

Green technologies as a factor in the sustainable development of the national economy

E I Mantaeva, I V Slobodchikova, V S Goldenova¹, I V Avadaeva and A G Nimgirov

Kalmyk State University named after B. B. Gorodovikov, 11 Pushkin St., Elista, 358000, Republic of Kalmykia, Russia

¹E-mail: goldenova-vs@yandex.ru

Abstract. Since the late 1980s, there has been a rethinking of views on the human impact on the environment in the world. In this regard, various theories have emerged that emphasize environmental friendliness while maintaining sustainable economic growth. These theories are called the concept of sustainable development. The ecological component of sustainable development focuses on a lean attitude towards the ecosystem, "green" technologies as the basis for innovative growth and protection of the right of future generations to the quality of the environment. Most developed countries are already focusing on the development of such "green" technologies as hydropower, wind energy, solar and bioenergy, as well as geothermal energy. In connection with the growing needs of countries for energy resources, it is the development of "green" energy that can become a key point of economic growth of the national economy without harming the environment.

Currently, all countries and regions are faced with the task of not only actively stimulating economic development as a means of meeting basic material needs, but also the need to improve the quality of life of the population as a whole. In this regard, the problem of environmental protection and the economical use of natural resources is being actualized. States have made it their top priority to conserve scarce resources in order to care for future generations. The late 1980s saw a radical reassessment of views on anthropogenic impacts on the environment, the ecological consequences of resource use, and the relationship between the environment, poverty and economic change [1]. As a result, a new approach to environmental issues and economic development has emerged - an approach based on the so-called principle of "competing goals", that is, preserving the environment and natural resources, economic growth or meeting human needs [2]. This concept is called sustainable development.

The concept of sustainable development is based on the assumption that the well-being of a nation depends not only on its economic wealth, but also on a favourable environment and habitat. It is assumed that economic development will not make sense if environmental risks are not prevented. By irreparably damaging the environment or depleting available natural resources, we limit the access of future generations to these resources and thereby jeopardize their ability to meet their own future needs. Thus, sustainable development is about the interaction of the economy and the environment and how they are managed to ensure equality between generations.

Despite the seemingly contradictory goals of sustainable development, they are more beneficial in the long term. For example, economic growth can conflict with the conservation of natural resources.



However, in the long term, the responsible use of natural resources today will help ensure the availability of resources for sustainable economic growth in the distant future.

Sustainable development is a concept that is found in many literature on environment and development issues and thus is becoming more and more popular in the modern world. Accordingly, there are currently many definitions of sustainable development. Most definitions emphasize that sustainability requires decisions that recognize the relationship between economic growth and its impacts on the environment, economy and society.

One of the most frequently cited definitions of sustainable development is the definition contained in the report by G.Kh. Brundtland, in which sustainable development is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" [3].

Another definition of the concept of sustainable development is "Caring for the Earth", where development sustainability is understood as an approach aimed at "improving the quality of human life during life within the carrying capacity of supporting systems" [4]. Sustainable development implies the use of limited resources and the impact on the environment in a way that does not destroy or worsen their condition, and also does not diminish their usefulness for future generations.

Using economic tools, early economic theorists assumed that economic development can coexist with environmental policies and can also foster innovation and profitability. Arthur Pigou, back in 1920 in his work "The Economics of Welfare", noted that the discrepancy between marginal private costs and benefits and marginal social costs and benefits creates what we now call neighbourhood effects or externalities [5]. These externalities act as side effects from economic activity, or as costs or benefits not accounted for in the prices of goods or services. To internalize negative externalities, Pigou suggested introducing a tax on those activities that create them at a rate that would equalize private and social costs. This tax is called the Pigou tax, thanks to the introduction of this tax, the market price will more accurately reflect the costs and benefits of economic activity. The practical implementation of the Pigou tax turned out to be extremely difficult, regional and global environmental problems arose. It turned out that the market system is incapable of efficiently distributing environmental resources and giving an adequate monetary value for their destructive use.

Taking into account the arguments of A. Pigou, Michael Porter and Klaas van der Linde theoretically substantiated that environmental pollution can be regarded as a sign of inefficient use of resources. Based on this, it was concluded that it is precisely the improvements in production processes that reduce the level of environmental pollution that are the condition for reaching a compromise between ecology and economy [6]. In their work, the authors substantiate that competitive advantages are directly dependent on the ability to innovate, which is why strict environmental standards can lead to stimulating innovation and, accordingly, the level of competitiveness and profitability [6].

Thus, the ecological dimension of sustainable development determines how to protect ecosystems, air quality, the integrity and sustainability of our resources, and focuses on those elements that put pressure on the environment. It also concerns how technology will shape our "greener" future; and that advances in technology and innovation are key to such sustainability and to protect the environment of the future from the potential damage that can be caused by scientific and technological progress.

Since the end of the last century, the concept of a "green" economy has been increasingly developed as an innovative form of a technological model and one of the main factors in achieving environmentally sustainable development. In light of growing global challenges such as climate change, population growth, pollution, and the inefficient use and depletion of natural resources, countries need to apply technologies and approaches to economic activity that are less harmful to the environment and conserve resources. Sustainable development is associated with less damage to the environment and taking into account the needs of future generations and should be stimulated by policy both at the international level and at the level of an individual country [7].

Thus, the European strategy for "smart, sustainable and inclusive growth" identifies the following main factors contributing to the strengthening of the economy: "smart" growth (development of an economy based on knowledge and innovation); sustainable growth (promoting a more resource efficient,

greener and more competitive economy); and inclusive growth (promoting the creation of a high-employment economy that ensures social and territorial cohesion). In the structure of this strategy, there are sections dedicated to the rational use of natural resources and energy sources, as well as the advantages of using renewable energy sources [8].

As such, countries need well-defined action programs and indicators to monitor sustainable development and "green" growth. The transition to "green" technologies should consolidate global trends in improving human well-being and social equality while reducing environmental risks. The success of this course depends on countries' efforts to increase public investment and spending; from the introduction of environmental taxes and approaches (which compensate for the lack of influence of market institutions) to reduce the "ecological footprint" of industry, from improving the regulatory framework in the field of environmental protection [9].

As studies show, among the main factors for achieving sustainable development, the priority is the use of "green" technologies, in particular, "green" energy as part of an energy-producing system that uses renewable energy sources. It is worth noting that renewable energy sources with their production and application technologies are recognized by the world community as an alternative environmentally friendly fuel, in contrast to the threats of pollution from the use of fossil fuels. At the same time, the degree of achieving sustainability based on the development of "green" energy increases with an increase in the degree of impact on technologies, industries and applications. The negative impacts on industrial, technological, social and economic development are partially or completely mitigated throughout the transition to green energy and technologies, when possible sustainable energy strategies are preferred and actively implemented. Sustainable development strategies based on "green" energy can make a significant contribution to the economies of countries that stimulate the accelerated development of alternative renewable energy sources (for example, wind, solar, backwater and tide, biomass). Therefore, governments should encourage investment in clean energy and progress in replacing fossil fuels with clean energy for a cleaner and more sustainable future [10].

According to analysis in Power-technology, hydropower is the most widely used renewable energy source. Hydroelectric power in the world accounts for more than 18% of the total power generation capacity and more than 54% of the global power generation capacity from renewable sources. China, Brazil, USA, Canada and Russia are home to some of the largest hydropower facilities in the world.

The second most widely used renewable energy source is wind energy, which accounts for about 24% of the world's total renewable energy generation capacity. China, USA, Germany, Spain, India, UK, Italy, France, Brazil, Canada and Portugal are major wind power countries, accounting for over 85% of all wind power in the world.

Solar energy is the third largest renewable energy source in the world. China, USA, Germany, Japan, Spain, Italy, India have the largest capacities in the world for the use of technology for concentrating solar energy.

Bioenergy has been identified as the fourth largest renewable energy source. Modern biomass (biofuels, wood pellets) is increasingly being used for heat and power generation alongside traditional biomass sources (agricultural by-products). The USA, Brazil, China, India, Germany and Sweden are currently the leading bioenergy producers in the world.

Geothermal energy is the fifth largest renewable energy source in the world. The types of "green" energy produced using geothermal sources are electricity as well as direct thermal energy. USA, Philippines, Indonesia, Mexico, Turkey, Italy are among the five largest producers of geothermal energy in the world [11].

The growth of the world economy entails an increase in energy consumption, in connection with which the desire to obtain energy at the lowest cost while reducing environmental pollution is becoming more and more urgent. According to experts' forecasts, by 2035 renewable energy sources will account for more than half of the world's electricity production. At the same time, today energy production in a number of states often does not meet the requirements for energy resources, for compliance with environmental safety requirements. In particular, the current level of use of "green" energy in Russia has not yet reached a sufficient level. This situation is developing not only in the energy sector,

environmental technologies in the country as a whole are developing unevenly in other areas as well. While developed countries have already started a campaign to develop clean technologies, in Russia this process has just begun. The lag is largely due to insufficient demand from business and the population. But it is worth noting the recent trend towards an increase in demand and investment growth, especially in alternative energy, energy saving.

Thus, "green" growth can reduce poverty, reduce vulnerability to climate change, create conditions for economic growth, and increase energy security. At the same time, innovative processes and scientific knowledge are fundamental for ensuring the rational use of natural resources [12]. In turn, the transition to the use of renewable energy sources is aimed at reducing the negative impact on the energy balance of the planet, and this is an important component of the concept of sustainable development of national economies. This, in turn, was the reason for the active development of renewable energy abroad and in Russia. And in general, there is great potential for the creation and implementation of environmental technologies in Russia, provided that new incentive instruments are used in the framework of the scientific, technical, investment policy of the state and the development of the green financing market [13].

It should be noted that each region of the country has the opportunity to develop a certain type of energy. For example, the natural and climatic conditions of the Republic of Kalmykia are favorable for the construction of generating facilities using renewable energy sources, in particular wind energy. In order to develop the energy system of the republic at the state level, directions have been determined to provide the region with affordable electricity. Among them is the implementation of investment projects for the construction of new generating facilities. So, in December 2020, the Salynskaya and Tselinskaya wind farms were put into commercial operation in Kalmykia, which became the largest generating facilities in the region [14].

World experience demonstrates the successful transition of countries to the level of sustainable development based on the creation and implementation of "green" technologies in various sectors of the economy, which is reflected in the state policy of modern states. Based on the study of the practice of foreign countries, Russia can work out its own approach to the development of "green" energy, generation of renewable energy sources that can compete with traditional energy, which is aimed at preserving the environment and rational use of natural resources.

References

- [1] Taiwo A A 2009 Waste Management Towards Sustainable Development: A Case Study of Lagos *International NGO Journal* **4**
- [2] Starikova E A 2017 Modern approaches to the interpretation of the concept of sustainable development *RUDN Journal of Economics* **25** (1) 7-17 DOI 10.22363 / 2313-2329-2017-25-1-7-17
- [3] United Nations 1987 *Our Common Future* (USA: Oxford University Press)
- [4] Trzyna T C 1995 *A Sustainable World: Defining and Measuring Sustainable Development* (London: Earthscan Publication, Ltd)
- [5] Pigou A 1920 *The Economics of Welfare* (London, England: Macmillan and Company)
- [6] Michael E Porter and Claas van der Linde 1995 Toward a new conception of the environment-competitiveness relationship *Journal of Economic Perspectives* **9** (4) 97-118
- [7] Guo M, Nowakowska-Grunt J, Gorbanyov V and Egorova M 2020 Green technology and sustainable development: Assessment and green growth frameworks *Sustainability* **12**(16) 65-71
- [8] Silander D 2019 *The European Commission and Europe 2020: Smart, Sustainable and Inclusive Growth in Smart, Sustainable and Inclusive Growth*; ed C Karlsson, D Silander and B Pircher (Edward Elgar Publishing: Cheltenham UK) pp 2-35
- [9] Martínez C I P and Poveda A C 2021 The importance of science, technology and innovation in the green growth and sustainable development goals of Colombia *Environmental and Climate Technologies* **25** (1) 29-41

- [10] Midilli A, Dincer I, and Ay M 2006 Green energy strategies for sustainable development *Energy Policy* **34(18)** 3623- 633
- [11] *The world's most used renewable power sources* 2020 Retrieved from: <https://www.power-technology.com/features/featurethe-worlds-most-used-renewable-power-sources-4160168/>
- [12] Piskulova N 2012 "*Green*" technologies in the global economy Retrieved from: <https://russiancouncil.ru/en/analytics-and-comments/analytics/green-technologies-in-the-global-economy/>
- [13] Borkova E A 2020 State support for green investments (using the example of renewable energy sources) *Administrative Consulting* **3 (135)** 73-9
- [14] Official website of the Ministry of Economy and Trade of the Republic of Kalmykia Retrieved from: <http://economy.kalmregion.ru/>

Reproduced with permission of copyright owner. Further reproduction prohibited without permission.