Unconventional Oil

Unconventional reserves of oil are not strictly defined, and are as diverse as shale oil and bitumen, liquids derived from gas and coal, as well as heavy oil and extra-heavy oil, all of which are potential sources of synthetic crude oil.

Bitumen

From Oil Sands / Tar Sands

Bitumen is not oil or tar, but a black, semisolid degraded form of oil. Naturally-occurring bitumen is found in rock deposits called “oil sands” or “tar sands”, which are composed of clay and sand particles with water and bitumen in the interstices.

Bitumen in shallow oil sands can be recovered using surface mining techniques, but about two tons of oil sand must be mined and processed to produce one barrel of synthetic crude oil.

Open pit bitumen mining in Alberta, Canada.

The world’s largest known deposits of bitumen are in northern Alberta, Canada. It is estimated the Albertan oil sands contain 280 to 300 billion barrels of recoverable bitumen, which is at least 85% of the world's total known bitumen reserves.

(photograph courtesy of Suncor Energy Incorporated, www.suncor.com)

Bitumen can be recovered from deep oil sands by injecting steam into the oil sand deposits, reducing the bitumen’s viscosity, increasing the reservoir pressure, and enabling the bitumen to flow to recovery wells. The recovered bitumen is then processed into synthetic crude oil.

(M.Sexton, 2002, University of Fairbanks, Alaska; ffden-2.phys.uaf.edu)

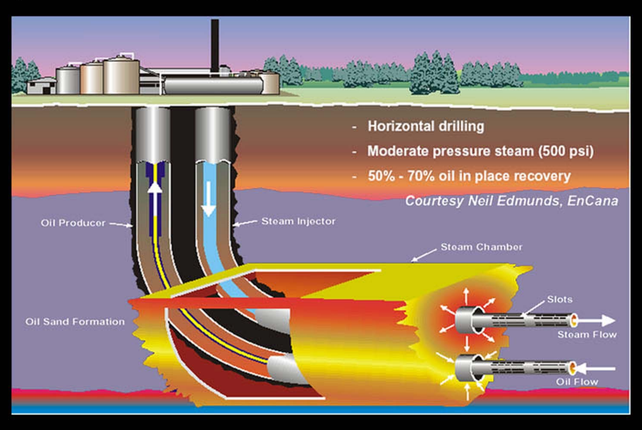

Diagram of “steam-assisted gravity drainage” method of extracting bitumen from oil sands.

(diagram courtesy of EnergyINet Inc., December 8, 2005, www.energyinet.com)

Shale Oil

Kerogen from Oil Shale

Kerogen is bacterially altered organic plant and animal material, found typically in shale rock, which has not gone through the “oil window” of heat needed to alter it into liquid petroleum. However, kerogen can be converted into a synthetic crude-like oil, called “shale oil”, through a heating process called retorting.

The world’s largest known deposits of oil shales are located in the western United States - predominantly Colorado, Utah and Wyoming. These deposits are estimated to be nearly 62 percent of the world’s potentially recoverable oil shale resources, and could yield more than one trillion barrels of synthetic crude oil. *(www.worldenergy.org)*

Shallow kerogen deposits are mined in open pits; typically, the shale will yield 15 gallons or more of synthetic oil per ton of mined rock.

(U.S. Bureau of Land Management, www.ut.blm.gov)

Unocal operated a large-scale experimental kerogen mining and retorting facility in the Parachute Creek, Colorado (photograph, above) which opened in 1980. Unocal produced 4.6 million barrels of synthetic crude oil from Parachute Creek, averaging 34 gallons of shale oil per ton of rock over the 10-year life of the project. Despite a Federal contract to purchase the synthetic shale oil for $41.50 per barrel - about twice the market rate at that time - the synthetic crude could not be produced profitably and the plant was closed in 1991.

(Energy Minerals Department, www.aapg.org, May 2005; and High Country News, www.hcn.org, March 2002)

Oil shale retort, circa 1900s

(photograph courtesy of Office of Naval Petroleum and Oil Shale Reserves, U.S. DOE)

A recovery method under development for deep kerogen deposits involves heating the oil shale *in situ* to release kerogen which is then recovered via wells. This method requires large amounts of power and four to five years to heat the shale up to the 600 to 650 degrees F needed to release the kerogen. *(www.denverpost.com)*

Heavy Oil

Viscous and Thick Crude Oil

Deposits of dense and viscous *heavy oil* are thought to be remainders of former “conventional oil” from which lighter hydrocarbon components have been degraded away. The term “heavy oil” is applied to any crude oil which does not flow easily, and relates to specific technical issues regarding pumping, transportation, and refining of these viscous oils. Generally, a viscosity-reducing diluent is added to heavy oil at regular distances in pipelines to maintain its flow.

Processing heavy oil produces upgraded synthetic crude oils with gravities ranging from API 20 degrees to 30 degrees. *(www.hydrocarbons-technology.com)*

The Hamaca project area in the Orinoco tar belt, Venezuela.

Heavy and extra-heavy crude oil deposits in Venezuela’s Orinoco oil belt represented nearly 90 percent of the known extra-heavy oil in the world as of 2005, with an estimated 270 billion barrels recoverable. *(www.worldenergy.org)*

(photograph courtesy of www.hydrocarbons-technology.com)

U.S. Strategic Unconventional Fuels

The Energy Policy Act of 2005

In the 2005 Energy Policy Act section entitled “Oil Shale, Tar Sands, and Other Strategic Unconventional Fuels”, it is stated that “United States oil shale, tar sands, and other unconventional fuels are strategically important domestic resources that should be developed to reduce the growing dependence of the United States on foreign oil imports.”

To that end, the overarching mission of that section is to coordinate creation and implementation of a strategic fuel development program through commercial leasing of public lands for research and development of oil shale and tar sands resources.

The Roan Plateau, Colorado

The United States’ oil shale resources underlay a total area of 16,000 square miles, more than 70 percent of which is on Federal landholding. There exists enough recoverable oil to meet U.S. demand at current levels for 110 years.

(photograph by Ed Andrieski; courtesy of multicmedia.msn.com)

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