Renewable Energy and Stable Development Project № 1 for International Cooperation in 2017

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Research area: **Environmentally friendly alternative power systems using renewable (solar) energy.**

Title of project: **Improving the efficiency of photovoltaic solar modules by using thermoelectric generators.**

Abstract

In conditions of the deepening energy crisis caused by rising prices for hydrocarbon fuels and the reduction of its reserves, using of alternative power plants, operating on renewable energy sources, becomes actual direction of industrial power development. One of the most promising technologies is the conversion of sunlight into electrical energy by using photovoltaic (PV) systems. It is well known that the efficiency of modern silicon monocrystalline photovoltaic modules, mass-produced by industry, is 14-16%. Their installation requires a significant area and tracking the sun mechanical rotary systems. However, a substantial portion of the solar radiation, the average specific power of which is about 1000 W/m^2 in the European territory, is not used. An infrared component of solar spectrum is lost as well, which causes heating modules and reduce their total power of up to 5% for every 10 degrees of heating. As a solution to this problem, the project provides the utilization of excess thermal heating of photovoltaic modules and increasing the overall efficiency of the solar energy conversion by using of the low-cost semiconductor thermoelectric generator (TEG), working on the basis of the Seebeck effect. These generators do not contain any moving mechanical parts and can operate in a predetermined temperature range. Mounted on the solar module from the back, the thermoelectric elements can be able to raise the overall efficiency of the use of solar radiation up to 20% by utilizing the excess module heating without requiring any additional area. During the project the most optimal design of the proposed facility, at which the cold side of the TEG can be equipped with radiators or low-power fans, running on solar energy, will be determined. It is planned to develop a fully functional mockup sample and investigate it on the basis of computer data acquisition system. The analysis of technical and economic parameters and evaluation of the competitiveness of this technology on the market will be made as well. Practical results of the investigation announced for the proposed integrated PV module with TEG can be used in industry to improve the efficiency of solar photovoltaic installations and to intensify the process of solar radiation conversion into electrical energy.