

Temperatures and potential geothermal resources in the Piceance Basin, Colorado

Paul Morgan

Colorado Geological Survey, USA

Bottom-hole temperature (BHT) data have been compiled from 10,372 hydrocarbon wells in the Piceance basin with an average depth of 2103 ± 685 m (\pm one standard deviation). The data were combined in 0.4 by 0.4 degree blocks by their geographic coordinates and average geothermal gradients calculated for each block. Gradients ranged from 22.7 to 41.8°C/km. Block gradients corrected for the disturbance caused by drilling ranged from 27.3 to 51.5°C.km. Uncorrected BHTs indicate geothermal resources at temperatures of 100 to 250°C at depths of 2.5 to 5 km. Corrected BHTs reduce these depths to 1.7 to 4.2 km. Generally permeability at these depths is low. The Leadville Limestone, a Mississippian karst-forming limestone is likely to underlie most of the basin, shallowing on the southwest margin of the basin. Observations of this limestone at other locations indicate that it is a very permeable aquifer. Production from similar fractured karst limestone aquifers in Germany has generated ≥ 3.0 MWe from single wells. Alternatively, impermeable strata could be hydraulically fractured to produce an enhanced/engineered geothermal system (EGS). In addition to power production, geothermal systems are being investigated in northern Alberta, Canada, as a source of thermal energy for in situ extraction of hydrocarbons from oil sands. Geothermal energy is an environmentally clean source of energy for these processes. Direct use of geothermal energy from the Piceance Basin, and similar sedimentary basins associated with hydrocarbon resources, could provide economic and clean energy for enhanced hydrocarbon extraction. For oil shale in the Piceance Basin, geothermal energy might be tapped either for power generation or for preheating of oil shale for in-situ extraction of hydrocarbons.