

Challenges of Indian Oil and Gas Sectors: Exploring the Rationale and Alternatives

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Abstract:

Fossil energy industries, such as oil and gas extraction companies must decrease their fossil emissions from their core operations and a need to improve environmental footprints and decarbonization. It can also leverage its engineering capabilities and seek managerial expertise to increase its financial resources and transform itself into a performance-oriented entity. There is a need for green investment by oil and gas companies in the non-core areas of energy diversification is appalling. In addition, dealing with climate change involves a coalition of various stakeholders and adhere to strict environmental regulations standards.

Keywords: climate-neutral economy, green environmental footprints, carbon capture and storage (CCS), Panch-Amrit Action Plan, fossil energy industries.

Introduction:

Energy resources have been and continue to be the building blocks of the world economy. Amidst a climatic vulnerability, the burning of fossil fuels, i.e oil and gas has caused global environmental hazards like global warming, natural disaster and ozone depletion. The relentless use of this energy has created environmental degradation. The fossil fuel based industries account for around nine percent of human-induced greenhouse emissions in its operations (PIB 2024). The fuel supplies that it generates add to another thirty percent of global emissions. Non-conventional energy resources, on the other hand, have provided an alternative to the normal. Thus, the sector faces a crisis-like situation on many fronts. It is curious to see how it will resurrect itself in the future.

The oil and gas industry faces the critical challenge of driving the headwinds of worldwide recession, geo-political upheavals and increasing trend of protectionism. The industry needs to orient the economy towards the 3As- affordability, accessibility and availability. This would accompany decarbonisation and digitalisation to give them a competitive edge. The geopolitics played out in international relations causes disruptions in oil prices. The latter affects not just the economic growth prospects but also threatens international security. It causes political instability in many consumer countries as well. The International Economic Agency, in its forecast, has stated that the global energy demand is set to grow by one-third by 2025 with the rise in population and better living standards (PIB 2024).

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One of the emerging challenges in the oil and gas sector is related to its use of technology. The use of archaic technologies from extraction to distribution account together for a release of around fifteen percent of energy-related greenhouse emissions. One method of cost-effective ways of reducing overall emissions is controlling methane leaks. The emission intensity can be lowered by avoiding routine flaring and employing renewables and low-carbon electricity for its upstream requirements and LNG developments. The oil and gas companies could also enhance their energy recovery from deep offshore sites and mature oil fields (brownfields) by employing new technologies. For instance, explorations have enhanced our knowledge of abundant energy resources beneath our oceans. The use of such technologies has helped to distinguish between conventional and non-conventional energy sources.

Another major structural challenge confronting the energy sector is labour shortage. It can be compensated through various capacity-building programs geared towards building a trained workforce. The industry needs to recruit new engineers, technicians, managers and geologists to maintain professionalism in the workforce. The oil and gas sector also needs refinement in operation and inventory management. One of the significant challenges that has been facing on the ecological level is increasing local environmental hazards like oil spills and gas flaring have contributed to the larger spectre of global environmental crises like global warming. Developing eco-friendly technology like carbon capture and storage (CCS) would reduce the negative externalities of fossil fuel use. Other initiatives to offset emissions would be tapping into carbon sequestration methods such as carbon sinks, which include forests, soil, and oceans, which are highly beneficial.

There is an increasing call for producing more energy at lower costs with fewer emissions, which can be achieved through energy diversification and efficient and clean technologies. Changing power sources, for example, switching from generators to solar PV and battery set-up, would not only reduce emissions to a great extent but also help in the long term. The demands for uncertainties are also significant challenges which affect the producer countries. The concerns for supply-side bottlenecks need to balance with the producing countries for security of demand. Thus, energy security is viewed from both the consumer and producer perspectives and there is a need for renewed investment to meet the rising demands.

There is a significant debate about whether the public or private sector should play a role in managing the oil and gas sector. Supporters of privatisation emphasise that it will improve and foster competitive operational and dynamic efficiencies. Conversely, those opponents of privatisation have contended that public sectors can play a critical role in steering economic advancement. They have carried out vital social and financial objectives. Along with a reasonable rate of guaranteed return on investment, the public sector could link underdeveloped areas, provide employment opportunities, and promote inclusive development. The public sector is the critical link in the global oil and gas sector as it controls vast national reserves and can determine global oil prices by varying the amount of oil and gas supplied. Lately, the public sector has been inflicted with malaises such as corruption, bureaucratic hurdles, and public debt, which hamper the sectors' growth. It needs to leverage inter-firm competition and a well-functioning market to improve its performance efficiency. The private sector also needs a well-

functioning market with independent regulation to ensure equitable outcomes. Both sectors complement each other in driving the economy towards energy sustainability.

One of the main obstacles facing the oil and gas industry is the push for clean energy transitions. The primary concerns related to the operation model of business and energy transition. The emission of greenhouse gas (GHGs) coming out from the petroleum sectors have led to a growing concern for the climate-neutral economy. A carbon-neutral economy could play a vital role in providing solutions in several ways. The green economy has gained popularity and attention, subsequently, other nations also implementing such policies in accordance with non-fossil strategy. If these demands are not met in accordance with non-fossil energy, the petroleum sector may lose its long term profitability and social acceptance.

1. Alternative Renewable Energy Advancement

Petroleum companies can initiate necessary technological upgradation and financial resources advancement and can invest in alternative renewable options like offshore wind. Similarly, it can enable capital-intensive carbon-neutral technologies such as the development of hydrogen fuel, carbon capture, and storage and utilization. Undoubtedly, an expanding global economy would need the oil and gas sector's services. These sectors could continue to play a vital role in today's economic and energy systems that call for an affordable and reliable supply of fuels for the development needs of all. However, the main challenge has been not to break down the vital functionality of the oil and gas sector but to align it with the international climate targets. The World Energy Outlook, in its series, has laid out a path entirely consistent with the Paris Climate Agreement of holding. The target is to keep control of global temperature to average well below 2°C and strive to limit it to 1.5°C (MoEFCC 2024). These imply the relevant stakeholders to the agreement would comply with its objectives of providing clean air, universal energy access and developing alternative energy resources. While they supply fuels that form the energy systems' bedrock, they must provide climate solutions to ensure long-term prosperity.

❖ International Solar Alliance

India has increased its energy cooperation with the world. The International Solar Alliance (ISA) –is a joint initiative of India and France, is an effort to promote solar energy (PIB 2024). The International Solar Alliance launched in COP21 is a coalition of solar-resource-rich countries (which lie partially or entirely between the Tropic of Cancer and the Tropic of Capricorn) to facilitate the installation of more than 1000 GW electricity capacity by 2030 and has projected funding of \$1000 billion over the same period (UNFCCC 2015). The Alliance targets to decrease the cost of solar energy to the level where its deployment can be scaled up in solar-rich countries. It will aid in meeting the high energy demands of developing countries and contribute to climate change mitigation.

The ISA ensures the creation of a political, contractual and regulatory environment that encourages investment in solar energy through harmonising public policies. 'Open Solar Contracts' has been created by the International Renewable Energy Agency (IRENA) to reduce transaction costs and render greater visibility to the project developers. One of the goals of the

ISA is to facilitate affordable and accessible funding for solar projects in member countries. The World Bank and the AFD joined the ISA to launch the Solar Risk Mitigation Initiative (SRMI) at COP24 in 2018 (MoEFCC 2024)). It also involves a technical assistance programme for developing sustainable solar projects. A new procurement platform has been created to facilitate and collect solar project bids. The ISA has started five actions level programs since 2016, that has decentralised rural application and affordability, financial access, mini-grids, solar e-mobility, and rooftop installations.

India aims to generate 175 GW electricity from renewable energy sources by 2022 and 100 GW from solar energy. In just three years, the Government has distributed 28 crores of LED bulbs and saved about 4 GW of electricity (PIB 2023). India also aims to provide 500 training slots for ISA member countries and begin a solar tech mission to lead research and development. These summits also have significant geopolitical implications. Apart from the ISA's institutional structure and directions, its permanent secretariat is located in Gurugram, India. This is the very first time an intergovernmental treaty-based alliance has its headquarters in India. This will allow India to position itself in a key global leadership role in climate change, renewable energy and sustainable development.

The ISA has also launched its training programme for trainers, which India will fund. It aims to assist member countries in drafting solar policies. There is an emphasis on developing standards, specifications and test protocols for solar energy systems. Collaborations in solar resource mapping and deploying suitable technologies in member countries are encouraged. It strives to work with ISA member countries to provide universal access to solar lightning. The ISA also designs training programmes for students, engineers, policymakers, and other professionals and organises workshops, meetings, and conferences.

❖ **India's Collaboration for Nuclear Energy**

India has actively engaged with various countries on nuclear energy aiming for clean energy. It has signed civil nuclear cooperation agreements with countries like the United States, France, Russia, Kazakhstan, Australia, and others. India has actively participated in the international nuclear fusion research and engineering megaproject (ITER) since 2005 (PIB 2020). It is an experimental fusion reactor facility in France that has been used to prove nuclear fusion as a source of future energy. India is also one of the parties to the ITER Agreement that entered into force in 2007. Since 2008, India and the EU have agreed to expand their nuclear energy and environmental protection cooperation and deepen their strategic partnership at the India-EU summit in Marseille.

The 2008 India-EU Joint Action Plan stipulated that both parties should 'cooperate in civil nuclear research and development in a consistent manner with their international obligations'. In 2020, the Indian Government and the European Atomic Energy Community signed an agreement for cooperation in research and development and the peaceful uses of nuclear energy. It also aims to facilitate the participation of India in projects of research programmes in areas such as radiation protection and nuclear safety & security, and nuclear waste management. India is also one of the parties of the ITER agreement that covers research and

development in the field of non-power nuclear and radiological technologies and its applications in the areas of health care, agriculture and industrial isotopes

2. India's Panch-Amrit Action Plan

The COP26 summit witnessed the launch of the Panchamrit Action Plan, which sets forth India's vision for energy transition. Each of the plan's five pillars comes with its own set of challenges and opportunities.

- ❖ *Expanding Non-Fossil Energy Capacity to 500 GW by 2030:* To achieve this target, India needs massive investment in wind, solar, and hydroelectric power (Ministry of Power 2018). It has emerged as one of the largest solar markets globally due to considerable progress in solar energy. However, scaling up to 500 GW requires more than double the existing infrastructure, substantial capital investment, and technological advancement.
- ❖ *To Achieve 50 percent of Energy Needs via Renewable Sources:* Currently, renewable energies account for approximately eight percent of India's energy consumption (Vardhan & Gabrielle 2025). Meeting half of the renewable energy demand in the coming six years (by year of 2030) needs logistical challenges. This goal requires grid advancement to manage supply fluctuations and robust storage solutions to the intermittency of solar and wind power energy.
- ❖ *Reducing Carbon Emission by One Billion Tonnes:* To achieve this target, India need to concentrate on carbon capture technologies, reforestation and improved industrial efficiency (UNFCCC, 2022). Carbon capture, utilisation and storage (CCUS) technology advancement, necessitating research and development (R&D) and financial support to scale up this goal.
- ❖ *Decreasing Carbon Intensity by Forty Five Percent:* India aims to reduce its carbon intensity to forty five percent by 2030 (from 2005 levels) in accordance with the Paris Agreement commitments (PIB 2022b). To achieve this, India is expanding renewable energy (targeting 500 GW capacity), by improving energy efficiency, promoting green hydrogen and biofuels, enhancing carbon sequestration through afforestation, and decarbonizing coal and industrial sectors.

However, challenges include rising energy demands, financial constraints, and policy implementation issues. India seeks global climate finance and technology transfers to support its transition. As the world's third-largest CO₂ emitter, India's success in balancing growth with sustainability has significant international implications (Deb and Kohli 2022). Reducing carbon intensity involves lowering carbon footprints per unit of GDP. This mechanism requires clean energy investment and innovation in manufacturing and industrial sectors. There is a need for green energy advancement in transitional industries, such as the cement, steel, and chemicals industries, which need alternative renovations.

- ❖ *Achieving Net Zero by 2070:* commitment to this net zero emission was India's long-term pledge under the aegis of the Panchamrit plan (PIB 2023). To reach this target,

India plans to expand renewable energy, reduce carbon intensity by forty five percent by 2030, and promote green hydrogen and clean technologies (Kant 2024). The country also aims to increase carbon sinks through afforestation, improve energy efficiency, and adopt electric vehicles (PIB 2023). Although the year 2070 may seem distant, achieving net zero emissions requires groundwork. Technological innovation advancement, behavioural shifts in energy consumption and institutional regulatory support are essential to meet these targets. While acknowledging logistical, financial and social behaviours are still obstacles to its proper growth. However, each pillar of this Panchamrit Action Plan has embodied the vision of a sustainable future of green and renewable energy in India. With the unwavering dedication to the Panchamrit action plan, India already surpassed expectations by achieving forty percent of power capacity from non-fossil fuels as pledged at COP-26. Closing the remaining ten percent gap within the next six years is not an illusion but an achievable reality (PIB 2023).

3. Conclusion:

It is noteworthy that no oil and gas industry would be unaffected by the energy transition, be it the major international oil companies, national or private oil companies. Each stakeholder is responsible for responding to the challenge. The average investment by oil and gas companies in the non-core areas of energy diversification is appalling, with a minimum of one percent. By increasing their research and development in this domain, the role in non-core activities like electric vehicle charging, electricity transmission and distribution, and developing efficient batteries would be stepping stones to a sustainable future.

Electricity alone cannot be the only change factor in transforming the present energy sector. The industry such as oil and gas extraction companies must decrease its fossil emissions from its core operations. There are various ways by which oil and gas companies can decarbonise. Developing eco-friendly fuels such as biomethane, hydrogen, and advanced biofuels will require around ten percent of the investment in the coming decade. Dealing with climate change involves a coalition of various stakeholders, such as investors, states, companies, etc. Any climate solution would not come to fruition without taking on board the oil and gas industry.

Energy transitions do not mean the existing oil and gas industry needs no investment. There is expected to be an eight percent output decline if the investments in the present oil and gas fields stop entirely. These petroleum companies can build a specialisation in the oil and gas sector by shifting to more promising ventures like natural gas and hydrocarbon resources. The national oil companies face challenges as they have been endowed with the management of the countries' hydrocarbon resources. The stakes are exceptionally high for these companies and governments, who rely heavily upon the returns that the associated oil resources would bring.

Since the fossil energy industries are the biggest users of energy and water consumption, there is a need to improve environmental footprints and adhere to strict environmental regulations standards. It could also transform itself into a performance-oriented sector. It would also avoid the unnecessary cost of looking for new sites to extract these resources with prompt risk

aversion, which should match its operational efficiency. Overcoming the above challenges requires a constant dialogue, transparency, accountability, and cooperation and undergo a shift of transformation of the climate-sensitive world.

References:

1. Ministry of Power. (2020). The Electricity (Amendment) Bill, 2020. Government of India. Accessed on April 2, 2024, from https://powermin.gov.in/sites/default/files/webform/notices/Draft_Electricity_Amendment_Bill_2020_for_comments.pdf
2. Ministry of Power. (2024). 500 GW Non-Fossil Fuel Target. Government of India. Accessed on December 14, 2024, from <https://powermin.gov.in/en/content/500gw-nonfossil-fuel-target>
3. Ministry of Environment, Forest and Climate Change (MoEFCC). (2024). Action Taken Against Global Warming: Rajya Sabha - Unstarred Question No. 529. Government of India. Accessed on April 2, 2024, from <https://sansad.in/getFile/annex/257/AU529.pdf>
4. United Nations Framework Convention on Climate Change (UNFCCC). (2015). International Solar Alliance at COP21. Accessed on December 12, 2024, from <https://unfccc.int/news/international-solar-energy-alliance-launched-at-cop21>
5. UNFCCC. (2022). India's Updated First Nationally Determined Contribution (NDC). Government of India. Accessed on December 14, 2024, from <https://unfccc.int/sites/default/files/NDC/2022-08/India%20Updated%20First%20Nationally%20Determined%20Contrib.pdf>
6. UNFCCC. (2024). Statement of the Director General, International Solar Alliance. Accessed on December 22, 2024, from <https://unfccc.int/sites/default/files/resource/COP29-High-Level-Segment-Observers-ISA.pdf>
7. International Energy Association (IEA). (2020). The Oil and Gas Industry in Energy Transitions. Paris: IEA. Accessed on from <https://www.iea.org/reports/the-oil-and-gas-industry-in-energy-transitions>
8. IEA. (2024). India's Clean Energy Transition is Rapidly Underway, Benefiting the Entire World – Analysis. Accessed on December 12, 2024, from <https://www.iea.org/commentaries/india-s-clean-energy-transition-is-rapidly-underway-benefiting-the-entire-world>
9. Organisation of the Petroleum Exporting Countries (OPEC). (2007). The Future of Oil and Gas and the Resultant Challenges and Opportunities for NOCs. Accessed on December 12, 2024, from https://www.opec.org/opec_web/en/864.htm
10. Press Information Bureau (PIB). (2022a). India's Stand at COP-26. Government of India. Accessed on December 10, 2024, from <https://pib.gov.in/PressReleasePage.aspx?PRID=1795071>
11. PIB. (2022b). India's Updated Nationally Determined Contributions (NDCs). Government of India. Accessed on December 12, 2024, from <https://pib.gov.in/PressReleasePage.aspx?PRID=1885731>

12. PIB. (2023). India is Committed to Achieve the Net Zero Emissions Target by 2070 as Announced by PM Modi, Says Dr. Jitendra Singh. Government of India. Accessed on April 1, 2024, from <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1961797>
13. PIB. (2024). India-France Joint Initiative: International Solar Alliance 2024. Government of India. Accessed on December 12, 2024, from <https://pib.gov.in/PressReleaseIframePage.aspx?PRID=2071486>
14. Deb, K., & Kohli, P. C. (2022). Assessing India's Ambitious Climate Commitments. Center on Global Energy Policy. Accessed on December 12, 2024, from <https://www.energypolicy.columbia.edu/publications/assessing-india-s-ambitious-climate-commitments/>
15. Kant, A. (2024). India's Net Zero Commitment by 2070: The Challenges and Roadmap. The Economic Times. Accessed on December 22, 2024, from <https://economictimes.indiatimes.com/opinion/et-commentary/indias-roadmap-to-doubling-energy-efficiency-a-key-to-achieving-net-zero-emissions-by-2070/articleshow>