Numerical Simulation of Horizontal Alternate Steam Drive (HASD) for Heavy Oil Fields in the Marañon Basin

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Abstract

The Heavy oil reservoirs in Marañon Basin in Peru have been exploited for more than 40 years under primary recovery techniques using mainly deviated and horizontal wells with ESP pumps. "Cold production techniques" only accounted for a recovery factor ranging in between 12% and 15 % with a vast potential of remained oil. What is more, high viscosities and heterogeneities affect well productivity, which creates the perfect scenario for the implementation of different thermal recovery methods.

Innovative techniques are highly required in the oil and gas industry to meet the future demand of the hydrocarbon fuels; as a consequence, significant efforts have been deployed on the development of new innovative technologies to increase the oil recovery; Horizontal wells and steam injection are becoming a very important component in the thermal recovery of heavy oil reservoirs; Steam Assisted Gravity Segregation (SAGD) and Cyclic Steam Stimulation (CSS) are two of the most successful technologies worldwide.

Horizontal Alternate Steam Drive (HASD) is a repetitive pattern that uses horizontal wells with equal depth which alternate as producers and steam injectors; the main recovery process is horizontal steam flooding between consecutive wells and is more efficient than the traditional cyclic steam injection to achieve an effective sweep in the vicinity of the producers while decreasing oil viscosity and improving oil drainage.

A conceptual simulation model was built to evaluate production performance and estimate a recovery factor of SAGD and HASD processes in a heavy oilfield of Marañón Basin (as compared with cold production); a local-grid-refined sector was used to model the heat transfer process, as well as, oil drainage. Deliverables of the study include a matrix with recovery factors of each development scenario, as well as, some recommendations towards its implementation.

The HASD process looks very promising for a feasibility study with an expected recovery factor between 30 – 40%; this project aims to bridge the gap that Peru has in Thermal Recovery and EOR processes.