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Geographical and Cartographic Characteristics of use of Alternative Energy Resources in Uzbekistan

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Abstract. In this article, average daily and annual sunlight falling on the horizontal surface of the territory of the Republic of Uzbekistan was analyzed. In addition, the geographical distribution of the technical potential of wind alternative energy resources in Uzbekistan was analyzed and a digital map was created in the geodatabase. Methodology for creating alternative energy resources maps was developed using international experience and national level research. Geodetic survey of energy objects for the use of alternative energy resources is carried out, and methods of measuring are determined

Keywords: database, electronic map, alternative energy, topographic survey, GPS device, Credo CAD software and AutoCAD software

The primary stage of the use of alternative energy resources at the national and local level is inextricably linked to the development of its geographical, cartographic and geodetic foundations. Because wind, solar, bio and hydro resources have different characteristics of territoriality, periodicity, complexity and structure. For example, while the use of solar energy is widespread in Southern Europe, wind energy is unique to Northern Europe. Considering that in Uzbekistan , unlike Europe, there are almost 300-320 sunny days, this source is considered primary for us. According to the experts of the "Physics-Solar" Institute of the Academy of Sciences of the Republic of Uzbekistan, the gross potential of solar energy is 51 billion/t.n.e., the technical potential is 177 million. t.n.e. is equal to However, the incidence of solar radiation on the surface is variable due to local conditions. That is why it is very important to research the geographical features of alternative energy resources and develop cartographic and geodetic bases for carrying out zoning work on them.

The map was developed using data from the Global Solar Atlas (GSA) project compiled by the World Bank. It was created based on the database of average daily and annual sunlight on the horizontal surface of the territory of Uzbekistan for the last years 1999-2018. In map creation, the data is taken from the satellite at 15 and 30 minute intervals, and the relief surface is given with a nominal spatial resolution of 250 m. Due to the lack of data obtained from high-precision geodetic instruments in providing such cartographic data, they were modeled, and the error rate was 8% to 61%. up to (Fig.1).

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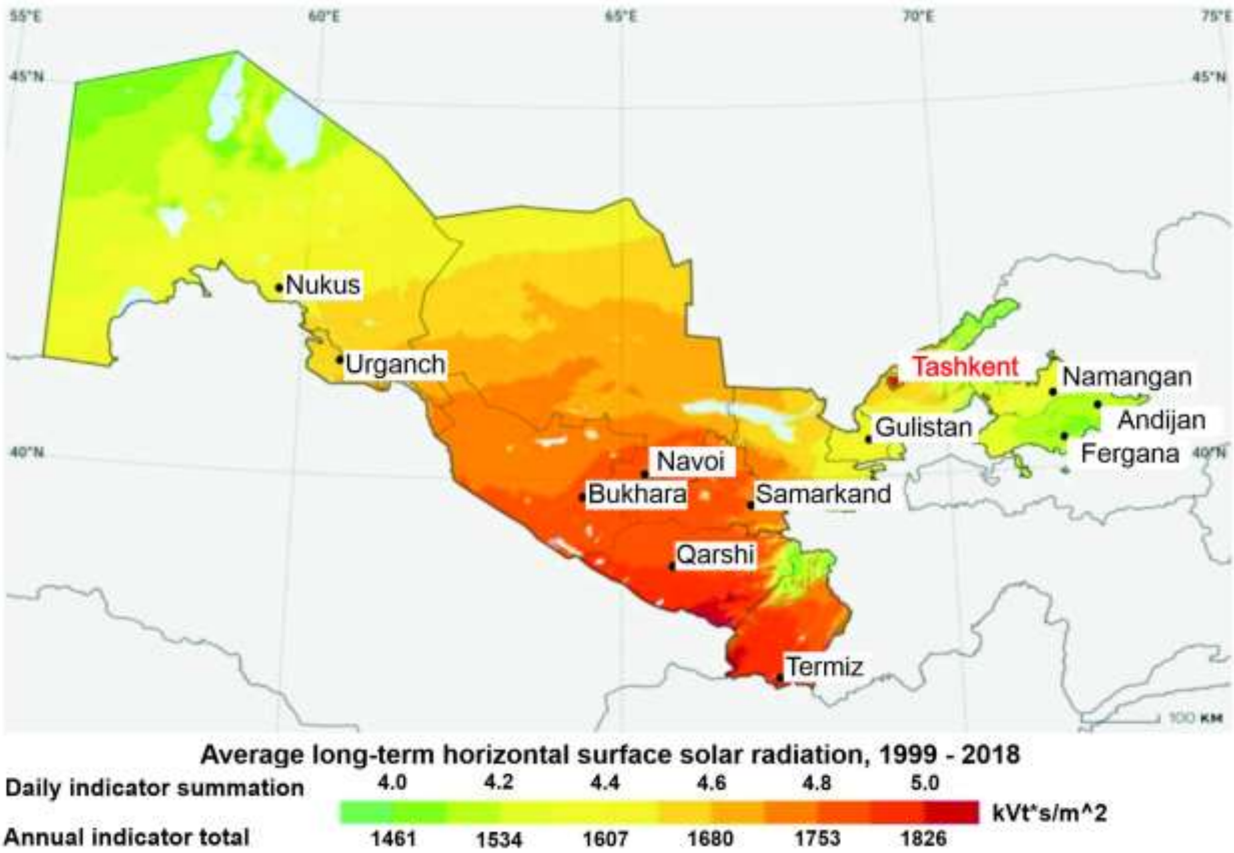

1 **. Average daily and annual indicators of sunlight falling on the surface of the territory of Uzbekistan, in kWh/ m ^{2}**

It can be seen from the map that in the Kashkadarya and Surkhandarya regions of our country, the daily rate of sunlight reaching the earth's surface is 4.8-5.3 kWh/m ^{2} , in the northern regions of Ustyurt, Kyzylkum and Orolboyi it is 4.0 kWh/m ^{2} v a drops to an even lower index. The annual figure also varies northward from 1,400 to 1,830 kWh/m2 based on geographic patterns. Such variability corresponds not only to zonal, but also to the laws of zoning of solar radiation in altitude regions.

In practice, to reduce the consumption of electricity and natural gas for social purposes, the daily capacity is 54.3 K cal and the total capacity is 1.5 It is planned to introduce solar photovoltaic power stations with MW. The total capacity for hot water supply and heating of apartments in social facilities is 1.3 per day It is planned to introduce solar collectors with Gkal.

The technical potential of alternative wind energy resources in Uzbekistan is 1 mln. It has more than GW/s of electricity or 520 MW. However, their geographical distribution is also different. **(Fig.2).**

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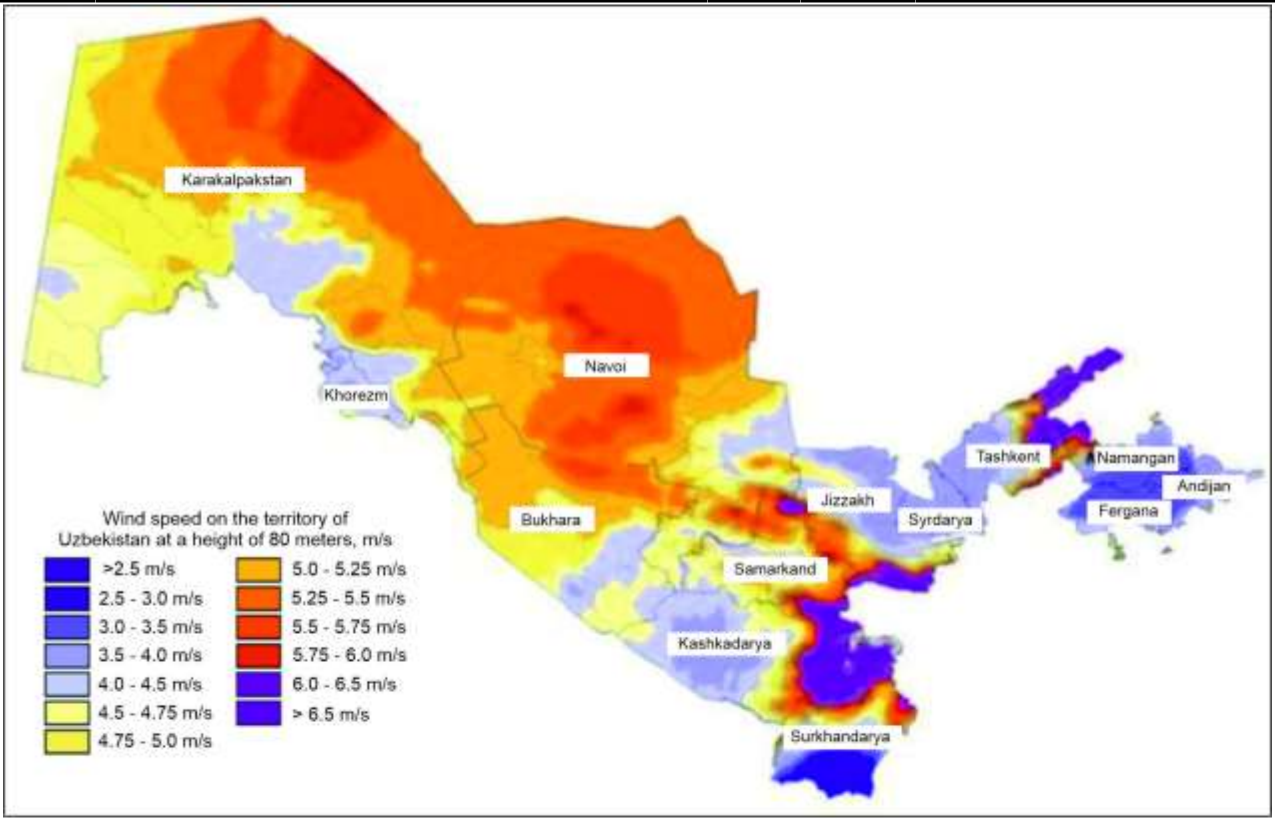

2 . Wind speed in the territory of Uzbekistan at a height of 80 meters , ***m/sec.***

Contrary to the intensification of sunlight falling on the earth's surface, the wind energy blows more strongly in the northern regions and high mountain regions at an altitude of 80 meters, and its speed is 5.5 m/sec. It is possible to blow at a speed of up to 6.5 m/sec and even more. Bekobad-Khovos of Syrdarya region and Kokan-Yazyovon zone of Fergana valley and Southern Surkhandarya zone, where "Afghan" winds blow, are examples of this.

It is desirable to build wind power plants with a capacity of 100 MW or more to replace thermal power plants with electricity obtained from alternative energy resources. In this case, the issue of providing energy to social objects located far from the IES is of primary importance.

In 2017-2019, in order to develop the potential of biowaste in our country, it is planned to introduce biogas devices in 726 large poultry and livestock farms in the country. The share of livestock and poultry farms equipped with biogas plants increased from 0.7% in 2017 to 11.2% in 2019. This allows to meet corporate and local needs of up to 60.8 million m ^{3} of biogas annually . In addition to electricity, it has been determined that farmers and peasants can produce 170,000 tons of ecologically safe biological fertilizers (in dry weight) by placing Biogas devices.

Using international experience and research work at the national level, the method of creating maps of alternative energy resources was carried out in a 5-step process **(Fig.3).**

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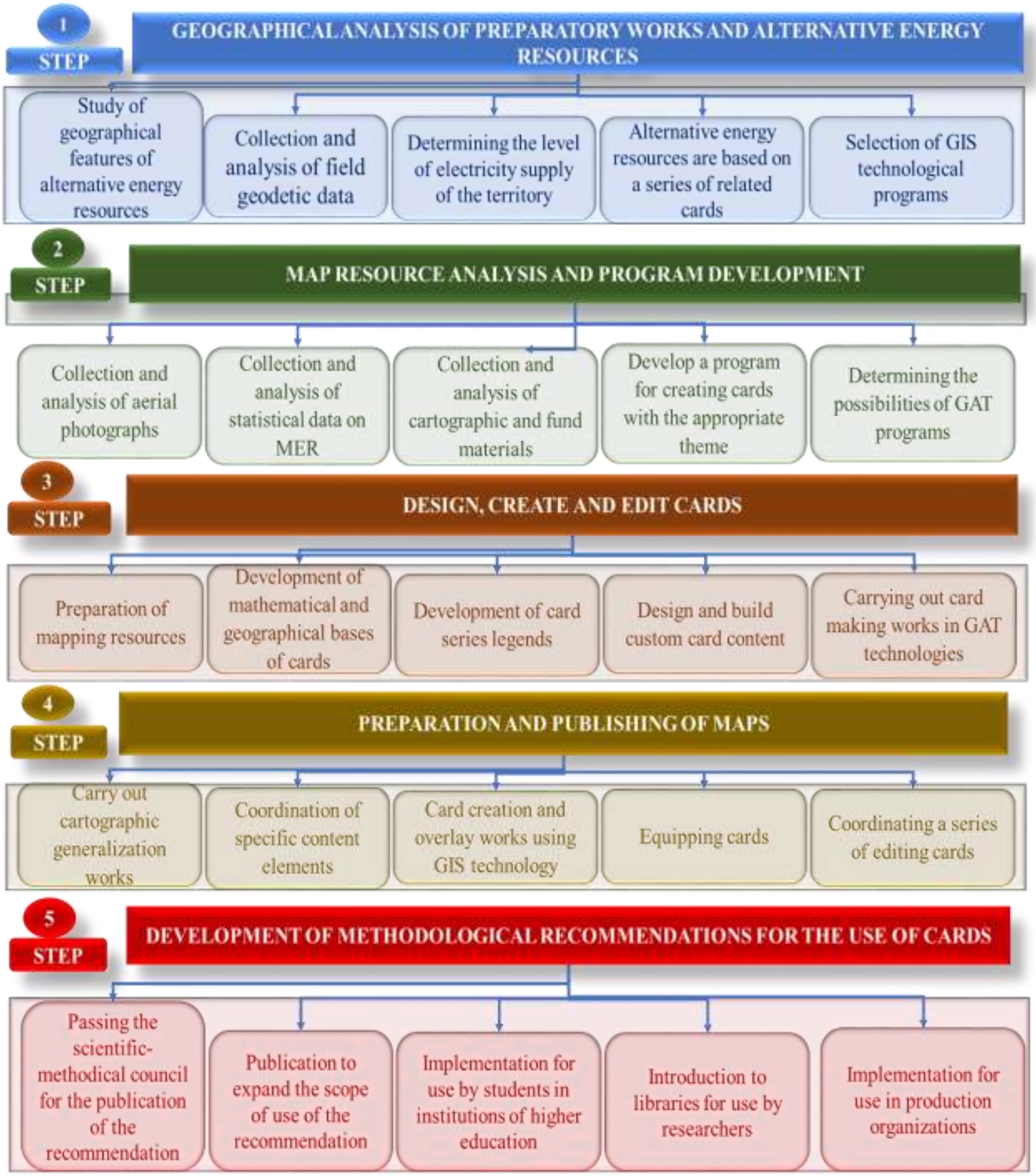

3 - picture. Methodology for creating maps of alternative energy resources

Its first chapter begins with data collection, analysis, classification and disclosure of the geographical distribution of alternative energy resources. Then, geodetic data is collected and analyzed on site . It is necessary to determine the level of electricity supply of the area according to the research objects. Based on a series of maps related to alternative energy resources, GIS technologies programs were selected.

At the 2nd phase of mapping resources analysis and program development, aerial images are collected, analyzed and geographic bases are prepared. Then, statistical and cartographic data on alternative energy resources were collected and analyzed. A program for creating thematic maps is developed, and the possibilities of GIS programs such as ArcGIS, AutoCAD, MapInfo are determined.

At the 3rd stage, thematic maps related to alternative energy resources are designed, compiled and edited**.** It collects the sources of map making, mathematical, geographical bases and legends developed. The

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special content of the maps was designed and compiled. At the end of the stage, GIS technologies are selected, and with their help, map creation was carried out.

The 4th stage of the preparation and publication of maps is carried out by cartographic generalization of special content and content is coordinated by elements. Then, a map is created using GIS technologies. Equipment and editing and coordination of the series of maps was carried out and distributed, illustratively, in a specific sequence and based on specific practical instructions .

In the 5th stage, methodical recommendations on the use of maps created on alternative energy resources were prepared and distributed, illustratively, in a specific sequence and based on specific practical instructions.

After determining the territorial distribution patterns of alternative energy resources through appropriate maps, a sequence of geodetic works, that is, a methodology, is developed for surveying and constructing each selected object. These geodetic works are carried out in 3 stages. In the first camera phase, information on alternative energy resource facilities is collected (Figure 4), studied and a large-scale topographic framework is developed. Then, exploration and research work was carried out on the geological and lithological basis of the place where the energy facilities are located.

Depending on the size of the station to be built, a cross-section of the location of its layers in depth is made and the mechanical stability of the rocks is determined. Geodetic survey of energy facilities for the use of alternative energy resources and surveying methods are determined. At the end of the preparation, GIS technologies were chosen to carry out geodetic works.

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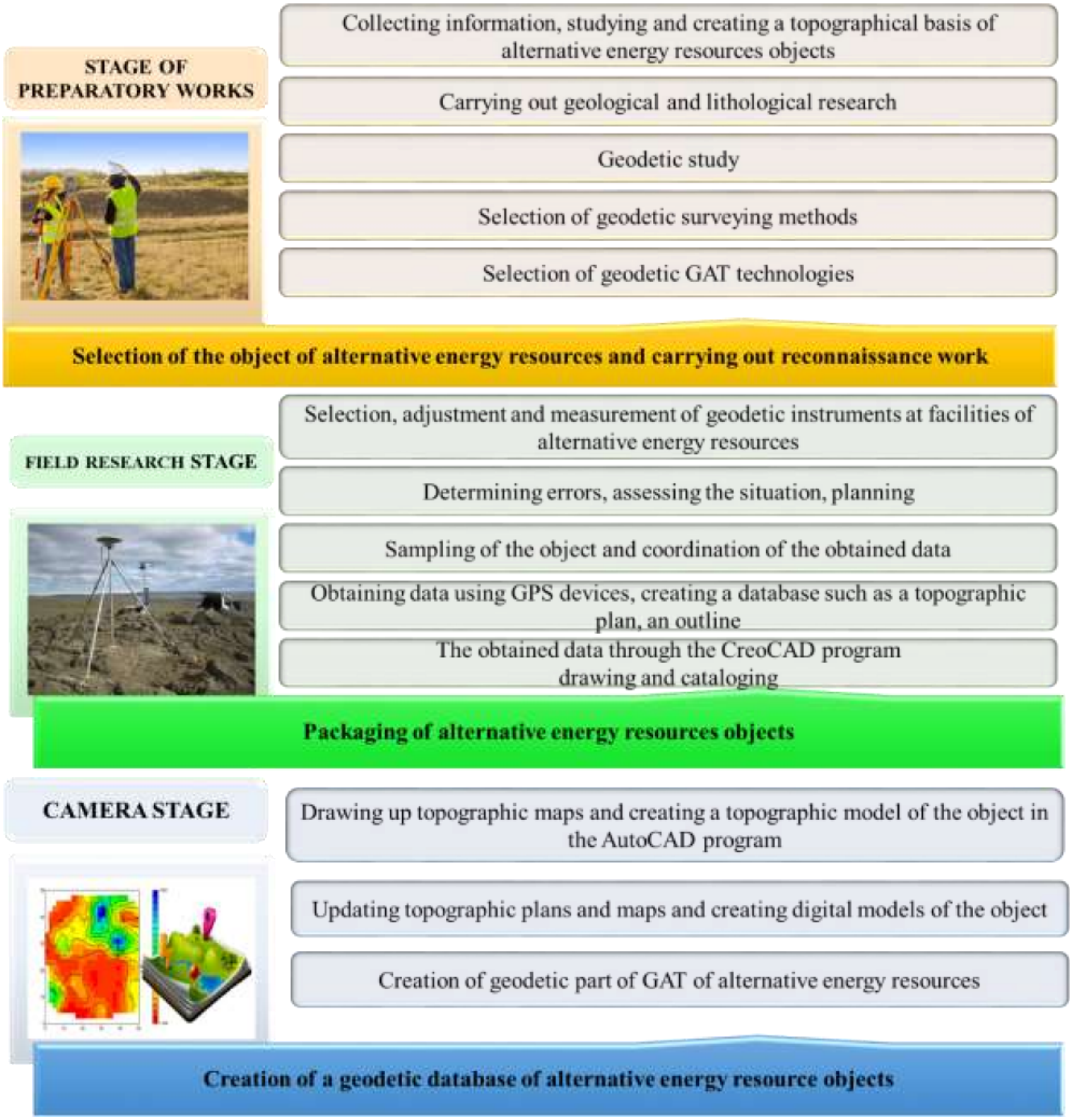

Figure 4. Methodology of carrying out geodetic surveying works in the construction of alternative energy resources

After the completion of the preparatory stage, field research works are carried out to select, adjust and measure geodetic instruments that provide the opportunity to record the data necessary for measuring and designing alternative energy resource stations with low error. Possible errors in conducting geodetic works are identified, the real situation is assessed. The selected object is scanned and the received data is coordinated on the basis of a single criterion. With the help of GPS devices, additional information is obtained, a large-scale topographical plan of the place is created and a database is created. Based on the obtained data, a scheme and catalogs were created using CredoCAD software.

After the completion of the field work, large-scale topographic maps were created using the AutoCAD program in camera mode, and a topographic model of the selected object was created. By summarizing and coordinating the data, the topographic plan and maps prepared earlier were updated, and the digital models of the object and the geodetic basis of the geoinformation system of alternative energy resources were created.

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