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ECOLOGICAL POTENTIAL OF THE SIXTH TECHNOLOGICAL MODE

SUMMARY. The article is devoted to the analysis of the current stage of technical and economic development and identification of environmental potential of the advanced technologies.

KEY WORDS. Technologies of the sixth technological mode, ecology.

Analyzing the crisis development in the modern economy, Russian economists (S.Yu. Glaziev, D.S. Lvov, B.N. Kuzyk, V.I. Kushlin, Yu.V. Yakovets, etc.) use the theory of long-term technical and economic development. On the basis of the theory of the Russian scientist N.D. Kondratiev one can describe the process of technical and economic development “as a sequential replacement of massive complexes of technologically associated production — technological modes” [1]. In the 1920s N.D. Kondratiev advanced the idea that the development of capitalism has great economic cycles, which are characterized by a certain level of development of productive forces. At the end of each cycle there is crisis, which leads to the transition to a higher level of development. Nowadays the world is entering the sixth technological mode. “Forecasting experts believe that with the current pace of the technical and economic development the sixth technological mode will begin taking shape in 2010-2020, and the mature phase will start in 2040-s. Thus in 2020-2025 there will be scientific, technical and technological revolution” [2]. At present researchers refer nanotechnology, genetic engineering of plants and animals, global information networks, hydrogen and alternative energy, membrane and quantum technologies, photonics, micro-mechanics, production of composite materials to the technologies of the sixth technological mode.

In our view, this theory has a side, the analysis of which is highly relevant due to the deteriorating environmental situation. It is the ecological potential of the sixth technological mode.

Any problems are today have taken roots in the past and are determined by a combination of factors. This holds true both for the global problems in general and environmental issues in particular. Specialists divide the factors that have led to the current state of the environment into three groups: cultural reasons, religious reasons, social and economic reasons. But the authors of this article have tried to analyze how environmental situation is associated with technological modes.

The fourth technological mode was based on the comprehensive application of hydrocarbons: internal combustion engine, electric motor, automobile, tractor, aircraft manufacturing, coal and petroleum products power industry. Besides, the production was based on materials combination. Although the mass development of these

technologies in the economy does not happen at once, all of the potential consequences are within these technologies. The use of hydrocarbons has caused global warming, air pollution, reduction of oil, gas and coal; the production of synthetic materials has caused, in addition to depletion of natural resources, huge environmental pollution by waste products.

The process of accumulation of future technological potential happens in the present. Concerns about global environmental problems cause orientation to the development of environmentally friendly technologies. If a society has a firm belief that we have no future with the existing technologies then these technologies will change.

The burden of environmental problems and fear of environmental dead end have led to the formation of the direction of the sixth technological mode technologies. Let us consider the forecast of the structure of the sixth technological mode [3; 215]. The core of this mode is nanotechnology, genetic engineering, alternative energy engineering, global information networks. Manufacturing technologies include flexible system, unmanned production, waste-free, environmentally friendly technologies, nanomaterials, composites, transportation revolution, global communications, space technology. It is expected to renovate the social sphere and modernize the agricultural sector.

Therefore, these technologies realize aspiration for the environment conservation. Future belongs to the technologies that enable to implement the noosphere conception when a human is able to wisely control and regulate natural processes, to maintain natural cycles. "The technological revolution of the early twentieth century, the transition to alternative energy, to green transport, the development of nanotechnology create the conditions for a relative and then absolute reduction in the consumption of natural resources, beautification of the environment, implementation of the positive variant of the noosphere, co-evolution of nature and society» [3; 300-301].

Specifying these reflections according to regions, it is important to consider natural and climatic peculiarities, level of social and economic development, traditions in order to properly enter a new stage of human development, to select leading-edge technologies for the region. If we talk about the core of the technologies of the sixth technological mode, for Yamal-Nenets region power-generating sector is traditionally closer. This sector is expected to develop energy-saving technologies, hydrogen energy. P.Yu. Belyakov brings forward the analysis of the development dynamics of new, environmentally friendly electric power industries based on renewable primary sources. In the period from 1995 to 2005 the total electric energy generation from renewable sources increased from 2672.9 to 3282.5 terawatt-hours and was about 18.1% of the total electric energy produced. For comparison — the share of nuclear power in 2005 was 15.2% [4].

Wind energy is developing fastest (average growth of 28.4% per year), followed by solar energy (19.5%).

High growth rates are shown by biofuels, but that is because this type of fuel has spread comparatively recently. It is mainly used for combustibles production.

The increase in the electric energy production from geothermal sources slightly outperforms conventional electric energy industry (4% vs. 3.9%) [4].

These processes have two main explanations: first, significant progress in the sphere of renewable energy technologies makes them attractive to investors who show their interest not only in the developed countries of Europe, America and Japan, but also in China, Taiwan, India, Brazil, contributing to the further advancement of these technologies; secondly, the development of energy is induced by global environment problems, many industrialized countries have policies to support ecologically-friendly energy sources. We consider that the factor of increasing profitability in environmentally friendly technologies is a very important one.

In the fifth technological mode gas was the leading source of energy, but in the sixth growth of wind energy, solar, nuclear, geothermal, hydrogen energy is evident, so the role of gas as an energy source decreases. Yet, its value as a raw material for the production of various products increases. The most promising for the Yamal region is the development of such production and export of finished products with high added value. Trade of natural resources inevitably deprives the country of raw materials, hence the possibility for economic growth. So it is hardly worth boasting the high rate of oil and gas production, taking into consideration that the exported resources are coarse. According to the data of the U.S. Geological Survey, published in 2008, the territory north of the Arctic Circle may have about 22% of undiscovered, technically extractable world reserves of oil and gas. Russian experts agree to this: on the continental shelf there is about 100 billion tons of fuel equivalent, 80% of which is gas. Yamal gas reserves account for 16 trillion m³ (Russia now produces about 650 billion m³ of gas per year), potentially productive and expected — about 22 more. Condensate reserves are estimated at 230 million tons, oil — 292 million tons [5; 108-111].

Availability of processing enterprises with advanced technology would not only provide for the the region economic independence from the export of raw materials, but it would also help to solve many social problems. For these reasons it is necessary to diversify the Yamal gas industry, to change to complex technologies. For hydrocarbon processing in Yamal it is planned to establish three industrial zones — Bovanenkovskaya, Tambayskaya and Yuzhnaya (Southern). But what is meant here at this point is the full extraction of all gas deposits from the subsurface, not the deep processing of raw materials into products. At the moment, the assumed processing maximum is the construction of a plant for natural-gas liquefaction (NGL) on the east side of the Yamal Peninsula. But, once again, with the purpose of its convenient transportation abroad. Last year Russia took 5% market share of liquefied natural gas, it can take 25%. Still for what purpose will we expand this production? It is necessary to complete the production cycle with the production of finished products within the country, thus encouraging the development of new technologies, research and development projects and economic growth of the country.

Nevertheless, there is some progress in this direction. According to the Governor of the Yamal-Nenets Autonomous District Dmitry Kobylkin there are projects under consideration on the production of methanol, carbamide, polyethylene and polypropylene on the basis of processing associated petroleum gas. Novy Urengoy gas-chemical complex is being built. The complex is going to process ethane-bearing gas that is a by-product obtained from deethanization of gas condensate. The capacity of raw material processing enterprise has to be more than 800 thousand tons per year, every year it is planned to produce 300 thousand tons of polyethylene [6; 112-113].

Of course, these are just grains of the required rate of technological development of the sixth technological mode, the more so for its development Russia has only a few years.

In Yamal there are large reserves of solid minerals, but even explored reserves are difficult to get at. There is no transport infrastructure developed for this. Taking into consideration Yamal nature, one can create transport with the most advanced, environmentally friendly technologies. This will give impetus to the development of the transport industry and scientific developments in this field.

Great development potential is laid in the development of the Northern Sea Route. The Northern Sea Route is the main Arctic artery uniting regional transport subsystems of European, Siberian and Far Eastern north. Its development is an important component of the Russian national policy. For this aim it is planned to use private-state partnership. What advanced technologies will be used in this case is unclear. But there is already an awareness of the need to revive the Northern Sea Route, to construct new vessels, to modernize ports.

What prevents the development of new nature-aligned technologies of the six environmental mode in Yamal and in Russia on the whole? In our view, these are the following key factors:

1. Stiffness of our mind and habit of relying on the «maybe».
2. Lack of perspective thinking, which is a consequence of the desire to get the maximum own benefit here and now. Danger of raw materials depletion, economic stagnation is in this case ignored.
3. Lack of information about energy-saving and environmentally-friendly technologies, their suitability for the region is not analyzed.
4. Lack of legal framework for the development of such technologies, tax incentives and ways of concessional lending are not developed.
5. Lack of government support and encouraging for implementation of new technologies.
6. The most important reason is lobbying the interests of big oil and gas corporations that receive huge profits from the traditional sale of raw materials.
7. Lack of development of environmental business, its traditions and ideologies.
8. Systemic problem of Russian strategic planning, when the primary importance is attached to the development of industry sectors, not territories, resulting in embarrassing failures in practical implementation.

It is hoped that Russia will be able to join the advanced countries of the world through the development of the technologies of the sixth technological mode and realize the ecological potential of these technologies. Otherwise, the words of Russian economists sound as a warning, "Taking into account the global cyclical technological dynamics rhythm, it is necessary to correctly determine the time, and most importantly — the subject-matter of the next technological revolution, in order to concentrate resources on the design and innovative development of technology generations that will determine the competitiveness at the next turn of the technological spiral. Delay with the timing of the transition or the wrong choice of priorities can reduce the competitiveness and efficiency of the economy and as a result the corporation, industry, region, country will fall behind" [3; 210].

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