Economic and technical analysis of two options for an in situ oil shale retort

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An in situ oil shale retort operation with output of 50,000 bbl/day of refinery-ready shale oil was modeled for two different cases employing a closed-loop piping system to deliver retorting heat in the form of high-pressure steam to a subsurface zone. The retorting heat was delivered from a gas-fired burner in the base case, and from a high temperature gas-cooled nuclear reactor in the hybrid case. Over 75% of the produced gas in the base case was used to generate the heat needed for the retort process; whereas in the hybrid case, the full gas stream was available for sale. The base case produced more than 12 times more CO_2 and 42% more electricity than the hybrid case. The total heat input into the base and hybrid cases was 91,892 and 82,473 million Btu/day respectively. The energy return on investment (EROI) was 4.44 for the base case and 4.80 for the hybrid case. Based on the EROI, the analysis identified the in situ heat transfer rate as the most critical input parameter, followed by the recoverable fraction of the generated oil and gas, and the composition of the kerogen in the oil shale. The economic analysis concluded that both cases were economically feasible assuming an oil price forecast of \$60/bbl. Other critical economic input variables included the project discount rate, the CO_2 emissions tax, drilling costs, natural gas price forecast, and surface facilities capital costs.