

12.2 Radio-Frequency In Situ Heating to Extract Shale Oil

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The use of electrical energy to extract oil from unconventional reservoirs is attracting interest because the cost is lower compared with conventional methods, and also because the environmental impacts can be greatly reduced. Some of the early work done by IIT Research Institute [IITRI] is summarized and then re-appraised in light of additional technical developments.

In the 1970s and 1980s IITRI developed and field tested an in-situ radio frequency heating system to recover oil from shale. Special arrays of electrodes are imbedded in the deposit. This is functionally similar to a microwave oven, although lower short wave frequencies are used. Traditional antennas are not used because these heat unevenly. As funded by The U. S. Department of Energy (DOE) and Halliburton, two small scale field tests demonstrated that high quality oil and gases could be recovered. These results confirmed the technical feasibility of extracting oil in-situ from oil shale. Subsequently the Bechtel Group, as funded by Occidental Oil, and later by Parsons Brinckerhoff, designed a plan to extract oil from large blocks by RF heating. Heating times are in the order of months. Capital and operational cost were found to be highly competitive with conventional oil extraction systems. The oil produced would contain three times the energy needed to produce the electricity in a combined cycle power plant, and the CO₂ emissions from the power plant would be 1/3 of those from a conventional 1980 oil shale retorting process. Tests on other hydrocarbon-rich media, such as tar sand not only demonstrated good recovery, but also proved that the heating pattern in the tar sand deposit matched predicted values. After the oil price collapse, work continued on treating hazardous waste spills with RF energy. Volumes of soil up to 350 m³ were heated up to 350°C. More recently, a method to efficiently use intermittent wind power from the grid was developed; thereby further reducing CO₂ emissions and water consumption. In-situ electrical powered heating methods to extract oil from the Alberta oil sands are currently reported to be highly successful, and this suggest similar results, may be in the offing for the USA.