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Methods for evaluation of renewable energy resources in the territory

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Abstract

The use of renewable energy sources allows, in comparison with traditional methods, to improve the ecological condition of the territory. As a rule, the receipt of energy from renewable sources is determined by the territorial distribution (solar stations, wind generators, bioenergy stations occupy a certain area necessary for energy production), dependence on weather, geographic and other factors. For Kazakhstan, the territory of which is very rich in solar energy and wind energy, the problem arises of determining the optimum zones for the location of generators. However, for the identification of these areas, purely engineering considerations are not enough, because the placement of such structures are affected by many factors of different nature, which is necessary to evaluate and consolidate in the form of some generalized assessment. The sequence of assessing the applicability of RES in a given territory is carried out in several stages described in the article.

Keywords: RES, methodology, optimum zone, location of generators

1 Introduction

In recent years, worldwide there has been a tendency to increase the use of non-traditional energy sources, with the aim of generating electricity and heat energy. The use of renewable energy sources (RES) is an environmentally safe and affordable source of energy.

To date, Kazakhstan has huge reserves of RES and great potential for their application. Reserves of coal, gas, oil, uranium, livestock waste and many other things will in the future fully produce energy in the thermal and electrical. Favorable climatic conditions of the republic create prerequisites for the development of renewable energy sources.

The development of RES for Kazakhstan will not only be attractive economically, but will also significantly reduce the negative impact on the environment. According to the Statistics Committee of the Ministry of National Economy of the Republic of Kazakhstan for 2015, the volume of emissions of pollutants into the atmosphere was about 2 million tons, with the largest volume of emissions coming from power, gas, steam and air conditioning (37%) and manufacturing industries (30%) [1]. Therefore, application of renewable energy sources for the republic is an urgent task that will help solve strategic tasks for the creation of environmentally balanced and sustainable development.

2 Methodologies for estimating renewable energy resources in perspective areas

This article proposes a methodologies for estimating renewable energy resources in perspective areas, which consists of several stages:

Determination of natural characteristics for the corresponding type of energy. The main potential for using renewable energy in the Republic of Kazakhstan is related to hydropower, bioenergy, wind, geothermal and solar energy [2, 3]. For solar energy, the natural characteristic will be the incident solar radiation on a horizontal surface, for wind energy - the speed and frequency of the wind [4].

A full assessment of the level of environmental sustainability of renewable energy sources for wide application, which implies the development of electrical installations (EI), which operate on their basis [5]. Here it is necessary to determine the types of EC based on their technical characteristics, and it is advisable to reflect the calculations using the gross and technical potential of RES.

Determination of a number of factors affecting (inhibitor) or inhibiting (catalyst) the installation of renewable energy sources. The following groups of factors are proposed to be singled out (Figure 1).
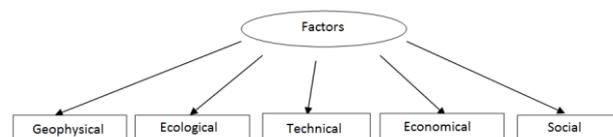

FIGURE 1 Groups of factors affecting the installation of RES

3 Example of using methodologies

The sets of factors that limit or, on the contrary, promote the use of renewable energy depend significantly on the energy source used, the class and type of the generator, the physico-geographical and socio-economic characteristics of the territory, the country, and so on. For example, in work [7] the potential of one of the regions of Spain (province of Jaen) on the use of RES (bioenergy, wind energy and energy of solar radiation) is considered. The region has about 669 thousand inhabitants and is located on an area of 13,500 sq. Km. Km. The territory has a mountain system and a valley in the riverbed of the Upper Guadalquivir river. The region's main production is olive oil, which is (at the time of writing)

20% of the world's and 50% of production in Spain. At the same time, the region produces less energy than it consumes. Wastes from the production of olive oil constitute the main source of bioenergy. To estimate the biomass potential, geographical conditions of the region are taken into account, for example, areas with steep slopes (more than 20 degrees) are excluded from consideration. Also excluded from consideration are areas that are further than 50 km from the places where biomass is burned.

protected areas, the impact of the installation of power stations on nearby territories, objects of historical and cultural heritage, etc. As for technical factors, the presence of a noise effect near wind turbines and the thermal effect on the environment plays an important role [8].

Thus, the conducted methodology for estimating renewable energy resources will allow us to identify promising areas that will be optimal for the placement of renewable energy sources.

7 Conclusions

In the case of regional assessments, it is necessary to take into account the availability of engineering and geological features, the size of the occupied territory, the availability of

Acknowledgments

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