



Oil and gas are here to stay: exploration is indispensable

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Abstract

The current dilemma facing the energy industry is whether hydrocarbons are going to stay as the dominant source for meeting the growing demands of energy. On the one hand environmental impact of continued usage of fossil fuels is evident in terms of unprecedented irregular rains and floods in some parts, and droughts in others, depleting glaciers and consequential sea level rise, acidification of sea water, etc., while on the other hand addressing the energy trilemma – energy security, accessibility, and sustainability – is a big challenge to all concerned. The world is looking at decarbonizing as a solution to environmental challenge, though addressing the energy trilemma is marred with uncertainties. Despite various commitments by different countries, the transition to renewable energy has progressed slowly. Furthermore, the per unit cost of renewable energy has significantly come down, though its life cycle environmental impacts are still not fully understood.

India is the third largest consumer of energy with per-capita energy consumption as one-third of the global average. It has an ambitious target of reaching the level of \$10 trillion economy in the next decade. Its energy consumption is going to double by 2050, and therefore, it has a big responsibility of addressing the energy trilemma. With this perspective, we have tried to argue that as far as energy mix for India is concerned, hydrocarbons will be the mainstay of energy in the years to come. Exploring frontiers within the country and through overseas E&P efforts coupled with traversing the path to net-zero, as committed, is the solution to meet these challenges.

Keywords: exploration, domestic demand, India's deep offshore potential, net zero, new momentum, accelerated scenarios

Introduction

The world is increasingly being impacted by the vagaries of climate change. Much of that is attributed to the continued use of fossil fuels. The global energy industry is under significant pressure to increase contribution from renewables and achieve net zero. Energy contribution from renewables, however, has remained consistently below 10%, while the share of fossil fuels in the global energy consumption has remained at upwards of 80% (Reuters, 2023). Oil and gas continue to lead for meeting the energy demand despite the largest increase in energy consumption from renewables (Energy Institute Statistical Review of World Energy, 2023). Furthermore, executives including BP's CEO, have recently expressed disappointment in returns from renewable investments (WSJ, 2023). In response to higher crude oil prices, the financial results for most U.S. exploration and production (E&P) companies showed large increases in cash from both operations and capital expenditures as of early 2022 (EIA, 2022). Global oil companies including the likes of ExxonMobil, Chevron, and BP are judiciously increasing their oil and gas budgets for the near future.

Indian energy scenario

With this background, let us now examine India's energy sector. India is the world's third largest energy-consuming country, thanks to the rising incomes and improving standards of living of people. India, however, remains one of the lowest per capita consumers of the energy which is almost one third of the global average.

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With the 'Make in India' drive and the ambition of becoming \$ 10 trillion economy by 2030s, its energy consumption is poised to increase substantially. As per BP Energy Outlook 2023, India's primary energy consumption is expected to more than double by 2050. In the current energy mix for India, the share of coal, oil and natural gas is around 75% (Coal - 45%, in 2022, Oil - 24% and Natural gas – 5.1%; in 2019). Further, BP's Energy Outlook 2023 uses three scenarios, namely, Accelerated, Net Zero and New Momentum, to consider a range of pathways for the global energy transition to 2050. As per BP these are not predictions but provide a wide range of the possible outcomes for the global energy system over the next 30 years. Under these scenarios, BP has projected the share of the three primary energy sources put together for India are to be 30%, 18.4% and 52% respectively. In an absolute sense, however, the oil demand is expected to be half in the Net Zero scenario but continues to remain almost at the current level in 'Accelerated' scenario and increases more than one and half times in 'New momentum' case. The natural gas scenario is different, in that in all the three cases it is expected to increase significantly. Similar projections are made by other energy watch dogs.

In a nutshell, in all probability, India's oil and gas demands are expected to significantly increase in the years to come. India's petroleum minister, Mr. Hardeep Singh Puri, highlighted at the World Energy Policy Summit 2022 that India continues to rely on hydrocarbons to meet the country's energy needs. With oil imports standing at around 85%, coupled with increasing global oil prices, there is a renewed push towards increasing domestic oil and gas production. Given this scenario, it is apparent that fossil fuels will continue to be the mainstay of the country's energy demand and, therefore, an extensive and focused effort is required to meet this increase in demand.

Ambitious target to meet domestic demand

To meet the increased domestic demand, an ambitious target has been set to massively increase the areas under hydrocarbon exploration and production in the years to come. While onshore drilling is cost effective and economically beneficial, the running room to target the resource may be limited. Notwithstanding the 49% of land area spread over twenty-six sedimentary basins, India's vast coastline offers an excellent opportunity to help with the proposed increase in exploration and production acreage. Mumbai High is the largest Indian oil field. A great deal of India's east coast passive margin deep offshore basins remains underexplored. Deep and ultra-deep-water exploration in global basins has been rejuvenated given the progress made in deep water drilling resulting in significant cost reductions and critical technological breakthroughs. The increasingly high oil prices and diminishing reserves has increased the focus on deep-water exploration and development. In line with these targets the government of India has also aligned its policies and released 99% of the prohibited areas for security reasons in the India's Exclusive Economic Zone for the E&P sector.

Deep offshore potential in India

The eastern offshore basins of India, including the Krishna-Godavari (KG), Cauvery, Mahanadi, and Bengal Basins, have been explored for more than four decades with commercial hydrocarbon production established in KG basin in the Neogene sequences. Additionally, older sequences in the coastal areas of KG, Cauvery, and Mahanadi Basins have been proven to contain hydrocarbons. Nevertheless, the deeper Paleogene and Cretaceous strata deep offshore remain largely unexplored.

The deep offshore East Coast Margin of India (ECMI) showcases shallow water oil and gas discoveries, as well as a few deep offshore discoveries indicating the presence of an active petroleum system in the deep offshore. The geological characteristics of ECMI, characterized by a narrow shelf, broad slope, and abyssal setting, draw

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parallels with the Equatorial Margin of Africa and South America, known for their giant oil and gas discoveries (Yanqun et al., 2017).

The stratigraphy of ECMI mirrors that of the Equatorial Margin basins and the Eastern Margin deep offshore of the South American Continent (Pellegrini and Ribeiro, 2018; Raju et al., 2017). These basins are associated with world-class source rocks, including the Cenomanian-Turonian and Aptian source rocks (Amy, 2019; Price et al., 2021). It is highly probable that both the Aptian and post-rift Cenomanian-Turonian source intervals are part of the deep offshore ECMI succession. Consequently, similar petroleum systems can be envisioned within the deeper succession due to the nearly identical stratigraphic succession in terms of source rock development. Furthermore, the thick stratigraphic succession in the deep offshore drives maturation which in many ways may be like the ultra-deep Gulf of Mexico and the Atlantic margin basins, both renowned for their substantial oil reserves.

The need of the hour is renewed and targeted effort in exploring these basins. This can only be achieved through adoption of new technologies including AI/ML, and analysis of all the available data, international collaboration and above all, belief in the potential of the deep offshore basins. Back to basics have always paid and developing deeper understanding of play fairways and identification of potential sweet spots can give an impetus to the hydrocarbon exploration endeavors. The world class Guyana discovery could only be made after many unsuccessful drilling campaigns and belief in the USGS assessment of huge potential of the basin. The Namibian deep offshore Orange Basin discoveries are also part of a similar story.

International portfolio can augment domestic production

While domestic exploration and production efforts are critical, let us not forget global basins where the international oil companies have been remarkably successful in making giant oil and gas discoveries in the deep offshore, e.g., the Atlantic margin basins of Guyana and Suriname, Brazil, West Africa. Countries with high projected hydrocarbon demand for years to come such as India cannot ignore global basins where hydrocarbon potentials are established. From a humble beginning in the year 1974, PETRONAS, the national oil company of Malaysia, reached a daily production of 1.75 million boe in 2010 and stood at whopping 2.434 million boe per day in 2022. This growth of Petronas is attributed to both domestic as well as global assets.

ONGC also started its venture abroad to acquire equity oil through its subsidiary Hydrocarbon India Limited (HIL) established in 1965. After initial success in Iran, Iraq, and Tanzania the focus of ONGC shifted back to domestic operations after the discovery of Mumbai High, a giant oil field. Overseas focus remained subdued till the mid-1980s. With the renewed international focus, a profit-sharing contract was signed for few exploratory blocks in Vietnam, of which Block-6 later became a flagship project for ONGC. In the year 1989, HIL was rechristened as ONGC Videsh Ltd (OVL). Since then, OVL has come a long way and has been contributing significantly to help alleviate the domestic shortfall. During the financial year 2019-20, OVL achieved its highest production of around 15 MMTOE through both organic and inorganic growths.


Considering the past success, venturing into international oil and gas basins for exploration would certainly be beneficial. Acquiring discovered assets only to enhance oil and gas production, however, cannot give the kind of jump that is needed for India. With the current market of higher oil prices and diminishing reserves, discovered assets for sale are exceedingly rare and they often tend to carry a hefty price tag, resulting in a limited rate of return on investment. Discovered assets almost always are sold when the fields are on a decline. Hence exploration and organic growth are the best way forward to achieve a higher rate of return resulting in

cash flow that can be put to effective use to expand the international portfolio. OVL's Colombia Block CPO5, Vietnam, and Brazil SEAL Basin assets are a clear testament to that. Sudan project of OVL is another example where producing asset with significant upside exploration potential has paid back the investment much earlier than initially envisaged, partly due to oil price rise and partly due to new discoveries resulting in a significant increase in production. This clearly brings out benefits that can accrue to an organization venturing overseas in the hunt for oil, the black gold, by investing into exploration portfolios.

Conclusions

Studies by various agencies have established that in all possible energy transition scenarios, hydrocarbons are going to stay as dominant source of energy for India. The sentiment that globally hydrocarbons are going to continue as an important source of energy was also reflected by many prominent industry players during the World Petroleum Congress (WPC) held recently at Calgary. Exxon CEO, Darren Woods, expressed that it will be difficult to replace today's energy system because oil and gas are so widely available, and the transition would take time. He also advocated maintaining some level of investment, absence of which could result in shorter supply and higher prices. Speaking from the same panel, Aramco CEO, Amin Nasser also expressed similar views and warned that absence of continued investment and consequential price rise could lead to people going backward and use more coal and other cheaper products that are available today. This situation could be more detrimental to the environment and derail the de-carbonization journey the world has embarked upon.

Currently India is meeting its domestic requirement through import of oil to the tune of 85%. And this demands India to continue its exploratory efforts more aggressively than in the past. This was very evident from the point made by Ms. Sushma Rawat, Director (Exploration) of ONGC, the national oil company of India, from the WPC Stage. Ms. Rawat shared ONGC's vision of exploration by expanding offshore acreages to half-a-million km² and addressing 1600 MMTOE of yet-to-find resources in the next few years. Besides, she also shared that other focus areas/plays for ONGC include Mesozoic plays, the Himalayas, ultra-shallow water zones, unconventional resources and CCUS wherein ONGC is open to partnership for the shared growth.

At the COP26 held under the United Nations Framework Convention on Climate Change at Glasgow, United Kingdom, the Honorable Prime Minister of India committed to achieve net zero by 2070. Further, India is also committed to address the issues of Energy Trilemma – providing energy security and accessibility to all its citizens in a sustainable way. It will be years, if not decades, before renewables can make a significant contribution to global energy consumption. Until such a time, fossil fuels are here to stay. The reliability and affordability of oil and gas within the context of global energy system will be hard to replace. In line with the national net zero commitment, companies have also set targets for themselves to achieve. All this necessitates a multipronged approach to meet both environmental protection and projected hydrocarbon demand targets which will require focusing both on domestic and international opportunities. 

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References

1. Amy, L. A., 2019, A review of producing fields inferred to have upslope stratigraphically trapped turbidite reservoirs: trapping styles (pure and combined), pinch-out formation, and depositional setting, AAPG Bull. **103**(12),2861-2889. DOI:[10.1306/02251917408](https://doi.org/10.1306/02251917408)
2. WSJ (Wall Street Journal) report, 2023, BP's CEO Plays Down Renewables Push as Returns Lag.
3. BP Energy outlook, 2023 accessed at <https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/energy-outlook/bp-energy-outlook-2023.pdf>.
4. EIA, 2022, Annual energy outlook, <https://www.energy.gov/sites/default/files/2022-11/05%20October%2027%20-%20EIA%20Annual%20Energy%20Outlook%202022.pdf>.
5. Energy Institute Statistical Review of World Energy 2023, available at <https://www.energyinst.org/statistical-review>.
6. Price, L. M., R. A. Perkey, J. W. Oswald, E. A. Elkington, 2021, Liza field Guyana: The finding of a stratigraphic giant from early exploration to production, AAPG Memoir **125**: Giant fields of the decade: 2010-2020,433-455.
7. Reuters, 2023, Renewables growth did not dent fossil fuel dominance in 2022, accessed at [https://www.reuters.com/business/energy/renewables-growth-did-not-dent-fossil-fuel-dominance-2022-statistical-review-2023-06-25/#:~:text=LONDON%2C%20June%2026%20\(Reuters\),Energy%20report%20said%20on%20Monday](https://www.reuters.com/business/energy/renewables-growth-did-not-dent-fossil-fuel-dominance-2022-statistical-review-2023-06-25/#:~:text=LONDON%2C%20June%2026%20(Reuters),Energy%20report%20said%20on%20Monday).
8. Yanqun, Q., G. Zhang, Z. Ji, W. Yiping, X. Wang, X. Liang, 2017, Geological features, hydrocarbon accumulation and deep-water potential of East Indian Basins; Pet. Expl. and Dev., **44**(5), 731-744. [https://dx.doi.org/10.1016/S1876-3804\(17\)30084-8](https://dx.doi.org/10.1016/S1876-3804(17)30084-8).
9. Pellegrini, B. S. and H. J. P. S. Ribeiro, 2018, Exploratory plays of Pará-Maranhão and Barreirinhas basins in deep and ultra-deep waters, Brazilian Equatorial Margin, Brazilian J. of Geol., **48**(3), 485-502. <https://dx.doi.org/10.1590/2317-4889201820180146>
10. Raju, D. S. N., A. N. Reddy, B. C. Jaiprakash, H. Gilbert, and D. P. Sangwar, 2017, Age and paleoenvironmental evolution of the syn-rift fill sediments in east coast basins of India, ONGC Bull., **52**(2), 127–133.



Dr. Srinivasan Krishnan graduated from IIT Kharagpur with a master's degree in geology. Subsequently he went on to pursue a Ph.D. in geology from University of Tennessee, Knoxville, USA, followed by a post-doctoral fellowship at the University of Tennessee and Oak Ridge National Laboratory. His professional experience spans over 11 years with ExxonMobil, 7 years with BHP Billiton, 2 years with ConocoPhillips, and 2 years with ONGC. Lately, he has been with ONGC Videsh Atlantic Inc., Houston, for the past 7 years. He is a business focused manager with a 28-year background in leading discoveries and development of oil and gas resources onshore/offshore worldwide.

Dr. Krishnan is proficient at managing teams and leading companies, generating high-quality results, and building a strong reserves base. He has proven leadership skills through planning and executing technical evaluations of exploration acreage, preparing, and executing field development plan in mature basins. All these personal traits show up in his excellent track record of guiding companies as he executes successful new venture opportunities in hydrocarbon-rich basins worldwide.



Mr. Vishal Shastri is an explorationist with an industry experience of over 35 years in the gamut of exploration. He started his carrier in ONGC as a geophysicist in the year 1985 and has acquired a vast experience of working in various petroliferous basins of India. He has now risen to the level of Executive Director in the company. He has had international exposure through working in the Muglad Basin of Sudan/South Sudan as an exploration geophysicist. During his tenure in ONGC Videsh (OVL), the international arm of ONGC, he has evaluated several potential global E&P opportunities, spread across various basins, some of which are now key assets of OVL. He had also steered the exploration program of the blocks of OVL in Asia pacific region. Currently he is steering the exploration endeavors in Assam and Assam Arakan Basin as Basin Manager. His qualifications

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