axtell, Robert, Kirman, Alan, Couzin, Iain D., Fricke, Daniel, Hens, Thorsten, Hochberg, Michael E., Mayfield, John E., Schuster, Peter, and Rajiv Sethi (2016), 'Challenges of Integrating Complexity and Evolution into Economics', Wilson, David S. and Kirman, Alan (eds.), *Complexity and Evolution: Toward a New Synthesis for Economics. Strüngmann Forum Reports*, vol. 19, series ed. J. Lupp. Cambridge, MA: MIT Press.

Baley, Peter (1992a), 'Is communism possible without Marxism? (about "Economic monologues" by Mykola Rudenko)', in: Baley, Peter *Free of Ideological Fanatism*. Los Angeles-Baltimore: Smoloskyp, pp. 200-212. (In Ukrainian).

Baley, Peter (1992b), 'Mykola Rudenko on economic topics?', in: Baley, Peter *Free of Ideological Fanatism*. Los Angeles-Baltimore: Smoloskyp, pp. 213-222. (In Ukrainian).

Boichenko, M. (2021). Human Evolution: the Limits of Technocentrism. *Anthropological measurements of philosophical research*, 19, 15-22. <https://doi.org/10.15802/ampr.v0i19.235956>

Fokin, V. P., Chernyak, V. K., Shynkaryuk, O. V., Stolyarov, V. F. (2024a). *To the Ukrainian people – stable, planned and stable human development (a collection of historical-analytical essays: reinterpretation of the past and vision of the post-war future). Vol. 1. Definition of stable, plan-resistant human development as a nationally consolidated civilizational platform of Ukraine*. Kyiv: S. A. Podolinsky Institute of Physical Economy. (In Ukrainian).

Fokin, V. P., Chernyak, V. K., Shynkaryuk, O. V., Stolyarov, V. F. (2024b), *To the Ukrainian people – stable, planned and stable human development (a collection of historical-analytical essays: reinterpretation of the past and vision of the post-war future). Vol. 2. Formation of socially adequate management of the unitary Ukrainian state*. Kyiv: S. A. Podolinsky Institute of Physical Economy. (In Ukrainian).

Logvinenko, Yulia (2020), 'Mykola Rudenko's military lyrics in the context of the totalitarian literature of the XXth century' (in Ukrainian), *Philological Treatises*, 6(3), 11–17. <https://tractatus.sumdu.edu.ua/index.php/journal/article/view/392>

Logvynenko, Yulia, Mazurenko, Volodymyr, Sytnyk, Larysa, & Bilyk, Nadiia (2024), 'Anti-marxist polemics in Mykola Rudenko's novel-treatise "Formula of the Sun"' (in Ukrainian), *Amazonia Investiga*, 13(75), 285-295. <https://doi.org/10.34069/AI/2024.75.03.24>

Logvynenko, Yulia, Mazurenko, Volodymyr, Sytnyk, Larysa, & Bilyk, Nadiia (2023), 'Mykola Rudenko's poetry and prose as a platform for popularizing the author's alternative hypothesis of the Universe' (in Ukrainian), *Amazonia Investiga*, 12(67), 223-231. <https://doi.org/10.34069/AI/2023.67.07.20>

Mazurenko, Volodymyr and Logvinenko, Yulia (2020), 'Anthropological vector of Ukrainian science fiction (after the novel of M. Rudenko "The Ark of the Universe")' (in Ukrainian), *Philological Treatises*, 8(1), 141–149. <https://tractatus.sumdu.edu.ua/index.php/journal/article/view/245>

Podolynskyyi, Serhii (1878), *Life and health of people in Ukraine*. Geneva: Community. (In Ukrainian).

Podolynskyyi, Serhii (1990). *Selected works*, arranged by Roman Serbin. Montreal: Ukrainian Historical Society. (In Ukrainian).



Rapp, Iryna and Ovsiyenko, Vasyl (2005), 'RUDENKO, Mykola Danylovykh' (in Ukrainian), *Dissident movement in Ukraine. Virtual museum*. <https://museum.khpg.org/1113938141>

Renchka, Inna (2019), 'Language issue in M. Rudenko's memoirs and art' (in Ukrainian), *Ukrainian Language*, 3(71), 94-107. doi.org/10.15407/ukrmova2019.03.094

Rudenko, Mykola (2015), *Energy of progress. Selected works on economics, philosophy and cosmology*, arranged by R. A. Rudenko. Kyiv: "CLIO Publishing House" LLC. (In Ukrainian).

Rudenko, Mykola (1978), *Economic monologs*. Introduction by P. Hryhorenko. Without a publisher: Sučasnist, 199 p. (in Ukrainian).

Rudenko, Mykola (1987), *The Cross*. Trans. from the Ukrainian by Roman Tatchyn; Introduction by Leonid Rudnytzky. St. Sophia Religious Association of Ukrainian Catholics Translation Series, vol. I. Washington, Philadelphia, Toronto, St. Sophia Religious Association. 29 p.

Rudenko, M. D. (2001), *Gnosis and modernity: (the Architecture of the Universe)*. Ternopil: Jura, 547 p. (In Ukrainian).

Schweitzer, Frank and Silverberg, Gerald (eds.) (1998), *Evolution and Self-Organization in Economics*. Berlin: Duncker & Humblot.

Spencer, Herbert (1867), *First Principles*. 2nd ed. London: Williams and Norgate.

UN General Assembly. (2015). *Transforming our world: the 2030 Agenda for Sustainable Development*. [https://wedocs.unep.org/bitstream/handle/20.500.11822/9824/-Transforming\\_our\\_world\\_the\\_2030\\_Agenda\\_for\\_Sustainable\\_Development-2015TransformingOurWorld\\_2015.pdf.pdf?sequence=3&isAllowed=](https://wedocs.unep.org/bitstream/handle/20.500.11822/9824/-Transforming_our_world_the_2030_Agenda_for_Sustainable_Development-2015TransformingOurWorld_2015.pdf.pdf?sequence=3&isAllowed=)

Vernadsky, V. I. (2007), *Geochemistry and the biosphere: Essays*. Trans. from Russian by O. Barash; ed. by F. B. Salisbury. Santa Fe, NM: Synergetic Press.

Vernadsky, V. I. (1997), *The Biosphere*. Trans. from Russian by D. B. Langmuir. New York: Nevaumont/Copernicus/Springer Verlag.

Zinchenko, V. V. (2012), 'Physical economy as a management model for competitive planning of maximum efficiency' (in Ukrainian), *Actual problems of the economy. Scientific economic journal*, 8(134), 10-18.

Zinchenko, Viktor and Boichenko, Mykhailo (2022), 'Buddhist economics as a return to a rational model of economic management', *The Journal of Philosophical Economics: Reflections on Economic and Social Issues*, XV (1), 227-244. <https://doi.org/10.46298/jpe.10032>

Zinchenko, Viktor, Polishchuk, Oleksandr, Levkulych, Vasyl, Bulvinska, Oksana, Iehupov, Mykola, Levkulych, Viktoriia (2024), 'Paradigmatic alternatives of global development, scientific and technological progress and prospects for the development of civilization in the institutional "physical social economy" models', *E3S Web of Conferences*, 474, 01016. <https://doi.org/10.1051/e3sconf/202447401016>