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Current Scenario and Future Prospects of Shale Oil & Gas in India

ALOK KUMAR GAUTAM, MD ISA

STUDENTS DEPARTMENT OF PETROLEUM ENGINEERING, UTTARANCHAL INSTITUTE OF TECHNOLOGY (UTTARANCHAL UNIVERSITY), DEHRADUN

Abstract - *Unconventional oil resources are more important in the quest for energy security. This is concern that conventional oil resources will be not able to meet major supply requirements. This concern has triggered a scramble to secure long-term oil supplies. In a high oil price environment, unconventional resources are indicate as important and sparing attractive components of future oil supplies.*

Shale gas is gas created from sedimentary rock formations. Gas sedimentry rock are organic-rich sedimentry rock formations. In terms of its chemical makeup, sedimentary rock gas is largely a dry gas composed of paraffin. Various factors that have contributed to its speedy development area unit primarily advancement in horizontal drilling, hydraulic fracturing, & may be most significantly,

India has high potential of sedimentry rock reserves. According to sources, a comprehensive sedimentary rock gas trial applied in Damodar vale Basin, has created associate degree an initial gas-in-place estimate of 300-2,100 trillion blockish feet (tcf) in Indian sedimentary rock gas basins that is around three hundred times more than Krishna Godavari (D6) Basin, out and away the biggest gas field within the country. In matured Cambay Basin wherein more than 5000 wells have been drilled and initial oil in-place of the order of 1150 million tonnes have already been established.

With most of the conventional oil already depleted, business hopes to extend liquid provide through the evolution of unconventional resources. The paper reviews the evolving plays and technologies that impact the event and way forward of the sedimentary rock resources in Asian nation.

0Key Words: Rich sedimentary rock, Important Indian basin, Using technologies, challenges, future aspect, Government policies.

1.INTRODUCTION

Shale gas & oil is defined as natural gas & oil from sedimentry rock formations. The sedimentry rock acts as both the source and the reservoir for these unconventional hydrocarbons. Older sedimentry rock wells were vertical while more recent wells are primarily horizontal and need artificial stimulation, like hydraulic fracturing, to produce. Only sedimentry rock formations with certain characteristics will produce gas and oil. The Government of India has carried out studies through various national and international agencies for the identification of sedimentry rock oil and gas resources in the country. Based on the info. Accessible from typical oil/gas exploration within the country for the last numerious years, the country holds promising reserves of Shale Gas & Oil resources and the following matter basins are square measures thought about prospective from sedimentary rock oil and gas purpose of view:

Three such unconventional gas resources square measure tight gas reservoirs, coal bed alkane, and sedimentary rock gas. These resources hold great potential as a source of natural gas and at the moment extensive work is being done for the development of these resources across the world. However, the technological advancements, environmental benefits, long term potentials, and attractive gas prices bring unconventional gas resources more rather than oil into the forefront of our energy future. Nowadays the world is witnessing an increasing demand of gas and thus unconventional gas resources development has the focus of increased attention. In future, a significant percentage of the world's energy demands will be satisfied by the natural gas. Gas consumption will increase and it will be a key factor in the future economic performance and strategic stability of any nation. Some expert believe that vulnerability of gas increase that of oil by 2025.

1.1 Shale Gas: A Promising Unconventional Resource:

Shale gas is natural gas produced from sedimentry rock. Shale is a fine-grained, clastic sedimentary rock composed of mud that is a mix of flakes of clay minerals and tiny fragments (silt-sized particles) of other minerals, especially quartz and calcite. Shale gas is outlined as a finegrained reservoir within which gas is self-sourced, and some of the gas is stored in the sorbed state. Sorbed gas is predominantly keep within the organic fraction – therefore organics are present. Shale gas is not just "sedimentry rock". Productive gas sedimentry rocks range from organic-rich to finegrained rocks.

Shale has low matrix permeability, therefore gas production in commercial quantities porousness. Shale gas has been made for years from sedimentary rocks with natural fractures; the sedimentry rock gas boom in recent years has been due to modern technology in hydraulic fracturing to from in depth artificial fractures around well bores. Horizontal drilling is often used with sedimentry rock gas wells, with lateral lengths up to 10,000 feet (3,000 m) within the sedimentry rock, to create maximum borehole surface area in contact with the sedimentry rock.

The gas is produced by inducing fracs preferably by water from multilevel completions. The pressures are generally low but the length of production period compensates by volume. Among various unconventional gas resources; the Coal Bed Methane (CBM), tight gas, and sedimentry rock gas are being commercially exploited in the US and Canada, Australia, China etc in different proportions (see Figure 1 and Figure 2). India too has kept pace with the CBM industry but the tight gas and sedimentry rock gas are yet to find a place in the country's energy basket.

1. 2 Various Agencies Estimation :

Various agencies have estimated the sedimentry rock gas resource potential in selected sedimentary basins/ sub-basins as indicated below: Schlumberger: 300 to 2100 TCF of sedimentry rock gas resource for the country (as available in public domain)

Energy Information Administration (EIA), USA in 2011: 290 TCF of sedimentry rock gas in 4 basins (Cambay Onland, Damodar, Krishna Godavari Onland & Cauvery Onland)

Energy data Administration (EIA), USA in 2013: 584 TCF of sedimentry rock gas and eighty seven billion Barrels of sedimentry rock fossil fuel in four basins (Cambay Onland, Damodar, Krishna Godavari Onland & Cauvery Onland)

ONGC: 187.5 TCF of sedimentry rock gas in 5 basins (Cambay Onland, Ganga Valley, Assam & Assam-Arakan , Krishna Godavari Onland & Cauvery Onland)

2. RECENT EXPLORATION:

April 2014 estimated Technical Recoverable volume of 62 million barrels of sedimentry rock oil for Cambay Basin and more than 3.7 TCF of technical recoverable gas for Tight arenaceous rock for Cambay & KG basins. Further, USGS has indicated that these basins have also potential for sedimentry rock oil.

Ministry of Petroleum & Natural Gas, Govt. of India vide policy dated 14th October 2013 granted permission for Shale gas and oil exploration and exploitation initially only by NOCs (ONGC & OIL) in on-land nomination blocks i.e. blocks awarded to the NOCs on nomination basis before the advent of Pre-NELP and NELP PSCs. The policy was proclamed with exclusive purpose of promoting Sedimentry rock Gas & Oil operations within the existing onland PEL/PML areas underneath Nomination acreages within the overall interest of energy security in the country. As per the policy, the NOCs have been permitted 3 Assessment Phases for exploration (Phase I, II & III) of 3 years. As per the Policy, the NOCs area unit indebted to hold out committed work program in respect of following for every known block:

- Baseline EIA study let in sourcing of water and its subsequent to disposal.
- G&G Studies
- Drilling of pilot/test wells Coring,
- hydro-fracturing etc.
- Geochemical studies Geo-mechanical/Geo-hazard/Geo-technical studies
- Resource Assessment for Sedimentry rock Gas and Oil
- Minimum no. of PEL/PML areas to be taken up by the NOCs during every Assessment Part is specified in the Policy and is as follows: Company/Phase ONGCOIL
- **Table -1:**

Company/Phase	ONGC	OIL
PHASE1	50	5
PHASE2	75	5
PHASE3	50	5
PHASE4	175	
GRAND TOTAL	190	

- However, the corporate shall have the freedom to take-up additional no. of PEL/PML areas for Sedimentry rock Gas exploration & exploitation.

Current Standing on Exploration of Sedimentry rock Gas & Oil: As per the policy tips, ONGC have discover and initiated exploration activities for sedimentary rock Gas & Oil in 50 proposed blocks respectively under Phase-I. The details of known blocks by ONGC area unit as under:

India has huge sedimentry rock deposits across the board Gangetic plain, Assam, Gujarat, Rajasthan, and many coastal areas.

India contains a number of basins with organic-rich sedimentry rocks, mainly the Cambay, Krishna Godavari, Cauvery, and Damodar Valley basins. There are some other potential reserves such as the Upper Assam, Vindhyan,

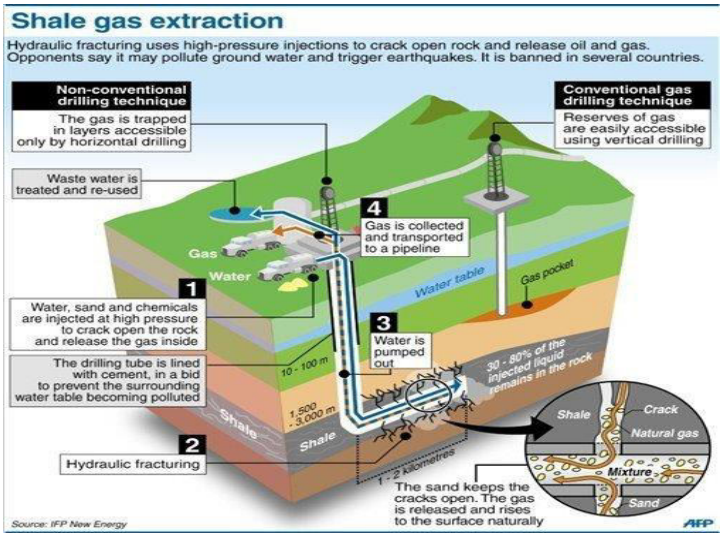
Shale basins in India are geologically highly complex. Many of the basins, such as the Cambay and the Cauvery, have horst and graben structures and are extensively faulted. The prospective area for sedimentry rock gas in these basins is restricted to a series of isolated basin depressions (sub-basins).

While the sedimentry rocks in these basins are thick, considerable uncertainty exists as to whether (and what interval) of the sedimentry rock is sufficiently mature for gas generation.

Recently, ONGC drilled and completed the India's first sedimentry rock gas well, in northwest of Calcutta in West Bengal. The well was drilled to a depth of 2,000 meters and reportedly had gas shows at the base of the Permian Barren Measure Shale.

Two vertical wells were previously tested in the Cambay Basin and had modest oil and sedimentry rock gas production in the shallower, 4,300 foot thick intervals of the Cambay "Black Shale".

Overall, ARI estimates a total of 290 Tcf of risked sedimentry rock gas in-place for India. The technically recoverable sedimentry rock gas resource is estimated at 63 Tcf in India. These guess could increase with collection of additional reservoir info..



Shale gas Extraction Technique.

commonly starts with observation of gas in the cuttings with the circulation fluid. Understanding the extent of sedimentry rock gas paywith the help of pilot wells, seismic interpretation and log correlation is important. Quantification of sedimentry rock gas can be done by adsorption and desorption studies on the cores to measure Langmuir volume and gas content with change in pore pressure.

The petrophysical evaluation and reservoir characterization is the backbone of evaluating a sedimentry rock gas reserve. Various other techniques such as coring methodology, open-hole logging, elemental spectroscopy, and lithology identification are essential for understanding the Total Organic Content (TOC) and estimate the production potential. Geomechanical analysis and the study of stress regime help to design well completion, drilling horizontal wells, and selecting appropriate perforation technique.

The data gathered during the process, right from drilling to completion and fracturing, can be used to predict the performance of the sedimentry rock gas production for future using numerical reservoir simulator. The use of horizontal and multilateral techniques in sedimentry rock gas reservoirs is expanding rapidly.Hydraulic fracturing stimulation is the most extensively accepted tool used for the development of sedimentry rock gas reservoirs. This is due to the fact that sedimentry rock reservoirs have a very tight nature with low permeability and to make them flow at an economical rate stimulation by hydraulic fracturing is necessary.

. The ultimate aim is to increase the productivity index. This technique helps to gain vertical connectivity amongst different gas bearing layers and allow easy connectivity.

3.Challenges and Environmental Issues

The primary differences between modern sedimentry rock gas development and conventional natural gas development are the extensive uses of horizontal drilling and high-volume hydraulic fracturing. Although sedimentry rock gas has been produced for more than 100 years in the United States, the wells were often marginally economical. Higher natural gas prices and the recent advances in hydraulic fracturing and horizontal completions have made sedimentry rock gas wells more profitable. Sedimentry rock gas tends to expensive than gas from conventional wells, because of the expense of massive hydraulic fracturing required to produce sedimentry rock gas, and of horizontal drilling. However, this is often offset by the low risk of sedimentry rock gas wells.

It has been a belief that sedimentry rock releases fewer greenhouse gas (GHG) emissions than other fossil fuels.

However, there is growing evidence that sedimentry rock gas emits more greenhouse gases than conventional national gas, and may emit as much or more than oil or coal.

Recent evidence indicates that methane has a global warming potential that is 105-fold greater than carbon dioxide when viewed over a 20-year period and 33-fold greater when viewed over a 100-year period, compared mass-to-mass.

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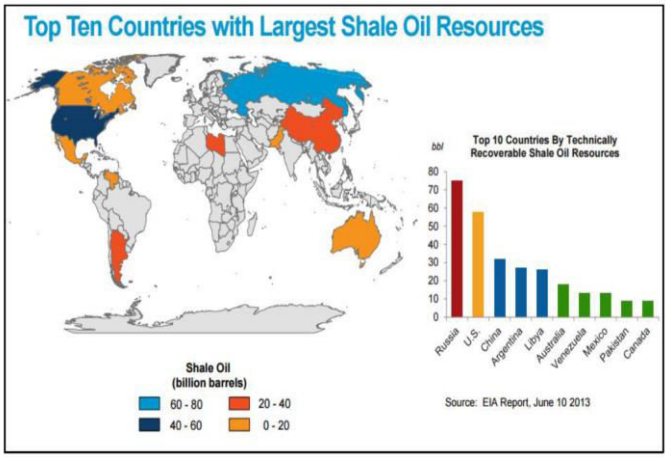


Fig -1: Name of the figure

Some basic challenges faced are (see Figure 3):

• Screening exploration targets • Gas in place • Matrix permeability • Determining intervals to frac or drill horizontals • Predicting production rates • Predicting decline rates • Determining drainage areas (spacing units) in thick intervals of sedimentry rock • Gas producers have no confidence in their Original Gas in Place calculations

4. Some of the vital issues are as follows:

(a) Cost of field development operations. Cost of drilling and completing in Asian countries is 2.5 to 5 times higher than similar operations in USA and Canada. This may be due to less infrastructure and government support in terms of subsidies.

(b) Lack of fiscal incentives and infrastructure. Unlike the USA and Canada, most countries have so far not offered significant fiscal incentives

(c) Inability to experiment with wellbores. Reservoir development in western countries is built around the need to experiment with the wellbore - a process of trial and error. But Asian based mostly firms realize this idea tough to know . Here much of the engineering is done retroactively, based on the actual performance of the well bore, rather than up-front before the well is drilled.

(d) Lack of political will. There are considerable political differences among many of the countries in this region - so much so that some of the countries have actually been to war with each other in the recent memory. Apart from this corruption, bureaucracy, political instability, and prohibitive customs regulations all mean that operations are often significantly delayed or cancelled altogether.

(e) Competition from alternative sources Companies need to face a huge market competition from existing products and also due to the monopoly of gas rich countries.

5. CONCLUSIONS:

India's gas demand is limited by its access to gas supplies based on domestic production and imports availability. If India can produce more gas, then it can reduce its coal imports which is environmentally more unfriendly.

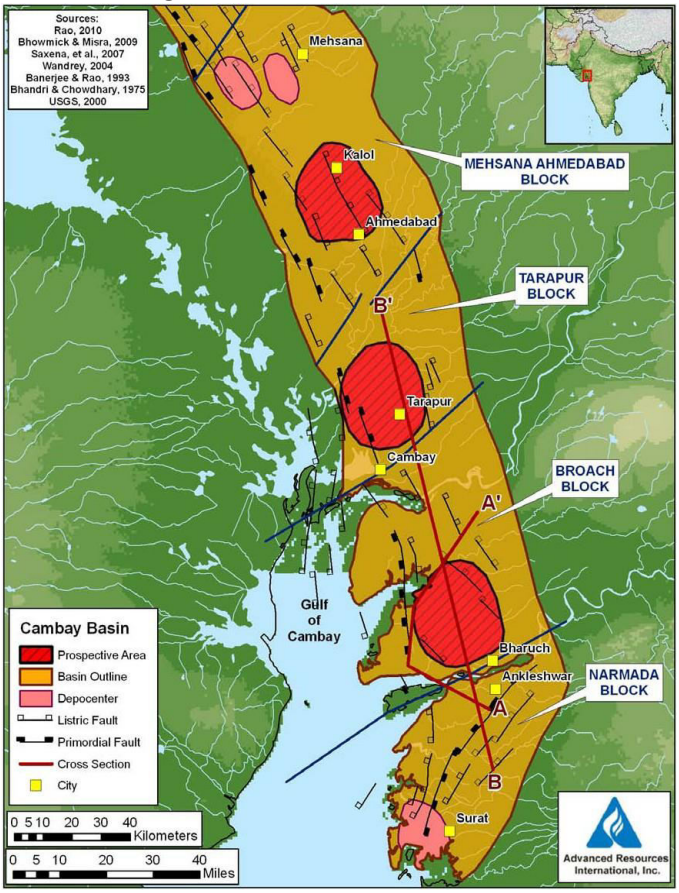
Unfortunately, the Indian government has not been able to implement the right kind of gas policies even after the recommendations given by several high powered commissions. The basic demand for correct gas sector development in India is that the government ought to enable the market to line the cost as counseled by several gas committees. Why has no company in India explored for sedimentry rock gas despite several rounds of bidding for exploration blocks in the last two decades? The

unhappy answer is that our exploration policy permits firm to provide solely conventional oil and gas.
From their exploration blocks. . If they find non - conventional energy — such as coal-bed methane or sedimentry rock gas — they are forbidden to produce this!
This is as a result of the petroleum ministry regards associately non conventional deposit as an unwarranted windfall for the exploring company, and wants separate bidding for non-conventional energy. For coal bed gas, it's entailed bids and awarded exploration contracts in noted coal deposits.

But gas can even be found in deep coal deposits unknown these days. When drilling for oil, Indian firms have already hit thick coal seams deep underground, but not bothered to test these for gas because they would not be allowed to extract it.

The same holds for sedimentry rock gas. When drilling for oil, every firm hits sedimentry rock deposits, but ignores their gas potential since they are not allowed to harness it.

• All future exploration contracts for oil should permit exploitation of sedimentry rock gas as well as conventional gas.



Combay basin fig.3

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