

# Gravity-Assisted Drainage Techniques for Heavy Oil Recovery in Trinidad – A Review of Macroscopic Processes and Film Drainage Considerations

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## **Abstract**

Crude oils of viscosity higher than 20 cp and a density close to that of water ( $>0.96\text{gm/cc}$ ,  $^{\circ}\text{API}<20$ ) are difficult to recover from the reservoir. Such oils are commonly termed 'heavy oil'. Trinidad has over 2 billion barrels of heavy oil. New process designs using horizontal wells and heat (steam) or volatile solvents such as SAGD (Steam Assisted Gravity Drainage) and Vapex (Vapour Extraction) can allow gravity to enhance the production process. These processes lower the viscosity of the oil by warming or by dilution, and the oil is produced by gravity drainage (vertical movement of fluids) to horizontal wells placed lower in the reservoir. They can be effective in producing more of the oil using less energy and at lower production costs. This paper describes these extraction techniques for heavy oil, particularly SAGD and Vapex. The gravity drainage processes at the macro- and micro- scale are examined and some experimental work is presented to demonstrate the importance of viscous film flow by gravity drainage. Finally, the new processes are discussed in the context of Trinidad's heavy oil reservoirs.

**Keywords:** Heavy oil, gravity drainage, thermal recovery, horizontal wells, viscosity reduction, SAGD, Vapex