

## PROSPECTS FOR THE DEVELOPMENT OF GEOTHERMAL ENERGY IN THE TOMSK REGION

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According to the UN [1], the world is on the verge of a climate catastrophe. The time needed to prevent this catastrophe is running out. On the one hand, there is a constant increase in energy demand, and on the other, increasing greenhouse gas emissions into the environment, which is the main cause of global warming.

The goal of global energy trends is the development of renewable energy sources (RES) [2].

Geothermal energy is a permanent and reliable source of energy, independent of weather or seasonal fluctuations, unlike solar and wind energy. Geothermal heating and cooling systems can provide buildings with inexpensive resources and, as a rule, have a longer service life, reliability and stability compared to sources such as wind and sun [3]. Geothermal energy is the heat stored beneath the Earth's surface. It can be used to provide heat or to generate electricity and, therefore, is one of the energy sources available to achieve “net zero” [4]. Currently, less than 1.0% of the potential of geothermal energy of the Earth is used, the cost of which is one of the lowest among various power generation technologies according to the statistics of the US EIA (Table 1) [5, 6].

*Table 1. Average aligned cost of electricity for non-renewable and alternative fuels*

Type of power plant	Cost*, \$ / kW.hour
Coal	0,12–0,13
On natural gas	0,043
Atomic	0,093
Wind (on land)	0,038
Wind (offshore)	0,106
Solar (photovoltaic)	0,036
Solar (thermal energy)	0,165
Geothermal	0,040
On biomass	0,090
Hydroelectric power station	0,039

### **Geothermal power plants in Russia**

Large reserves of geothermal resources are concentrated in the Russian Federation (Fig. 1) [7], in such regions as the Pre-Caucasus, Western and Eastern Siberia, Kamchatka, the Kuril Islands, Sakhalin, and the Far East [2]. According to some estimates, the thermal potential of geothermal resources is equivalent to 1702 trillion tons of conventional fuel (t.u.t.) [8]. In 2021, the geothermal power industry of the Russian Federation had an installed electrical capacity of 74 MW, and a thermal capacity of 110 MW [9].

Currently, geothermal resources for generating electric energy in Russia are used in the Kamchatka Territory and the Kuril Islands.

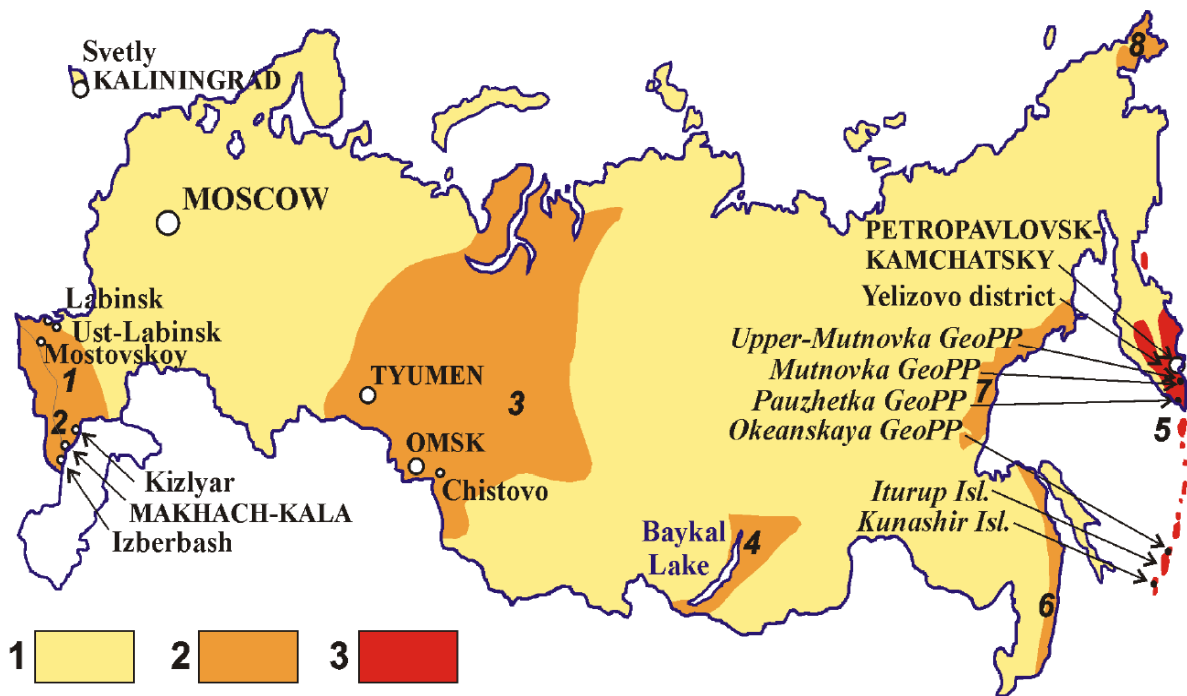


Fig. 1. Promising geothermal areas of Russia: 1 – The North Caucasus (high mountain zone), 2 – the North Caucasus (platform area), 3 – Western Siberia, 4 – the territory adjacent to Lake Baikal, 5 – the Kuril-Kamchatka region, 6 – Primorye, 7-8 – the Okhotsk-Chukchi volcanic belt

### Geothermal energy of the Tomsk region

The West Siberian oil and gas-bearing megabassane has large reserves of thermal waters. A significant part of these sources is concentrated on the territory of the Tomsk region. The central part of the Tomsk region has the greatest geothermal potential. (Fig. 2) [10].

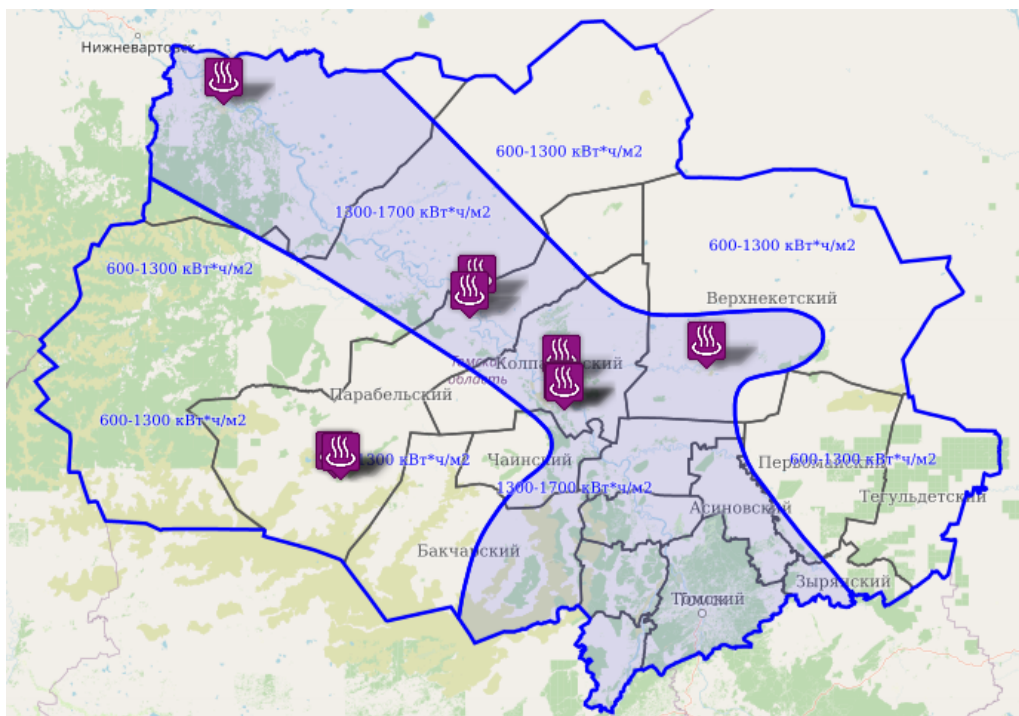


Fig. 2. Map of geothermal sources of the Tomsk region

One of the examples of the implementation of the use of geothermal energy in the Tomsk region is a kindergarten in the village of Turuntaevo (60 km from Tomsk). It was opened in June 2013 in the village of Turuntaevo, Tomsk region and is equipped with a geothermal heating system. According to their energy characteristics, the geothermal waters of the Tomsk region are low-potential and medium-potential, but they can be used not only for heating purposes, but also for generating electricity. Already, work is underway in Tomsk on the development of geothermal energy [11, 12].

### Conclusion

Global warming is one of the most serious problems of modern society. In such conditions, one of the most promising ways to combat it is the use of alternative energy sources, for example, geothermal. Despite the fact that there are no high-temperature geothermal sources in the Tomsk region, modern developments make it possible to provide consumers with electric and thermal energy at relatively low temperatures, due to the implementation of the organic Rankine cycle [13].

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