

Energy value and economical utilization of the Himmetoglu (Bolu, Turkey) oil shale

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With a reserve of 1.6 billion tons, Turkey has a significant oil shale potential. The most important oil shale deposits are located in Beypazari (Ankara), Seyitomer (Kutahya), Hatildag (Bolu) and Himmetoglu (Bolu) in northwestern Turkey. The oil shale deposit at Himmetoglu is situated about 200 km WNW of Ankara. The oil shale occurs in a 75 to 124 m thick calcareous-dolomitic bituminous limnic series of Miocene age, overlying a lignite which is mined in open cast. The organic material of the bituminous sediments consists of laminated algae and pollen, the latter mainly derived from conifers. The economic grade oil shale (EGOS), defined by a minimum thickness of 5 m, occurs in the lowermost section of the bituminous sequence mostly immediately overlying the lignite; it is 5 to 35 m thick and the upper calorific values range from 750 to 799 kcal/kg. On average the thickness is 25.4 m, upper calorific value is 777 kcal/kg (1.86 MJ/kg) and the oil content is 4.6% (51 l/t), and the mean total sulphur content is 0.92%. The EGOS of the sequence is on average of poor quality, although it contains the Himmetoglu oil shale (HOS), an extremely rich oil shale with an oil content of 43% (482 l/t) and upper calorific value of more than 5000 kcal/kg (11.94 MJ/kg). The high grade oil shale tends to spontaneous combustion in the tailings and is burnt out in outcrops at the field. The reserves of economic grade oil shale amount to 150 million tons. From these approximately 90% are mineable by open cast, if underlying lignite is also mined. The HOS is occasionally used for domestic purpose; the industrial utilization of the EGOS, however, is due to its properties and reserves at best given by the fluidized bed combustion (FBC) technology for the generation of electricity. The suitability of the oil shale was demonstrated by a pilot plant test by the Vereinigte Kesselwerke (VKW) in Düsseldorf, Germany. As a first step, three channel samples were taken in an open pit, which at this time was the most suitable site for excavation. The three channel samples covered in total 12.8 m of the bituminous sequence that immediately overlies the lignite. The results of the analyses provide evidence of the general suitability of the layers and 100 t oil shale and 50 t lignite were excavated and sent to Germany by trucks. The best results with very low air pollutant emissions were obtained with mixtures of oil shale with up to 40% lignite.