Shale Resources Exploration and Energy Independence of India

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Introduction

Gas emissions by switching to a cleaner energy economy. There is global consensus that fossil fuels are responsible for climate change and global warming, mounting international pressure on developed nations to cut emissions and shift to clean energy technology, and/or natural gas/shale gas, which is proven to be a cleaner fuel than the carbon-intensive fossil fuels.

As one of the largest importers of crude oil with current imports at 78% of its total domestic oil consumption, India's ability to exploit domestic shale resources is a critical step toward energy independence. Several Indian exploration and production (E&P) companies bought stakes in the U.S. shale assets to gain access to the technological resources, to be implemented subsequently for exploration and development of shale resources in India. A strategy well planned but largely ineffective without formidable policy support and an adequate understanding of the Indian sedimentary basins for shale resource exploration.

Recent Trends

India has 26 sedimentary basins (covering an area of ~3.14 million km^2 with ~1.3 million km^2 located in deep waters and ~ 1.84 km^2 on land or in shallow waters) representing important targets for conventional and unconventional resources exploration. Presently the exploration of shale resources (gas and oil) in India is at an incipient stage,but several shale formations (e.g. CambayFormation Shale, Cambay Basin; Barren Measures Formation Shales, Damodar Basin) have been identified with the potential to meet the energy demand in the country.

To ease the energy crunch over the past few years, the Government of India (GoI) has focused on unconventional resources. Various estimates of different agencies show that India has good shale resources (oil and gas) potential. To explore this potential, the GoI in October, 2013 notified the policy guidelines for the exploration and exploitation of shale resources (primarily gas and oil) by national oil companies (NOCs), and the blocks were allotted to them under the nomination regime (DGH).GoI has introduced a new Hydrocarbon Exploration and Licensing Policy (HELP) through Open Acreage Licensing Program (OALP) program that covers acreage for all types of plays- conventional and unconventional. HELP introduces OALP that will allow companies to approach the government at any time and seek permission to explore any block. It also gives companies' access to the National Data Repository (NDR) maintained by the government, to consult these maps and data to help inform them about which areas to bid on.

Under the initial assessment phase, Oil and Natural Gas Corporation Limited (ONGC) and Oil India Limited (OIL) were permitted to carry out shale 'gas and oil' exploration and exploitation activities in 55 blocks located in Gujarat (28 blocks), Andhra Pradesh (10 blocks), Tamil Nadu (9 blocks), Assam (6 blocks), Arunachal Pradesh (1 block) and Rajasthan (1 block) (DGH). According to the policy statutes, the NOCs were to undertake a mandatory minimum work programme in a fixed time frame for the optimum development of shale resources. Under the next phase of the

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assessment, ONGC and Oil India Limited (OIL) were to identify an additional 80 blocks. Further, in the subsequent phases, ONGC and OIL have to identify 55 blocks to carry out shale gas exploration and exploitation (DGH). The NOCs are primarily focusing and concentrating significant exploratory efforts on the shale resources potential of the Cambay and Damodar basins.

The Damodar Basin exhibited the flow of shale gas at the surface in an exploratory well drilled by the ONGC and Schlumberger in 2011, marking the beginning of the shales resources exploration in India. Subsequently, in 2013, ONGC drilled the first well in Jambusar area (Cambay Basin, Gujarat) to exploit the gas trapped within the shale formations exhibiting good shale gas potential. ONGC drilled one more well for shale resources exploration in the Gandhar area (Cambay Basin). Additional wells are also being drilled in the Cambay Basin by the ONGC as huge shale gas potential has been recognized in the Gulf of Cambay and other areas forming the continuity of the Cambay Basin. In addition, ONGC has collected shale cores in prospective formations from another nine wells. OIL has also discovered potential shale formations in Arunachal Pradesh and Assam (northeast India) but assessment of the shale gas and oil prospects in these formations is still meager (DGH).

Present scenario

In the present scenario where the sharp decline in oil and gas exploration is pushing the industry to its nadir, India is moving ahead to encourage exploration and production on the domestic and international front. After a decline in production over the last decade, India – which has been fiercely battling growing energy demands – is making bold moves to open its underexplored oil and gas fields and to enact policies that make exploration and development oil and gas resources more attractive and rewarding (AAPG Explorer, Nov. 2015).

In India, the production has primarily been achieved from the ageing oil and gas fields (viz. Assam, Cambay, Krishna-Godavari, Barmer etc.). This meager production is declining and new fields with good prospects are yet to be discovered. The hydrocarbon assessment data from 15 out of 26 sedimentary basins puts total reserves of crude oil at 28 Billion Tons (BT) (out of which 11 BT is established and the remaining 17 BT is yet to be found!) (DGH). This staggering 61% of 'yet to be found' crude oil is a matter of concern and perhaps has pushed the GoI into action develop multi-potent strategy to attract the Indian and overseas companies to invest and explore in India. To strategize the policy certain key points have been addressed:

1. Improved and increased access to the unconventional resources.
2. Increasing exploration status in the underexplored areas with increased access and better infrastructure.
3. Reducing the bureaucratic hurdles in contracting process.
4. Implementing fresh oil and gas pricing policy. (DGH, TOGY and AAPG Explorer, Nov. 2015)

The rapidly growing Indian economy is causing an increase in the demand for energy (oil and gas). To meet this demand, it is important to produce more, and increased geo-scientific exploration is cardinal to achieve significant domestic oil and gas production. Nearly 3 million km^2 of the sedimentary basin area in India is without credible and sufficient geoscientific data. The Indian Government plans to bridge this data deficit by covering ~1.4 million km^2 area over the next 5 years following fresh policy measures for geoscientific data generation concerning both unconventional (shale oil and gas) and conventional exploration (DGH, TOGY, AAPG Explorer, Nov. 2015).

Shale gas revolution had the potential to weaken the oil supremacy of the oil cartel viz. Russia, Iran and OPEC, while the U.S., Europe and China were to be greatly strengthened.

India could also have been a beneficiary. But, the strategy followed by the OPEC (Organization of Petroleum Exporting Countries) 'cartel' kingpin Saudi Arabia sent Shale gas on a roller-coaster ride from being a significant and relatively low cost new unconventional resource in the world, to a nearly insignificant resource in the present global crude oil price crash. In the wake of present global shale gas turnover, India hopes to reduce the dependence on the imported energy from 70 to 50 % by 2030. The change is coming and only time will reveal whether or not India will become more attractive destination for the international explorers (AAPG Explorer, Nov. 2015).

The Make in India approach

The 'oil and gas' industry is one of the core industries of India. Oil imports constituted about 78.6% of India's total domestic oil consumption in 2014-15. Oil and gas contributes about 35.5% to primary energy consumption. During 2014, natural gas constituted about 7.1% of the energy mix. Energy Information Administration (EIA) as part of International Energy Outlook 2013 has projected India and China to account for nearly half of global energy demand growth through 2040, with India's energy demand growing at 3% per year. The surging energy demand will require additional exploration and production of nearly 800 Million Metric Tonnes (MMT) of the proven oil reserves (as of 2014) mostly in the western part of India. About 44% of reserves are onshore resources, while 56% are offshore (Make in India Initiative).

The present Indian Government has accepted and identified the important problems, as quoted by Dharmendra Pradhan (Minister of State for Petroleum and Natural Gas), *"India's 26 sedimentary basins have not been exploited to optimum levels, and we plan to encourage their exploration"* (Interview published in TOGY-2015, India). Once identified, India intends to tackle the problems (primarily concerning under-to-no exploration) by strategizing the complete policy revamp.

The attractive feature of the revamped policy is to allow 100% foreign direct investment (FDI) in the hydrocarbon industry, but keeping in view their past experiences the international investors may exhibit reluctance to invest in India. Primary hurdles include a policy blockade and ambiguous regulations, e.g., production-sharing contracts, the pricing of commodities and subsidy mechanisms. The current government is committed to implement an operational framework that will incentivize domestic exploration and production through appropriate fiscal policies, a transparent and stable regulatory regime, a reliable monitoring mechanism and a facilitating business environment (Make In India Initiative).The Ministry of Petroleum and Natural Gas is taking measures to advance along these fronts, and as stated by Dharmendra Pradhan, *"Our government endeavours to ensure maximum exploitation and utilization of our natural resources, especially in the field of energy. For this, we will take all necessary measures, including encouraging private players, to achieve our targets. We welcome global majors to participate in all sectors of the industry. Outside investment is one of the 25 major thrust areas of the 'Make In India' initiative of the new government aimed at bringing back international investors to manufacture, research and set up their facilities here"* in India (TOGY, India-2015).

The present Indian Government seems to be very proactive and is projecting the ease of doing business. This is also reflected by the proposed Uniform Licensing Policy providing rights to explore all type of hydrocarbons – conventional and unconventional. Presently India is exhibiting transparency and equally opens to the domestic/private companies, foreign investors and national oil companies – all enjoying the same fiscal and contract terms.

The GoI has provided a healthy and attractive FDI and Sector Policies (importantly, the Policy on Shale Gas and Oil – 2013). Additional incentives have been proposed, e.g., the area based incentives, involving the plans

for setting of projects in the special areas (viz. NE India; Jammu and Kashmir; Himachal Pradesh andUttarakhand).

Where are we heading towards?

The global energy requirement will increase by 50 % by the mid-21st century.Presently more than a billion people don't have access to the basic energy services. Affordable and reliable energy will make it easier for them to grow more food, run schools and hospitals and businesses, and take advantage of all the amenities of modern life. Low- and middle-income countries need energy to develop their economies and help more people escape poverty (Bill Gates, 2015).

But the increasing energy demand in itself is breeding a serious problem as the energy (nearly all of it) comes from the hydrocarbons, which emit greenhouse gases triggering the present day environmental catastrophe – the climate change and global warming. There is an urgent need to have clean, reliable and affordable sources of energy. The alternate energy sources and renewable technologies, like wind and solar, have made a lot of progress and could provide the solution. But considering the magnitude of the challenge, present and future energy requirements, and the alternate resources seem nowhere close to provide us with the dependable solution.

For any energy resource to be dependable, affordable and resilient it has to stand the test of time, industry, policy, environment and technology. The shale gas resource is emerging as a possible solution and a true 'game changer' as exemplified by the shift of the global energy balance. Nearly a decade ago, Saudi Arabia was the world's largest oil producer, pumping nearly twice as much crude oil as the U.S. But the production of oil and particularly gas in U.S. shot up following the shale revolution, which completely changed the global energy equation. Today the U.S. nearly matches the production in Saudi Arabia. The onslaught of U.S. oil has sent prices spiraling from over $100 a barrel in mid-2014 to around $60 a barrel currently (CNN).

To overpower the 'shale gas' revolution, the Saudis flooded the world markets with oil causing the global crude oil price to its knees much to the dismay of less affluent OPEC members like Ecuador, Nigeria and Venezuela (Venezuela's oil minister predicted that the oil could plunge to $25 if the OPEC didn't act to provide remedial measures). As the leading oil producer, the Saudis hold enormous sway over the oil cartel (OPEC and also the Organization of Arab Petroleum Exporting Countries-OAPEC). Their long term plan is to keep the oil prices low, which will squeeze American shale oil and gas producers out of the game. That way, the Saudis can again regain market share lost to the U.S. (CNN), but this has had serious repercussions on the Saudi economy which has forced the 'giant' Saudi Aramco to go public for the first time.

Shale gas in India: how tangible?

Shale - as a global energy resource is resilient and flexible and shale technology has changed the energy industry forever, it won't disappear and will get better as it's based on technology (CNN). Now is the time for India to recognize that shales resources (oil and gas) have the potential to change the energy landscape. India has to decide soon as the ignorance and indifference to the potential of the shale resources will leave our country with no options to respond to the future energy demand. The decision has to be holistic and has to take into consideration the challenges of exploration in India, particularly concerning the availability of large volumes of clean water and land acquisition, the principal determinants of the viability of shale resource and technology.

Today, the energy landscape is dramatically different, giving rise to what Goldman Sachs Global Investment Research (GIR) calls "The New Oil Order". The shale resources industry has dramatically reduced the

time from the exploration to production creating afavorable investment environment. Now it merely takes months not years to get a well from the planning to production stages (GIR). As a result, the market is much more flexible but oil prices will have to remain lower for longer period before the industry shuts down capacity for good. Considering the present decline in the crude oil price globally, how beneficial and economical shale resource exploration will be in India is seriously concerning.

The shale resources (particularly gas) have potential to provide a solution for the impending energy crisis in India. India needs strong and permanent shale resources (gas) exploration policy, which has to be holistic and incorporates the lessons learnt from the experiences of the countries that are ahead of India in this regard. It is imperative to address important concerns and challenges of fresh water requirement, local community displacement, environment, ecology, natural calamities and investment incentives which will allow creation of a more formidable and comprehensive shale resource policy which can be sustained over the long term to make India energy independent.

Envisioning the shale gas revolution in India – the way forward

We have identified one important problem concerning the meager understanding of the sedimentary basins in India, vis-à-vis their shale resources potential, representing one of the key factors limiting the framing of robust shale gas policy. Identifying the 'potentially prospective' sedimentary basins and the gathering of the geoscientific data from them for unconventional exploration is the first step in the right direction. For this to be a reality there is an immediate need for the academia, industry and government to collaborate. The collaborative research initiatives will bridge the gaps in geoscientific knowledge, not only providing a better understanding of the sedimentary basins, but also paving the way towards a formidable shale gas policy.

The research institutions have started generating the basic geoscientific data. The key is to identify and localize the sweet spots in the promising shale horizons, which will be a reality in a couple of years to come and a 'chimera' without the industry and government support. We are witnessing advancement in the 'shale resources exploration' research and the potential growth of collaborations. With the enrichment of geoscientific data and technological advances, the robust shale gas policy is knocking at the door and the foreign investors in anticipation are demonstrating keen interest to operate in India. In wake of these developments, we propose that India is poised to start the economic production from its domestic shale resources in the coming decade leading to the 'energy independence of India'.

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