
Memorandum on a novel IAHE conception of a hydrogen civilisation of the future: historical aspects and the new challenges of the present day

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Biographical notes: Victor A. Goltsov is a member of the Board of Directors of the International Association for Hydrogen Energy (IAHE), a member of the Honorary Editorial Board of the *International Journal of Hydrogen Energy* (IJHE) and the *International Journal of Nuclear Hydrogen Production and Application* (IJNHPA), Chairman of the Physics Department and Head of the Donetsk State Hydrogen Laboratory of the Donetsk National Technical University in Ukraine. Over a period of several decades he has been elaborating hydrogen materials problems and general questions of hydrogen energy (<http://donntu.edu.ua/hydrogen>). As the Chairman of the triennial IAHE special international conference 'Hydrogen Economy and Hydrogen Treatment of Materials' he represents IAHE's and IJHE's long-term goals and activities in Eastern Europe and North Asia (countries of the Community of Independent States).

We, scientists, engineers, experts, industrialists – representatives of 28 countries, participants of the *5th International IAHE Conference 'Hydrogen Economy and Hydrogen Treatment of Materials, HTM-2007'* (21–25 May 2007, Donetsk, Ukraine), representatives of the older and younger generations of the World Hydrogen Movement, taking into account that:

- the global energy and environment problems caused by fossil fuels continue to grow
- fossil fuel resources are limited and Hubbert's peak will be reached in the near future
- the world scientific and cultural community is separated and consider the problems above from different (sometimes antithetical) viewpoints

being active members of the World Hydrogen Movement and wishing to be of assistance in consolidating the world scientific and cultural community to successfully solve the problems above, discussed and adopted this full-scale memorandum on historical IAHE activities and the IAHE prognosis of the future humankind transition to the era of hydrogen civilisation and call on the world community to concentrate attention and activity on some new challenges of the present day.

1 Introduction: historical aspects

Hydrogen, being an effective source of energy, has systematically attracted the attention of scientists and engineers for about 200 years: examples include W. Cecil (1820–1822), W. Grove (1839), X. Teitman (1852), Jules Verne (1875), R. Erren (1920s and 1930s), B.I. Shelisch (1941–1945) and many, many others. But, as is well known from scientific and technical history, *even the greatest fundamental ideas give rise to public echo and may be realised in life only at a time when there appears to be a suitable industrial demand and public aspiration.*

In accordance with this historical tendency, the concept of hydrogen energy has its origin and development in the 1970s and 1980s. Three objective factors on a global scale changed scientific, technical and public comprehension. Two of these have already been mentioned: environmental problems and the problem of limited resources of fossil fuels, which began to be perceived on a global scale just at that time. The third factor was of an extremely active nature: that was the world energy crisis of the 1970s.

On 18–21 March 1974, at the landmark Hydrogen Miami Energy (THEME) Conference, a small group of ‘hydrogen romantics’ got together. They said their consensus aloud: “The Hydrogen Energy System is an idea whose time has arrived.” The International Association for Hydrogen Energy (IAHE) was established and began in earnest to spread information on hydrogen energy systems. In order to achieve this, a series of conferences were organised (and are being organised) around the world: the World Hydrogen Energy Conferences (WHECs) and some international specialised Hydrogen Conferences. Another important activity of the IAHE was to establish the *International Journal of Hydrogen Energy* (IJHE), which started publication in January 1976.

During those years, hydrogen energy was being also widely discussed in the former USSR and received an official acceptance. The USSR joined the IAHE.

In the 1980s and 1990s, hydrogen energy problems had been investigated in more than 40 countries, scientific information had been published in more than 20 languages and the World Hydrogen Movement had been steadily growing. Since the world economy runs on energy, the hydrogen economy concept emerged and had been gathering force from all possible directions.

By the end of the 20th century, it became absolutely clear for the specialists that an epoch-making replacement of the general energy carrier would take place in the 21st century. Fossil fuels will be substituted step by step by a new environmentally friendly carrier: hydrogen. More than that, it became absolutely clear that this historical process will subject human life to fundamental industrial and spiritual transformations. The thinking of a small IAHE pioneer team about this historical planetary process has originated a novel large-scale IAHE conception of Hydrogen Civilisation of the Future (HyCi-conception).

On 14–18 May 2001, at the *3rd International IAHE Conference ‘HTM-2001’* (Ukraine, Donetsk), the HyCi-conception was presented for the first time to the representatives of the World Hydrogen Movement. After an active discussion, the ‘Memorandum on the Transition from Fossil Systems to Hydrogen Economy and then to Hydrogen Civilization’ was accepted. The memorandum was published in a special issue of IJHE (2002, Vol. 27, pp.725–726) and in many other scientific journals.

It called on:

“All the members of the hydrogen energy and ecological movements, everybody who cares for the ecological well-being of the humankind, preservation of the Earth’s biosphere and ecosystem, to consolidate the efforts and to contribute to the approaching of the era of hydrogen civilization, the only ecologically clean and worthy civilization of the future.”

During the first years of the 21st century, the fundamentals of the novel HyCi-conception on the future transition to the era of hydrogen civilisation were established in full, widely presented to the world scientific community at the International Hydrogen Conferences (Yokohama in 2004, Donetsk in 2004, Istanbul in 2005, Moscow in 2006, Lyon in 2006) and were published in the *International Journal of Hydrogen Energy* (2001; 2006), the *International Journal of Nuclear Hydrogen Production and Application* (2006) and in many other journals and conference proceedings.

The HyCi-conception has a programme nature: it states that “humanity can preclude world ecological catastrophe and conserve the biosphere’s ability to sustain life only by movement along the vector: ‘hydrogen energy → hydrogen economy → hydrogen civilization’”. Historically prolonged movement in this direction will lead to global transformations in all aspects of human existence, human mentality and human society, the mode of political and international thought, environment and industry-friendly development. Correspondingly, the HyCi-conception consists of three interrelated basic parts: industrial-ecological, humanitarian-cultural and geopolitical-internationally legislative ones.

The HyCi-conception uncovers the legislative-economical mechanism of the transition to hydrogen civilisation. The HyCi-conception formulates the stages of transition to the era of hydrogen civilisation that will be put into operation in the 21st century, accenting the attention on the world scientific-cultural community’s future noosphere role, the principal importance of purposively forming a ‘hydrogen-ecological’ mass consciousness and the role and responsibility of international and regional legislative and political organisations, national parliaments and governments.

Furthermore, the development and detailed elaboration of the HyCi-conception must first be (and will be) a product of the joint collective efforts of the World Hydrogen Movement and the noosphere efforts of the world scientific and cultural community would then be needed.

To conclude an analysis of historical IAHE activity and the IAHE prognosis of the future humankind transition to the era of hydrogen civilisation, we, active members of the World Hydrogen Movement, call on the worldwide scientific, ecological, cultural, political, industrial and public communities to concentrate attention and activity on the new human challenges that are already coming into play.

2 New challenges of the present day

The transition to a hydrogen economy and then to a hydrogen civilisation will be a historic epoch-making transformation. Because such a transformation is on a global scale, one cannot be serene in principle. The whole history of engineering proves this. Along the way, we will come across global achievements and stoppages and maybe even step back:

The most important task of the humankind elite is to carefully observe and prevent negative technical and social tendencies of a different nature, but act in a manner similar to the 'Hindenburg syndrome'.

The generalised tasks include:

- 1 a systemic and synergetic analysis of the possible stages of the transition from the fossil fuel system to the hydrogen economy and then, to a full hydrogen civilisation, with an estimation of the probabilities of Earth's biosphere and ecosystem coming into bifurcation states and with an analysis of the possible further developments.
- 2 a development and estimation of some possible multivariant mechanisms of the influence and control of the processes of transition to a hydrogen civilisation regarding the development of the noosphere and a possibility of the occurrence of new mechanisms of its self-organisation.
- 3 analytical and practical activities to stimulate the process of transition to a hydrogen civilisation, such as:
 - consolidation of the hydrogen energy and ecological movements and winning over the scientific communities of other endeavours to solve complex tasks through systematical studies
 - achieving mass 'hydrogen-ecological' consciousness and attracting the attention of the public at large through mass media and educational programmes in schools, colleges, universities, *etc.*
 - initiating extensive discussions and taking in international and regional organisations to enact laws and economic regulations of the processes of the transition to the hydrogen economy and then, to a hydrogen civilisation
 - initiating practical activities through legal and economic controls for the development of a hydrogen economy in countries, groups of countries and the world
 - achieving extensive international cooperation in order to secure the participation and contributions of the whole humankind to the transition to a hydrogen civilisation.

The safety and efficiency of the hydrogen industry, hydrogen technologies and hydrogen energy systems are based on the activities of the World Hydrogen Movement, including three large international communities: hydrogen energy, hydrogen materials and hydrogen industrialists.

At this historical moment, one of the crucial questions is a necessity for a wide information exchange and cooperation between the leading representatives of these three communities. Such cooperation will make it possible to anticipate some specific bifurcation points on the road to a hydrogen civilisation. For example, this way of looking at the problem has already come up with an understanding of the probability that in the near future, there will be a commercialisation crisis in the world hydrogen economy that is induced by a deficit of platinum metals (tens and hundreds of tonnes of platinum per year).

The transition to a hydrogen economy and to a hydrogen civilisation will undoubtedly be accompanied by permanent global and/or local geopolitical and geoeconomic contradictions. In particular, changes in the national interests of many countries will take place – ‘old’ and ‘new’ energy resource owners and changes in the geoeconomic interests of transnational energy companies. A polarity reversal might arise in the sphere of geopolitical and geoeconomic attractions and the like.

The general task of the political elite and all of humankind is to work steadily under the legislative (not by force) governing of the possible negative geopolitical and geoeconomic tendencies of the movement on the road to a hydrogen civilisation.

The time is ripe to establish an international system transmitting the totality of hydrogen knowledge and experience to generation after generation. The establishment and operation of such an intergenerational system is a necessary condition for the safe and sustainable movement of humankind along the environment-friendly vector ‘hydrogen energy → hydrogen economy → hydrogen civilisation’.

3 Elaboration, discussion, adoption

The memorandum had been elaborated by the IAHE pioneer team constituted from Professor V.A. Goltsov, Professor T.N. Veziroğlu and Dr. Eng. L.F. Goltsova.

The memorandum has been discussed and adopted in the city of Donetsk (Ukraine) on 25 May 2007 at the final plenary session of the *5th International Conference ‘Hydrogen Economy and Hydrogen Treatment of Materials’* (21–25 May 2007) and recommended for publication in international and national scientific journals and in the public press.

4 Call for cooperation

We, the participants of the *5th International Conference ‘Hydrogen Economy and Hydrogen Treatment of Materials, HTM-2007’* (Donetsk, Ukraine, May 21–25 2007), being active older and younger members of the World Hydrogen Movement, call on all the members of the world scientific, ecological and cultural communities, industrial and political elites, everyone who cares for the ecological well-being of humankind and the preservation of Earth’s biosphere and ecosystem to consolidate our efforts and contribute to the approach of the era of hydrogen civilisation, the only one known as clean, efficient, sustainable, abundant and hospitable to life on Earth.

On behalf of the participants – representatives of 28 countries, this memorandum has been signed by:

Professor V.A. Goltsov, Ukraine	Dr. V.V. Vasekin, Russia
Professor T.N. Veziroğlu, USA	Associate Professor Siew Hwa Chan, Singapore
Dr. Eng. L.F. Goltsova, Ukraine	Associate Professor A.V. Goltsova, Ukraine
Professor E. Türe, Turkey	Manager Philippe Marty, France
Professor A.A. Minaev, Ukraine	Professor V.N. Svidenko, Kyrgyzstan
Professor Yasunori Hayashi, Japan	Dr. V.M. Skripnyuk, Israel

Professor Bent Sørensen, Denmark	Assistant Professor G.I. Zhiron, Ukraine
Professor Roger Sierens, Belgium	PhD St. Atsushi Unemoto, Japan
Professor Giovanni Principi, Italy	PhD St. Meng Ni, Hong Kong, China
Professor Rangan Banerjee, India	Student N. Grigor'eva, Russia
Professor R.A. Andrievsky, Russia	Student A. Lozovskaya, Ukraine
Professor A.A. Evdokimov, Russia	Student Ya. Makovskaya, Ukraine