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## Analysis of prospects of using solar energy in Russian Federation economy

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### Abstract

On our planet, the hydrocarbon is limited thus inefficiency of hydropower engineering and ecological damage made by heat and nuclear power engineering make it extremely important to develop alternative energy sources, for instance solar one. This article provides volumes and tendencies of solar energy use taken from all the territories of Russia, analyses problems of substituting conventional types of energy for solar one. The authors made conclusions and defined prospects of developing solar energy in Russia.

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### 1. Introduction

The power supply is one of the essential problems of human civilization. The level of economic welfare and social development of a society is largely determined by the level and type of energy consumed. All the processes of contemporary life, one way or another, are connected with necessity of energy use produced on an industrial scale.

The modern world dictates the need for scientific and technological research not only in the direction of technological improvements in the use of conventional energy resources (non-renewable fossil fuels - oil, natural gas, coal, uranium), but also in continuous search for the new sources of energy. This contributes to the exhaustion of non-renewable natural resources and environmental hazards of their consumption. The most disturbing consequence is the change of geological structures of the earth and environmental pollution by various industrial wastes, including radioactive wastes. The inevitability of constant increase in the costs of exploration and extraction of natural fuel resources, the complexity of the access to the new fields affect the importance of the shift to alternative energy sources.

The main conventional natural energy resource is oil - about a third of the world's total energy produced is at the expense of oil. The dynamics of oil production is characterized by a slowdown in production growth in the last decade (Fig. 1). This

indicates the transition to the stage of saturation in the life cycle of the industry and of the limitations of the developed deposits.

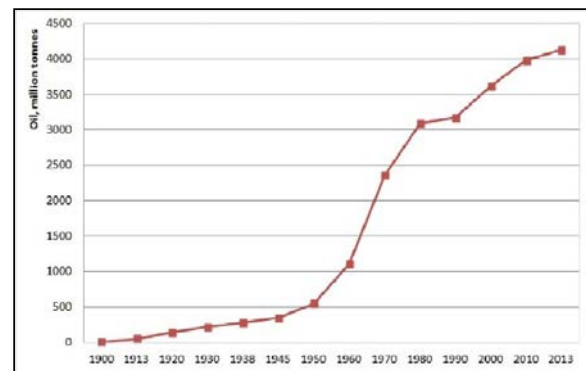


Fig. 1. The volume of oil production in the World, 1900 - 2013. [1]

A similar pattern exists in the Russian Federation. Oil production had been falling in 90th, due to the structural reform of the economy - the transition from the Soviet planned system to a market mechanism does not change the general trend towards the stabilization of oil production (Fig. 2).

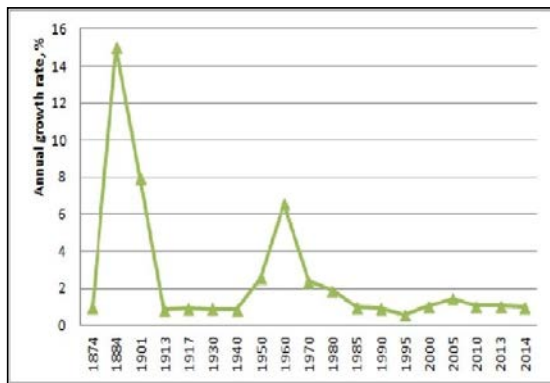


Fig. 2. The volume of oil production in Russia, 1874 - 2014. Calculated by [1].

Therefore, now more and more attention paid to issues related to the possibility of obtaining energy from renewable, natural unlimited and environmentally friendly sources. The formation of the renewable energy industry is the problem that every modern state is trying to solve somehow.

Russia is the largest country in the world by area and is one of the leading powers in population, and it is always in need of its own highly developed energy sector, which can ensure a stable supply of the state's economy. The presence of significant reserves of natural fuel resources (Russia contains on its territory 45% of the world's natural gas reserves, 23% - coal, 14% - uranium, 13% - oil) identified the main development of the energy industry. Of course, such a rich natural reserves can ensure the long-standing "comfortable life" (self-supporting with the necessary amount of energy). However, actual use does not match the existing needs. The power supply in Russian territory-administrative units differs regionally from one another because Russian Federation unites very different geoclimatic, industrial consumer characteristics. Currently about 25 million people live in areas of off-grid or unreliable centralized power, occupying more than 70% of the territory of Russia [2]. In addition, there is more serious environmental problems related to emissions of hazardous substances (wastes of conventional energy consumption) into the atmosphere, soil, water pools. The "environmental" diseases of the population and the threats associated with impaired functioning of nuclear power stations (such as Chernobyl (Ukraine) and Fukushima (Japan) nuclear power plants) are spreading.

The imbalance of power supply in Russian regions, together with the environmental hazards of exploitation of conventional energy resources led to increased attention to alternative sources of energy at all levels, from national to private consumers.

As an alternative (renewable) energy sources are seen «sources on the basis of existing or constantly recurring processes in nature, as well as the life cycle of plant and animal life and the life of human society» [3, 4]. These include the thermal energy of the earth's interior, wind energy, solar energy and cosmic energy (the energy of the orbital motion of the planets). In contrast to the limited natural fuel resources, alternative sources are inexhaustible – the possibility of their use is boundless in time, at least within the life cycle of our

planet. In addition, the production of heat and electricity in power plants that employs renewable resources significantly is greener than conventional power plants.

## 2. Trends of solar energy in the world

First place among the alternative sources of energy, of course, belongs to the sun. Solar radiation provides solar and thermal energy. It provides the electrical and solar heating systems, transformers scattered low-grade thermal energy, converted thermal energy for hydraulic installations, the kinetic energy for wind and wave installations, energy for photosynthesis, plants for processing of biomass. Let us dwell on the actual use of solar power the energy potential is many times greater than the energy needs. Famous Russian physicist and Nobel Prize winner, academician Zhores Alferov believes that "a bet on solar energy should be viewed not only as a win-win, but in the long run and uncontested choice for humanity" [5].

The recognition of solar energy industry of the future can be confirmed by the dynamics of the number of working stations and volume of the produced energy in the world practice (Fig. 3). Solar power plants that operate in the world can satisfy the domestic needs of 70 million people, with an average European level of consumption [6].

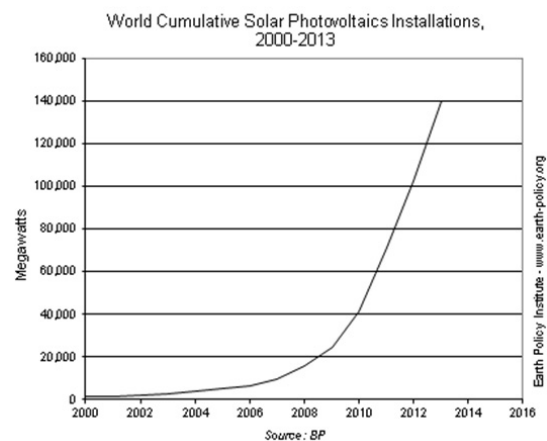


Fig. 3. Worldwide capacity of photovoltaic systems, 2000-2013. [7]

The market is growing by more than 40% per year, and falling prices for solar panels, make solar energy more accessible [6]. On the leading position among the manufacturers of the equipment required is China. The leader in the field of solar power is Germany. The share of the country accounts for about a third of the solar energy produced in the world [8].

The development of ways of converting solar energy into electrical energy is accomplishing in two ways: firstly, based on the photoelectric effect, and secondly, using photo thermal technology.

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