

THERMAL RECOVERY

Thermal recovery comprises the techniques of steamflooding, cyclic steam stimulation, and in situ combustion.

In steamflooding, high-temperature steam is injected into a reservoir to heat the oil. The oil expands, becomes less viscous and partially vaporizes, making it easier to move to the production wells. Steamflooding is generally used in heavy oil recovery to overcome the high viscosity that inhibits movement of the oil.

Cyclic steam stimulation, also known as the "huff-and-puff" method, is sometimes applied to heavy-oil reservoirs to boost recovery during the primary production phase. Steam is injected into the reservoir, then the well is shut in to allow the steam to heat the producing formation around the well. After a sufficient time, generally a week or two, the injection wells are placed back in production until the heat is dissipated with the produced fluids. This cycle may be repeated until the response becomes marginal because of declining natural reservoir pressure and increased water production. At this stage a continuous steamflood is usually initiated to continue the heating and thinning of the oil and to replace declining reservoir pressure so that production may continue.

In situ combustion, or "Fireflooding," is commonly used to recover heavy oil that is too viscous to be produced by conventional means. The fireflood is generally maintained by igniting air to create a combustion zone that moves through the formation toward production wells. The intense heat forms zones of steam and vaporized oil that move in advance of the combustion zone toward production wells, where the oil, water, and gases are brought to the surface and separated.

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This is accomplished either by hot fluid injection (hot water or steam) or *in situ* combustion (burning a part of the crude oil in place). Variations of these methods improve production of crudes by heating them, thereby improving their mobility and ease of recovery by fluid injection.

