The concept of sustainable development of renewable energy in the modern world

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Abstract. The article is devoted to the concept of sustainable development of renewable energy in the modern world. The concept of sustainable development of world energy is considered. The analysis of the current state of the fuel and energy complex is given. The principles of development and goals of the future sustainable world energy are given. The essence of sustainable energy development, environmental problems of the leading countries in the production of electricity is being considered.

Introduction
One of the main challenges for the world energy sector is a significant increase in energy consumption in the world due to the economic development and the population growth. In spite of the decrease of the energy intensity of the developed countries, the world energy demand according to the forecast will grow by 2030 up to 30% compared to 2014, to 2040 up to 37% [1]. The increased demand for energy has increased competition both among fuel-exporting countries for better terms of sale and among importing countries for access to energy resources. Under the circumstances, the concept of sustainable development at the current international energy level has acquired a key function.

Analysis of publications
Renewable energy is one of the most popular activities of innovative companies and their developments. Thousands of scientists from all over the world are engaged in this field. The results of scientific research are reflected in the materials of analytical reports [1, 2, 3, 4], energy strategies [5], scientific articles [6, 7, 8, 9, 10, 11], reports of scientific conferences...[12] In Russia, the Institute for energy research of the Russian Academy of Sciences, the Analytical Center under the Government of the Russian Federation, the national research University «Higher School of Economics» and others are engaged in research on long-term forecasting of the world energy markets.

Materials and methods of research
In all policy and strategic documents of the European Union, the concept of sustainable development is the basic concept, which is used to provide energy supply to the population, industry, economy from the point of view of global security of developing markets (Figure 1) [6, 8].
Figure 1. Sustainable development concept

Forecasting of technological and economic characteristics of energy resources, as well as measures of political regulation is considered as an integral component of modern energy security if it is necessary to ensure sustainable development and minimal impact of energy on the environment.

Energy plays an important role in any economy in the world. The requirements for energy for sustainable development laid down in the concept of an environmentally friendly energy system meet the following important principles (Figure 2).

Results and analysis
Today 85 per cent of the world's primary energy production comes from fossil fuels and nuclear power, and less than 15 per cent from renewable energy sources. Almost all types of energy production are associated with waste generation and environmental risk. For example, power plants that use the process of coal combustion in their production are considered to be the most environmentally «dirty». In the process of burning fossil fuels, carbon dioxide is formed, the
accumulation of which in the atmosphere contributes to the «greenhouse effect». [6] Most of the energy resources currently used, of the fossil fuels, are considered to be environmentally unsustainable. This state of affairs contradicts to the principles of sustainable development, the conformity of which should be the basis for the functioning of the economy of any state.

Most of the modern states have worked out long-term concepts for the development of renewable energy, which reduced the cost of its production. The states with emerging markets, such as Russia, China, India, continue developing energy-intensive production (ferrous and nonferrous metallurgy, chemical industry, etc.), using outdated technologies [2, 3]. Moreover, in these countries, one should expect the growth of energy consumption in connection with the improvement of living standards and changing lifestyle of the population, and in many of these countries a shortage of means to reduce the energy intensity of the economy. In modern conditions, it is in countries with emerging markets that the consumption of energy resources is growing, while in developed countries the consumption remains at a relatively stable level. On the example of assessing the state of the energy complex of Russia, we can conclude that it needs total modernization. Moreover, this applies equally to the decommissioning of worn-out equipment, the modernization of obsolete morally generating facilities, the use of new technologies to create fundamentally new solutions, and the updating of legal and regulatory documentation. The reasons for the slow transition to RES are given in the scheme (Figure 3). In turn, the energy complex corresponding to the modern policy will serve as a solid basis for the further development of the state economy.

**Figure 3. The reasons for the slow transition to renewable energy sources**

To achieve sustainable economic development on a global scale requires the reasonable use of resources, technologies, appropriate economic incentives and strategic policy planning at the local and national levels, the ability to assess the state of development. When selecting energy carriers and related technologies for the production, delivery and use of energy services, it is important to take into account economic, social and environmental aspects. Such an approach is an essential tool for sustainable global energy development, policy makers and the public, as well as for promoting institutional dialogue.

Constantly changing economic, technological, political and social conditions in the world have a significant impact on the possible trajectories of the renewable energy sector. In order to achieve sustainable development in the energy sector, it is necessary to improve technologies and reduce the cost of energy production, which in turn leads to the widespread use of alternative energy sources.

The future of sustainable global energy includes three long-term (up to 2030) goals, (Figure 4).
**Figure 4.** Long-term goals for the future of world sustainable energy (up to 2030)

**Summary**
Achieving the goal of sustainable development of renewable energy is possible on the basis of wind (45.2%) and solar (14-50%, on average about 27%) energy, hydropower (8.2%) and biomass (7.2%), under the circumstances of the introduction of advanced technologies for storage and transmission of energy, as well as changes in energy demand from some sectors of the economy. Energy produced on the basis of alternative sources will cost consumers less than a combination of fossil energy and nuclear energy. There is a reason to believe that the generation of renewable energy in the next two decades will largely determine the shape of the world's energy.

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