

Exploration and production issues in South Asia



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ARTICLE INFO

Article history:

Received 13 May 2013

Revised 25 July 2013

Accepted 24 September 2013

Available online 7 December 2013

Keywords:

CBM

Extra heavy oil

Natural gas hydrates

Oil sands and shales

Shale & tight gas

ABSTRACT

The rapid depletion of the conventional oil resources combined with the regional unrests and skyrocketing crude oil prices have paved way for unconventional oil and gas resources to emerge as the latest game changer in the world energy scenario. Unconventional resources though discovered about a century back never gained momentum due to the complexities of the technologies involved and more primarily due to the readily available conventional sources. The south Asian countries are heavily dependent on their oil imports from the Middle East nations. Due to the increasing instability in the rise of oil prices coupled with regional instability, these nations should invest in production of alternate resources to meet their future energy requirements. In the present day scenario, unconventional resources should be considered as a bridging option between rapidly depleting conventional resources and the nascent upcoming renewable and thorium (nuclear) based energy sources.

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Introduction

The impetus for the search of oil & natural gas resources across the world has been a never ending endeavor for developed and the developing nations. Due to the increase in oil prices and the increasing tensions in the Middle Eastern oil empires has forced nations to look out for other productive areas for exploration. Due to the wide spread depletion of oil resources, Nations have directed their areas of interest towards unconventional oil and natural gas resources. The focus on unconventional resources has come under severe hammer due to the compromise on investments on coal, nuclear and other renewable energy resources. The cost of conventional oil has escalated in many folds during the recent years and has posed a serious threat to the proclaimed “energy independence” claimed by developed nations.

Unconventional oil and gas resources

The unconventional resources are found in abundance across the world and when utilized in a pristine manner will definitely emerge as a game changer in the present world energy scenario (Fig. 1). The most common unconventional oil and gas resources explored around the world are enlisted below:-

- (i) Oil sands.
- (ii) Oil shale.
- (iii) Extra heavy oil.

- (iv) Tight gas.
- (v) Shale gas.
- (vi) Coal bed methane.
- (vii) Natural gas hydrates.

Oil sands

Oils sands are known by various names in different parts of the world depending on its composition or appearance. They are often called as Tar sands (Fig. 2) but technically known as bituminous sands due to the denser composition (Sikdar et al., 2009a). These oil sands mainly comprises of a mixture of denser form of petroleum along with water, loose sands and stones. The major barriers in the oil sand drilling are:-

- (i) Increased Green House Gas (GHG) emissions compared to drilling/processing of conventional oil sources.
- (ii) Requires large quantities of water.
- (iii) Land deterioration-Huge scars on land post drilling operations.

Oil shale

Kerogen a solid organic chemical compound found in sedimentary rock formation is known to produce liquid hydrocarbons known as Kerogen shale or more commonly called as oil shale (Sikdar et al., 2009b). Oil shale when subjected to pyrolysis forms a vaporous substance which on condensation yields combustible oil. Oil shales can be burnt directly so, it has been effectively utilized as a low grade fuel in power generation systems. There

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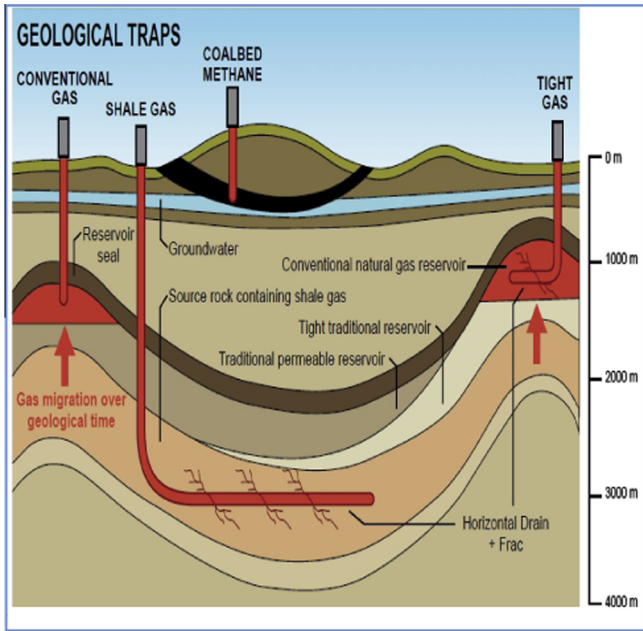


Fig. 1. Unconventional resources, Vertical drill extraction and horizontal drilling with Fractures.

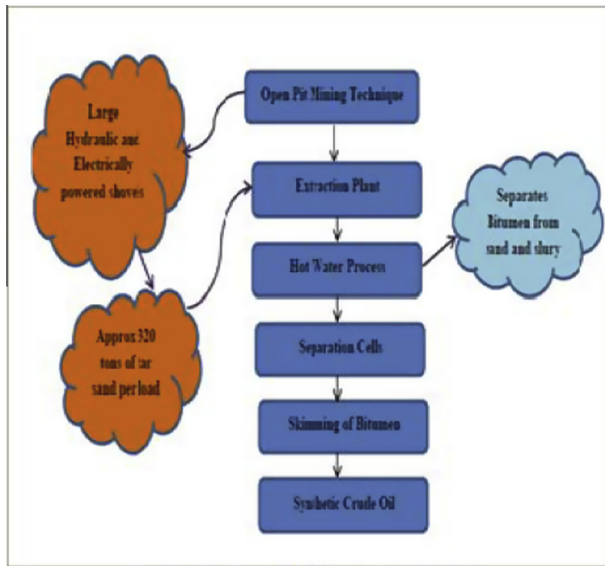


Fig. 2. Processing method of oil sands.

are various methods of extraction techniques mastered over the years, the wide prevalent being the technique employed by M/s Shell which later came to be known as the Shell technique (Fig. 3). The barriers in drilling of oil shales include:-

- (i) Increased green house gas emissions.
- (ii) Increased generation of waste material due to combustion and thermal processing.
- (iii) Ground water pollution and severe water contamination.

Extra heavy oil

Extra heavy oil or heavy crude oil has higher specific gravity and viscosity (Sikdar et al., 2009a). They have an API (American Petroleum Institute) gravity lesser than 10 and a specific gravity greater than 1. These Extra Heavy Oils poses a variety of problems

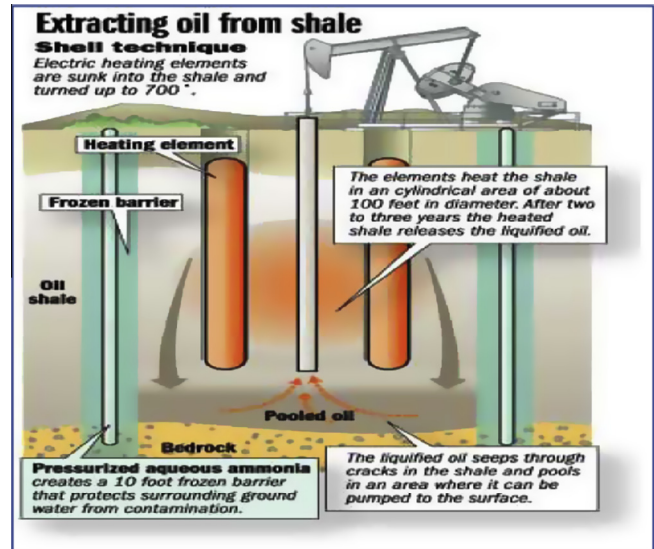


Fig. 3. Shale oil extraction-electric heating method. Courtesy: shell.

including production, transportation and during refining. For transportation over long distances there is a need for diluent to be added to the extra heavy oil. The barriers encountered in the extraction of extra heavy oils:-

- (i) Generates 03 times of CO₂ emissions when compared to conventional counterparts.
- (ii) Higher production/recovery cost due to high utility costs due to techniques such as steam flooding and steam stimulation.
- (iii) Increase in transportation cost due to the addition of the solvent blender to reduce viscosity of the oil.

Tight gas

Natural gases containing a mixture of sandstone or carbonate mix and possessing permeability less than 0.1 millidarcies ($1 \times 10^{-16} \text{ m}^2$) are known as tight gas (Lea et al., 2008a). The gases found in the rocks are irregularly distributed and are interconnected by very narrower capillaries. Various secondary production methods viz., direction drilling, acidization and artificial shifting (beam pumping) are employed in order to make production of tight gas economical.

Shale gas

Natural gases present in shales are known as shale gas and are extracted from natural fractures. Commonly shale possess low permeability matrix. The recent boom in shale gas is attributed to hydraulic fracturing technology for its ability to create artificial fractures on shales. Generally the gas availability from shale is calculated by two features:-

- (i) Risked gas in place-calculated by estimation of gas in place and later by de-rating the same considering resource knowledge and available technology.
- (ii) Technically Recoverable Source (TRS) is calculated by multiplying gas in place with shale gas recovery factor.

Coal Bed Methane

Coal Bed Methane (CBM) is form of natural gas extracted from the coal beds/mines. The production of Coal Bed Methane is

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