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Review

Biosphere synergism and the humankind virtual path to the hydrogen civilization era

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ABSTRACT

The social synergetic analysis of the biosphere and humanity shows that in near future two attractors (human paths) will really compete: the first is an irreversible biosphere catastrophe and the second is a motion along the vector 'Hydrogen energy → Hydrogen economy → Hydrogen civilization'. In accordance with the basic assumption of the social synergetics about a fundamental possibility of the mankind conscious choice of its own post-bifurcation path to the future, the analysis based on Kondratieff's study about large cycles of the economic development leads to the fundamental conclusion: two historical stages of Hydrogen Civilization will correspond to Kondratieff's sixth (~2030–2090) and seventh (~2090–2150) hydrogen energy technological cycles with a probability up to 100%. Copyright © 2014, Hydrogen Energy Publications, LLC. Published by Elsevier Ltd. All rights reserved.

Introduction

The world scientific pattern and the classic mechanics elaborated by Newton had proved themselves in the area of many astronomical and vital practical problems. In the following years, this notion of the world and human being was accepted by humanities, and by and large there was formed a mechanistic worldview which dominated for 300 years. In some respect it is still dominating.

What are the principal points of this worldview? Firstly, this is the classic philosophy of the verity that was formed, as from F. Bacon and R. Descartes' works, on the base of the postulate of the accurate exact knowledge. Secondly, undoubtedly this is a classical principle of causality named after

Laplace. Generalizing he could say: "The state of the nature system at present is obviously a consequence of the state in which it was in the previous moment. And if we imagine the mind which at the moment has grasped all relationship between the objects of the universe, it will be able to establish the appropriate positions, motions and general impacts of all these objects at any time in the past or in the future" [1].

Successes of the human thinking within the classic, deterministic world outlook, the development of the industrial and post-industrial civilization over the centuries cannot but strike the human imagination, especially at present, when contradictions in science (natural, technical and humanitarian) and in the humankind life have become more acute.

Within the scope of this progress of human thinking a special place is taken by Academician V. I. Vernadsky' creative

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work. Certainly, in the first place it concerns his study on the biosphere and noosphere [2–5]. This study on the biosphere and noosphere was originally comprehended by Vernadsky as an empirical generalization. Then, it was scientifically developed by him during many decades right up to the end of his life [3].

Vernadsky was a son of his time and not in vain he liked to focus on the determinism of the biosphere development and determinism of its transformation to the noosphere “... with the geological process being inevitable”.

It's natural that Vernadsky's study on the biosphere and noosphere is a *real epoch of the classical deterministic thinking of the humanit*.

The biosphere, in accordance with Vernadsky's study, is an “... organized, specific crust envelope of the Earth associated with the life”. So, the biosphere is bounded, first and foremost, by the area where the life exists. The upper limit of the biosphere space includes the troposphere on the border of the ozone layer (i.e. about 23–25 km). On the surface of the Earth the biosphere includes the World Ocean, the Earth hydrosphere and, of course, the entire dry land. In the Earth depths it extends up to ~16 km below the earth surface level.

The biosphere living matter includes all types of viruses and microbes, all types of mushrooms, plants, all kinds of living beings (creatures), animals and a human being. The very important point of Vernadsky's study is the statement of the fact that during the historical time scale the humanity has become (and is) the main driving force of the biosphere evolution. Vernadsky wrote: “... the humanity with the ever-increasing pace in its manifestation covers the entire planet, separates out, distances from other living organisms as a new, unprecedented geological force. At the rate comparable with reproduction expressed exponentially over time, a growing number of new natural bodies and new large natural phenomena are created just by this manner in the biosphere. So, we are the eyewitnesses of the biosphere dramatic changes”.

Now, some words about the noosphere. The noosphere, according to Vernadsky, is a *special stage of the biosphere development*, when the dominant driving force of the biosphere development is science accompanied by a very high universal intellectual activity as the main planetary phenomenon. Originally, in the 20-ies, Vernadsky expressed the idea that the biosphere had already entered a new stage of development – the noosphere. But about two decades later, in Vernadsky's declining years, he asserted himself in the thought (and wrote about it [3]) that the noosphere is the future of the biosphere.

It is clear that in the ‘after-Vernadsky’ epoch the biosphere and noosphere study was comprehended and detailed within the scope of determinism. In doing so, the problems of the biosphere, and noosphere especially, were and are still researching in the deterministic way: “In terms of the present, we predict what this future should be”. It has always been and remains aside the question: “What is a practical method to really achieve the predicted future?”

As it is demonstrated by the realities of the late XX century and now by the realities of the XXI century, the humanity and biosphere future cannot be positively interpreted within the classical deterministic thinking.

The main statements of synergetics and social synergetics. Synergism of the biosphere and socium

In the seventies of the XX century, an interdisciplinary science of synergetics originated (based on the physics of complex physical phenomena and devices) and then started its booming growth; it describes the development and self-organization of highly non-equilibrium (in the thermodynamic sense) systems, dissipative systems consisting of a large number of subsystems [6–9]. The ideas of synergetics and synergistic style of thinking quickly penetrated into the natural and engineering sciences, in biology, geology, archeology, meteorology, sociology, philosophy and history [1,10,11].

The biosphere continuously exchanges energy and matter with the outer space, with the central part of the Earth, with the upper part of its atmosphere. In other words, the biosphere is a highly non-equilibrium system consisting of a large number of non-equilibrium subsystems. So, the biosphere is a self-organizing synergetic system. Accordingly, all biospheres subsystems are also self-organizing synergetic systems.

Nowadays, an ideological apparatus of the social synergetics [1], which can be used as a basis to study prospects of the biosphere and humanity life, to study social and cultural dynamics, etc., has been formed.

What is to be noted first of all? If an object (a sub-system) under investigation is a part of another object (a system) of a higher rank, and they mutually influence each other's behavior, the subsystem cannot be studied apart from the system. It is necessary to study the whole set of these objects as a whole. *For example, a socium (and the humanity in general) is a subsystem of the biosphere as a system. Accordingly, the human subsystems should be studied only in the interrelationship with the biosphere as a system of a higher rank. It is important to comprehend that the system and its subsystems always have different statuses.*

Different statuses of the system (the biosphere) and its subsystem (the mankind) clearly manifest themselves in their fundamentally different life stability. For example, a possible destruction of the biosphere (under external or internal factors) will lead to an *inevitable* death of the humanity. On the contrary, a possible death of the mankind does not mean an inevitable destruction of the biosphere: it can simply undergo the restructuring of a required level, as it already occurred as a result of the Pre-Riphean disaster [10], or it might not ‘nearly notice’ this sub-system disappearance, as it was in the case of the Neanderthal extinction [1].

In this connection one should emphasize the incompetence of those aspects of the modern thought (after Vernadsky) when the humanity future is studied separately from the future of the biosphere, when the humanity ‘is transferred’ to the status of ‘a sphere’ equal with the biosphere, when one ignores the disparity of interaction, the disparity of co-evolution in opposite directions: the human ↔ the biosphere.

Let us now consider the particular characteristics of the evolution of synergistic systems. If the development of a system occurs at a steady state, this type of its evolution (and also

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