Blue economy of India

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Abstract

The global blue economy is booming with increased sea trade, bio-prospecting, marine construction, hydrocarbon exploitation, marine tourism, mineral exploitation, offshore energy, sea water utilization and research activities. With the likely increase in the continental margin till 350nm, India's EEZ is expected to get doubled from the present EEZ of 2.3 million km^2, opening up opportunities to utilise the huge cache of marine resources including mineral resources, hydrocarbons and renewable energy. These resources need to be utilised from the challenging offshore locations efficiently and in an eco-friendly manner so as meet the widening demand-supply gap in the country's strategic mineral and energy sectors.

The mineral resources in the Indian Oceans are estimated to be about 632 Million Tons (MT). They comprise of the placer and phosphorite deposits distributed in the continental shelf regions; the manganese nodules in the abyssal plains; the cobalt crust in sea mounts and the polymetallic sulphides in the deep ocean ridges. Considering the strategic importance of these deep sea minerals, due to their limited availability in land, India has allotted a site of 1,50,000 km^2 in the Central Indian Ocean Basin (CIOB) allocated by the UN-International Sea Bed Authority for exploitation of the poly-metallic nodules. After survey and exploration, 50% of the area is given for developing the technology to mine manganese nodules from this area. Even though developed countries are showing interest in deep sea mining, India is the forerunner in among them in demonstrating a crawler-based mining machine capable of collecting, crushing and pumping the minerals to the mother ship from a water depth of at about 500m, which is being augmented for deep sea mining demonstration. A joint effort by research centers, including NIOT, NIO and IMMT are taken up for the identification of potential mining locations for test mining at 5500 m water depth after environmental impact assessments. In order to carry out effective mineral exploration work in deep waters up to 5500m, an in-situ soil tester capable of measuring the sea bed soil properties and a deep water work class remotely operated vehicle (ROV) for deep water intervention have also been developed and demonstrated. Technologies are developed for webcasting of explorations activities from seabed

to mainland in real time for decision and support.

The conventional offshore-located hydrocarbon resources is estimated to be about 600MT (including 1.81 and 1.48 Trillion m^3 (TCM) of natural gas reserves in shallow and deep waters) and the unconventional hydrocarbons of about 1894 trillion m^3 in the form of marine natural gas hydrates is prognosticated at water depths ranging from 1000-1500m in the continental margins of India. During 2015, about 30 % of the domestic natural gas production was from onshore fields and 70% from shallow offshore fields. In 2015, in order to meet the demand-supply gap, about 80% of liquid hydrocarbons and 40% of the natural gas requirements were imported. In order to increase the energy independence, efforts are undertaken by a consortium of organizations including NIOT, NIO, NGRI, ONGC and DGH for realizing gas hydrates a future domestic natural gas resource. In order to carry out cost-effective ground-truthing of the gas hydrate's presence (compared to expensive ship based deep sea drill) in offshore locations of India, a wireline autonomous coring system is being developed. The system which shall be recovering core samples at prospective gas hydrate locations shall provide leads to commercial utilisation of the vast blue economic resource. The consortium shall soon be establishing a demonstration well in the Krishna Godavari basin, east coast of India for assessing the commercial viability. Multiple techniques are being analyzed for producing methane from potential gas hydrate reservoirs using reservoir simulators and custom-developed geotechnical aids.

Offshore wind, Ocean thermal energy and marine currents are promising strategic clean energy resources for India. With an estimated 350 GW in the offshore wind energy capacity, NITI-Aayog estimates about 20 GW of offshore wind energy capacity addition to the Indian electricity generation sector by 2047. With the present global investments at US$ 23 billion and upcoming technological trends, the levelized cost of electricity for offshore wind is forecast to reduce from US$176/MWh in 2015 to US$ $122/MWh in 2020. Offshore wind potential in the states of Tamilnadu and Gujarat are being analyzed and efforts are underway to set up wind profiling platforms at potential offshore locations. The National Offshore Wind Authority is also being established to carry out resource assessment in the EEZ of India.

With the earth surface receiving about 22 TW of solar radiation, Indian oceans receive significant portion of the radiation which is stored in the form of heat energy. The Ocean

Thermal Energy Conversion (OTEC) technique utilizes the thermal gradient between the surface and deep sea waters to operate a heat engine for electricity generation. The thermal gradient shall also be used for desalinating seawater based on low temperature thermal desalination (LTTD) technique. These techniques are specifically beneficial for islands as the topology favors easier collection of deep cold water due to the steep gradient. Desalination plants based on LTTD technique producing 1 lakh litres per day are put into operation in several islands of India such as Minicoy, Agathi and Kavaratti; and the same is planned to be put up in many more islands. Design of an island-based desalination-cum-OTEC plant of 150 kW electric capacities is undertaken. In addition to these systems, lower capacity floating wave energy devices and marine current turbines are demonstrated, improved for hydro-kinetic performance and scaled up for higher capacities.

Compared to land based oil crops, micro algae have excellent potential as prime land is left for agriculture. Lipids as well as Lutein can be extracted from microalgae in a cost effective manner. However, to do it on a commercial scale, sea leasing policy to be in place, for which action is on.

Based on the experiences gained by Indian organizations over the past few decades in the area of ocean technology, qualification facilities such as deep sea high pressure simulator and acoustic test facility were developed, while the deep sea technology demonstration vessel Sagar Nidhi inducted into the Ministry of Earth Sciences serves as an excellent platform for offshore research. Efforts are also undertaken for developing deep water human submersibles for deep water intervention and a numeric tank for facilitating design of deep water structures. The return of experiences has also resulted in evolving best offshore and subsea system developments with international standards, increased domestic innovation, international patents and publications.