

## 20.22 **Adaptation of Galoter Technology for High Sulfurous Oil Shale in Arid Region**

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A feasibility study for development of the El-Lajjun Oil Shale Project was elaborated by TTU Ltd, Russian Federal R&D Institute Atomenergoproekt and Science & Technical Center Ecosorb in 2007. Installations with solid heat carrier UTT-3000 based on the Galoter method are considered for oil shale processing. Eighteen UTT-3000 systems will be required for production of 30,000 barrels of oil per day. Two main problems were resolved in conceptual design: lack of water in the region and high sulphur content in the oil shale.

Jordan is classified among few countries of the world with limited water resources and it is one of the lowest on a per capita basis. In conditions of lack of water the closed circulation scheme was elaborated for water supply. Pyrogenetic water from oil shale is recovered and used for internal needs as well. Specific water consumption for needs of processing oil shale and power generation makes 0.7 barrels of water for producing 1 barrel of oil. Another problem is the high sulphur content in oil shale. Desulfurization of oil using a hydrogenating process will require additional investments and water supplies. TTU has elaborated the technology of cleaning shale oil with production of high value products without hydrogenation. The method comprises two stages:

- applying a special mode of air-fountain furnace operation providing destruction of carbonates to active lime that binds sulfur to gypsum in the process of contacting with shale and the vapour & gas mixture. Gypsum leaves the process with ash.
- Treatment of sulfur of the thiophene group remaining in the vapour & gas mixture by a special method of extractive rectification. The method and apparatus are protected by patents issued by Ecosorb.

The UTT installations can be added to oil & gas fired power plants for smoothing peaks in large electric networks. The opportunity of regulation of an output of liquid and gaseous products from UTT over a wide range allows switching quickly from manufacture of fuel to manufacture of electric power. The UTT complex can be added to cement works - it is possible to produce cement clinker from cyclonic shale ash.