

New Heavy Oil Production Technologies

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ABSTRACT

New production technologies are having a large impact on Canadian heavy oil production and will also increase oil recovery ratios in conventional oil, making many marginal and weak projects profitable. As world conventional oil production peaks in the next few years, these technologies will become vital to the international petroleum industry. Several new production technologies will be discussed, and the emphasis will be on the engineering and geological screening criteria that are used to identify optimum reservoirs for different cases. The geology of successful examples of each technology will be presented. Also, the key aspects of the physical mechanisms behind the processes will be discussed.

CHOPS (Cold Heavy Oil Production with Sand)

Thousands of shallow wells in Canada produce 10 - 300 b/d of viscous oil along with 0.1-10% of the formation sand; if sand is excluded, these wells cease economical production. CHOPS enhances oil rates because sand movement decreases flow resistance, sand production creates a high permeability region around the well, gas bubbles in the oil provide a drive mechanism, and sand movement reduces or eliminates pore throat blockages. CHOPS production exceeds 600,000 b/d in Canada (>20% of Canada's production), and the technology is beginning to spread to other sedimentary basins with unconsolidated heavy oil deposits (Venezuela, Oman, China).

PPFE (Pressure Pulse Flow Enhancement)

Dynamic liquid phase pressure pulsing enhances liquid flow rate through porous media. It can also help overcome capillary barriers, reduce pore throat blockage, and suppress viscous fingering. To date, PPFE has been used in ~100 heavy oil well workovers and in four small full-field projects where it enhanced oil flow rates to surrounding wells. PPFE is extremely economical and promises to become a powerful IOR approach for liquid-dominated systems.

GAD (Gravity-Assisted Drainage methods)

Several technologies based on phase density segregation have been developed (e.g.: inert gas injection, steam-assisted gravity drainage, vapor-assisted petroleum extraction). Properly implemented and managed, these can be used to connect to bypassed and isolated oil bodies, and will give high ultimate recovery ratios in both new and old fields.

HWCSS (Horizontal Well Cyclic Steam Stimulation)

The instabilities associated with conventional CSS can in large part be overcome through the use of arrays of horizontal wells. The reason is geomechanical: stresses are redistributed in a more effective way in HWCSS, providing that it is properly executed. Production mechanisms in HWCSS include three sources of energy: re-compaction, gravity drainage, and Darcian diffusion.