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Evaluation of hydorhermal resources of Lithuania, the well specific approach

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Lithuania is located in the eastern part of the Baltic sedimentary basin. The thickness of the sedimentary pile changes from 200 m in the southeast to 2300 m in west Lithuania. Two major geothermal aquifers are defined, referred to as Cambrian (30-70 m thick) and Lower Devonian (up to 120 m thick) dominated by sands and loosely cemented sandstones with subordinate shales and siltstones. The geothermal potential of different layers is different owing to different reservoir properties, thickness, and temperature. The latter parameter is controlled by depth and heat flow intensity which is twice as high in west Lithuania (70-80 mW/m2) as that in east Lithuania (40-50 mW/sq.m) The highest temperature close to 100degC is registered in Middle Cambrian sandstones of southwest Lithuania.

The methodology of the heat potential calculation was developed that is based on well specific parameters evaluation. It owes to dense distribution of deep wells in Lithuania that allows rather detailed heat potential mapping. The heat potential (MWth) is calculated for the well duplet (production-injection) for each well site (or well group site). It allows compilation of the heat potential map (MWth) for prospective geothermal aquifers in a country scale.

Aquifers of temperature exceeding 35degC were considered as potential formations for district heating application. The Cambrian geothermal aquifer covers the largest (29,800 km2) area in Lithuania. The most prospective area is confined to temperature range 35-65degC. A severe quartz cementation, dramatically reducing reservoir properties of Cambrian sandstones, occurs at higher temperatures, while average porosities are in the range of 22-15% within 35-65degC temperature interval. Assessment of geothermal resources show that 1-2 well doublets cover heating needs of individual towns. The well doublet extracted heat potential is estimated to range from 0.5 to 6.5 MWt. The depth in the potential area varies from 1 km in middle Lithuania to 2 km in west Lithuania.

The prospective area of the Lower Devonian geothermal aquifer covers much smaller part (810 km2) of Lithuania due to shallower depths ($\sim$1 km). Temperatures are in the range of 35-50oC in the prospective area. It is characterised by very high reservoir properties (average porosity 26%, permeability is 2-4 D). The extracted heat potential of well doublet is in the range of 4-9 MWt. Klaipeda geothermal power station exploits 38degC hot water of this reservoir.