# POWER-GENERATION POTENTIAL OF THE GEOTHERMAL RESOURCES IN UKRAINE

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Ukraine possesses abundant geothermal resources in the form of underground thermal waters and hot dry rocks.

For the assessment of power generation potential of the above-mentioned resources the administrative regions of Ukraine has been arbitrarily divided into two groups:

1. Group of the regions on whose territory the power is assumed to be generated from the heat of geothermal waters stored in the artesian basins (the regions of Crimea, Donetsk, Zakarpattya, Ivano-Frankivsk, Lviv, Nikolayev, Odessa, Poltava, Kharkiv, Kherson, Czernigiv).
2. Group of the regions on whose territory geothermal resources are represented by the heat of dry rocks (the regions of Vinnitsa, Volyn, Dnepropetrovsk, Zhitomir, Zakarpattya, Kyiv, Kirovograd, Lugansk, Rivne, Sumy, Ternopil, Khmelnitsk, Czerkassy, Czernovitsy).

The following assumptions have been made:

1. Water intake and re-injection sites are to be situated on the territory or close proximity of big cities and settlements;
2. Power generation technology implies the re-injection;
3. The mean values of temperature, porosity and filtration coefficient characteristic of specific regions of Ukraine are taken in the 1000-5000 metres interval;
4. Maximum depth under assessment – 5000 metres;
5. Operating time of power generating units: electric – 7500 hours/year, thermal – 4200 hours/year.

For group I (thermal waters) the power-generation potential was calculated using formula $\mathbf{E = G \cdot C_p \cdot \Delta T \cdot 10^{-6}}$ (1)

where: E – power-generation potential of hydrotherms, MW; G – thermal water flow rate, kg/s; $C_p$ – specific heat of thermal water, assumed to be 4200 J/kg·°C; $\Delta T$ – temperature drop in the heating systems, °C.

$$\mathbf{\Delta T = T_{in} - T_{out}}$$

where: $T_{in}$ – temperature of water at the heat exchanger inlet; $T_{out}$ – same at the exchanger outlet.

In the calculations $\Delta T$ is assumed to be 30°C.

The estimation results:

1. Geothermal resources of Ukraine can be used for the generation of heat (heat-generation potential) and electricity (electricity-generation potential).
2. Estimated technically accessible power generation potential of Ukraine is: for thermal waters of artesian basins with the temperature of up to 100°C – 33,12 mln MWh/year; for dry rocks – 18.02 mln MWh/year.
3. Technically accessible power generation potential of superheated geothermal waters with the temperature exceeding 150°C amounts to 2.36 mln MWh/year.
4. To harness the above-mentioned potential it is necessary to create in Ukraine heat generating units with total capacity of 12390 MW and electricity generating units with total capacity of 414 MW.

5. Harnessing the technically accessible geothermal power-generation potential would make it possible to save annually 8 mln tons of conditional fuel (C = 7000 kcal/kg), that is 9% of the amount of fuel consumed for power generation by the Fuel and Energy complex of Ukraine.
6. The economic studies revealed that at current prices as well as normative and legal base in Ukraine specific capital investments in the geothermal units under construction will not exceed 600 USD/kW for heat generating units and 1200 USD for electricity generating units. Energy production cost is under 6 USD/MWh of heat and 20 USD/MWh of electricity, the payback time for power generating units averages from 4 to 9 years.