

Non-renewable Energy and Mineral Resources in Bangladesh Part of the Bay of Bengal

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Introduction

Bangladesh's economy is rapidly expanding toward achieving trillion-dollar GDP, and most of its economic and industrial growth solely depends on energy and mineral resources. Until now, Bangladesh's hydrocarbon and mineral resources exploration activities primarily focus on the onshore territory of the country. However, the country is increasingly dependent on energy and mineral import due lack of discoveries, insufficient remaining prospects in land, and rapidly increasing demand. Recent international conflicts, geopolitics, and energy crisis forced the government to explore a new frontier for energy and mineral resources. Bangladesh has achieved

sovereign authority on approximately 1,18,813 sq km offshore areas by resolving maritime disputes with the neighboring countries. This area in the Bay of Bengal creates a massive opportunity for offshore hydrocarbon and mineral resources explorations. Hence, non-renewable energy and mineral resources in the Bay of Bengal are one of the vital sectors of the Blue Economy of Bangladesh. All available geo-scientific evidence suggests that the country has bright prospects for hydrocarbon and mineral resources discoveries in the offshore areas, which is sternly underexplored. Hydrocarbon and mineral resources exploration, exploitation, and development in the vast offshore and

deep-sea areas are crucial to achieving Bangladesh Vision 2041.

Coastal and marine mineral resources exploration started in 1961, and a survey was carried out in 1967 to estimate the reserve of coastal mineral resources by the then-Pakistan Atomic Energy Commission. After independence, Bangladesh Atomic Energy Commission's Beach Sand Minerals Exploitation Centre has discovered 17 heavy mineral deposits along the Bangladesh coast and offshore islands. Nevertheless, as the coastal mineral resources are limited and exhausted rapidly, the giant international mining industries are now turning their exploration target to the potential mineral deposits, which include high-value metals such as cobalt, lithium, aluminum, nickel, copper, zinc, and manganese on and beneath the sea floor. The Mining Code for the exploration of the seabed has been developed by the International Seabed Authority (ISBA). Bangladesh has enormous potential for mineral suites with large economic values in the Bay of Bengal.

On the other hand, offshore hydrocarbon exploration in Bangladesh is relatively recent, which started in 1974. The exploration activities regrettably decelerated after discovering two natural gas reservoirs (Kutubdia and Sangu) in the Bay of Bengal. However, Bangladesh's present government is now actively negotiating with the International Oil and Gas Companies (IOC) to renew hydrocarbon and mineral resources exploration activities in offshore and deep water. Therefore, it is essential to know the available energy and mineral

resources in the Bay of Bengal, their qualitative analyses, the quantity of the resources, and their economic significance in formulating an intelligent energy policy.

The Prospect of Non-renewable Energy Resources

Natural gas, oil, and gas hydrates are primary non-renewable energy resources available in offshore and deep-sea areas. These marine resources provide about one-third of global energy production, mostly from offshore shallow areas. The offshore and deep-sea areas may provide the majority of future non-renewable energy as land-based production is depleting rapidly worldwide. However, offshore and deep-sea hydrocarbon exploration is expensive, challenging, and less successful than land exploration. In Bangladesh's offshore part of the Bay of Bengal, nineteen exploratory wells have been drilled with only two successes. The total maritime area of Bangladesh has been divided into twenty-six blocks, of which eleven are located in the offshore area (Shallow Sea, SS), and the remaining fifteen are in the Deep Sea (DS). Several international companies estimated around 20 TCF (2P) gas reserves and approximately 3-17 TCF gas hydrate reserves in the offshore area of Bangladesh. However, only two gas fields have been discovered so far: Kutubdia in 1976 and Sangu in 1996. The Kutubdia field has less than 200 BCF gas reserves and is economically not viable for production. 470 BCF gas has been produced from the Sangu gas field, and the field is now abandoned. Major international companies that participated in the

offshore exploration activities mainly conducted 2D seismic surveys, including Santos, Cairn Energy, ConocoPhillips, KrisEnergy, POSCO Daewoo Corporation, and ONGC Videsh. However, most of these companies relinquish their exploration activities by claiming unfavorable Production Sharing Contracts (PSCs). In this regard, Petrobangla, a state-owned Oil, Gas, and Mineral Corporation, is now finalizing the new Production Sharing Contracts (PSCs) 2023 to make a breakthrough in hydrocarbon exploration, specifically in offshore and deep-sea areas by getting attention from the IOCs.

Bangladesh's 15 deep water blocks covered the north-central part of the Bengal Fan, the largest fluvial-deltaic-slope fan complex in the world. Although no extensive hydrocarbon exploration activities have been conducted so far in the Bangladesh DS blocks, exploration activities in the adjacent deep water areas of Myanmar's Rakhine Basin to the east and India's Krishna Godavari Basin to the west started long ago and have momentous hydrocarbon discoveries. All these gas fields in the Rakhine Basin of Myanmar are located close to Bangladesh deep water block 06-12 and, therefore, may have similar deep water architectural elements and petroleum systems. These similarities and published geological data sets suggest that Bangladesh's shallow and deep water blocks, expressly gas reserves, may have good to excellent hydrocarbon potentials.

The Prospect of the Mineral Resources

Marine and coastal mineral resources can be divided into two broad groups: placer and evaporite deposits found in the coastal or near-shore areas and marine minerals found in the sea bed of offshore and deep-sea sediments. Genetically, sorting and concentration of the beach placer heavy minerals occur either by denudation or by accumulating valuable minerals. These placer deposits are found mainly along the Chittagong-Cox's Bazar beach areas and in the few offshore islands. High concentrations of heavy minerals, which include ilmenite, zircon, garnet, and rutile, are found in the Cox's Bazar, Silkhali, and Teknaf coastal belt, and offshore islands of Maheshkhali, Sonadia, Nijhum Dweep, and Kuakata. An estimated 4.35 Million Tonnes (MT) of placer heavy minerals reserves are present in the coastal areas, of which 1.76MT are economically significant. Among these reserves, 1.02MT of ilmenite, 0.2MT of garnet, 0.16MT of zircon, 0.09MT of leucosene, 0.09MT of kyanite, 0.08MT of magnetite, 0.07MT of rutile, and 0.02MT of monazite.

On the other hand, sea bed minerals can be broadly categorized into polymetallic sulfides (hydrothermal deposits), cobalt-rich ferromanganese crusts, polymetallic manganese nodules, phosphorites, and clay minerals. Due to the tectonic-geological setup of the Bangladesh part of the Bay of Bengal, the sea bed minerals found are mainly clay minerals, which include illite, kaolinite, and montmorillonite. However, the total reserve of the economically essential minerals found in sea bed sediments is yet to be estimated. Bangladesh's demand for mineral

resources has significantly increased due to an average industrial growth rate of 6.7%. Bangladesh imports approximately 2.8MT of minerals worth 41.81 billion BDT as concentrates ore or primary products. Therefore, research and exploration initiatives must be taken to identify new mineral deposits in the near-shore, offshore, and deep-sea sediments within Bangladesh's maritime boundary.

Challenges, Opportunities, and Future Prospects

Offshore and deep-sea hydrocarbon exploration comes with various challenges, which include advanced technology, huge cost involvement, and massive uncertainty in success. Considering the tectonostratigraphic of the northern Bay of Bengal, Bangladesh has enormous potential for hydrocarbon discoveries in the offshore and deep-sea blocks, particularly adjacent to Myanmar's Rakhine Basin. As the existing gas reserves are depleting very rapidly with no significant discoveries in recent times and ever-increasing energy demand for industrialization, the country is desperate to secure future energy prospects by offering IOCs an attractive new PSC model for

hydrocarbon exploration and exploitation, specifically in the offshore and deep-sea blocks. On the other hand, although placer mineral deposits were discovered in Bangladesh in 1961 and having their substantial economic potential, the sector has yet to get due attention from government agencies and private entrepreneurs. Mineral resources are mined from coastal and offshore areas in many countries (e.g., Australia, South Africa, India, Sri Lanka, the USA, and Canada). India mines more than 2MT of heavy minerals annually from its marine and coastal areas. Hence, to thoroughly understand the economic potential of the mineral deposits in Bangladesh's GDP, a comprehensive study is needed to assess the proven reserve and identify future prospects. Suppose the already discovered mineral reserves are exploited systematically and sustainable way. In that case, it brings significant economic benefits and contributes to the establishment of mineral-based industries and employment generation.

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