

STATE REVIEWS



# Indian Minerals Yearbook 2018

(Part- I)

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**STATE REVIEWS  
(Offshore Regions)**

**(FINAL RELEASE)**

**GOVERNMENT OF INDIA  
MINISTRY OF MINES  
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## **OFFSHORE REGIONS**

The Government of India notified the Offshore Areas Minerals (Development & Regulation) Act, 2002 (OAMDR Act), No. 17 of 2003 in the Gazette of India, Extraordinary, Part-II, Section-1, dated 31.1.2003. The purpose of the Act is to provide for development and regulation of mineral resources in the territorial waters, continental shelf, exclusive economic zone and other maritime zones of India and to provide for matters connected therewith or incidental thereto. The Act is applicable to all minerals in offshore areas including minerals prescribed under Atomic Energy Act, 1962, but excludes oils and related hydrocarbons as there is separate legislation in force. The Act came into effect from 15.1.2010 vide S.O. 338 (E), dated 11.2.2010 notified by the Central Government.

The Act makes it mandatory to undertake reconnaissance, exploration or production operation in the offshore areas in accordance with the prescribed terms and conditions for Reconnaissance Permit (RP), Exploration Licence (EL) or Production Lease (PL) granted under the Act and the rules made thereunder. The Act further states that availability of the areas for grant of RP, EL or PL shall be notified within six months from the commencement of the Act, and subsequently at such times as considered necessary. The Act empowers the Central Government to make rules for the purpose of the Act including terms and conditions under the RP, EL, PL, etc. The Rules, namely, the Offshore Areas Mineral Concession Rules, 2006 have been framed and notified on 3.11.2006 by G.S.R.691(E) published in the Gazette of India, Extraordinary, Part II, Section 3 (i), No. 539, dated 4.11.2006. The Rules came into effect on the date on which the Offshore Areas Mineral (Development and Regulation) Act, 2002 came into force, i.e. 15.1.2010.

As per S.O.1341(E) dated 7.6.2010, The Controller General, Indian Bureau of Mines had notified the mineral-bearing offshore blocks available for grant of Exploration Licence. As per the attached Schedule to the said Notification, there were 26 offshore areas available in offshore waters of Bay of Bengal and 37 offshore areas in the offshore waters of Arabian Sea for grant of Exploration Licence.

The orders for grant of exploration licences were issued by the Administering Authority on 05.04.2011 for the 62 exploration blocks (the bounding latitude and longitude of Block Nos. 3 & 32 falling in the Arabian Sea were same and therefore these were considered as a single block and granted as Block No. 3). Before execution of deed granting such licence, the grant of exploration licences in 62 blocks was challenged through the writ petition in the judicature of various High Courts. Due to interim orders passed by various Hon'ble High Courts on the writ petition and non-disposal of the said petition, the offshore exploration licences granted have not been executed. Besides, it was brought to the notice of the Administering Authority that some of the exploration blocks notified for grant of offshore exploration licences vide notification dated 07.06.2010 overlapped with areas other than offshore area, to which the OAMDR Act did not apply.

The Central Government vide S.O.19 (E) dated 06.01.2011, published in the Official Gazette, declared the extent of the Coastal Regulation Zone (CRZ) and also imposed certain restrictions on the setting up and expansion of industries, operations or processes and the like in the CRZ. The said statutory order also did state that CRZ shall apply to the water and the bed area between the Low Tide Line to the territorial water limit (12 Nm) in case of seas and has prohibited in the area so identified as CRZ, inter alia, the mining of sand, rocks and other sub-strata materials except those rare minerals not available outside the CRZ area. In the context of the said notification, all the 62 offshore blocks lie within the area identified as CRZ which attracts the prohibition of mining (operation undertaken for the purpose of winning any mineral).

The OAMDR Act provides that the holder of an exploration licence for offshore area shall have the exclusive right to a production lease for winning of a mineral. In view of the effect of the CRZ Notification dated 06.01.2011, the purpose of executing the 62 offshore exploration licences could not be realised as the applicants could not undertake operations for winning of minerals inspite of grant of Production Lease after successful completion of exploration operations.

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Therefore, taking into consideration all the above stated facts, the Controller General, IBM and administering authority Offshore Areas Minerals (Development & Regulation) vide S.O.19 (E) dated 6<sup>th</sup> January, 2011, published in the Official Gazette, annulled the Notification issued vide S.O.1341(E) dated 7<sup>th</sup> June 2010 with effect that all subsequent actions undertaken for grant of the 62 exploration licences hereby would stand rescinded.

As per S.O. 1523(E) dated 06.04.2018, the Additional Director General, National Mission Head-II, Geological Survey of India has been notified as the "Administering Authority" for the purpose of the said Act by Clause (a) of Section (4) of the Offshore Area Mineral Development and Regulation Act, 2002, 17 of 2003 and in supersession of the notification published in Gazette of India, Extraordinary Part II Section 3, Subsection (ii) vide S.O. 339(E) dated 11<sup>th</sup> February 2010.

The Government of India further signed 340 contracts under NELP regime with National Oil Companies and Private (both Indian and foreign)/ Joint Venture companies. At present, 131 contracts are operational out of the total 340 contracts [(254 NELP, 56 Pre-NELP (small & medium sized discovered field)], 30 (DSF Round) signed so far under various bidding rounds.

The awarded 254 blocks under NELP regime are at locations in inland (114), offshore shallow water (59) and deepwater (81) areas. As a result of exploratory activities, several unexplored and poorly explored areas, in particular, offshore and deepwater areas, have been appraised through geophysical surveys and exploratory drilling. Details of exploration block awarded/ relinquished/operational are provided in Table -1.

In order to explore and produce new sources of natural gas from coal-bearing areas, the Government had formulated a CBM Policy in 1997, wherein CBM being Natural Gas is explored and exploited under the provisions of OIL Fields (Regulation & Development) Act 1948 (ORD Act 1948) and Petroleum & Natural Gas Rules 1959 (P&NG Rules 1959) administered by Ministry of Petroleum & Natural Gas (MOP&NG). CBM policy was aimed to provide attractive fiscal and contractual framework for exploration and production of CBM which is an environment-friendly clean gas fuel similar to conventional natural gas. In order to harness CBM (Coal-bed Methane) potential in the country, CBM blocks were offered through international competitive bidding for exploration and production for the first time

in the year 2001. Under the CBM policy, till date, four rounds of CBM bidding have been implemented by MoP&NG, resulting in award of 33 CBM blocks [including 2 blocks on Nomination and 1 block through Foreign Investment Promotion Board (FIPB) route]. Till date, most CBM exploration and production activities in India are pursued by domestic Indian companies. These CBM blocks are in the States of Andhra Pradesh, Assam, Chhattisgarh, Gujarat, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu and West Bengal.

**Table - 1: Details of Exploration Block Awarded (as on 10.04.2018)**

Round	No. of blocks awarded	No. of blocks relinquished	No. of blocks active	Currently Active Area(Sq. Km)
Pre NELP	28	18	10	8965.64
Pre NELP (small & medium sized discovered field)	28	03	25	3709.46
NELP-I	24	21	3	12870.01
NELP-II	23	20	3	1064.96
NELP-III	23	19	4	4176.5
NELP-IV	20	16	4	1438.29
NELP-V	20	15	5	2863
NELP-VI	52	42	10	8554
NELP-VII	41	29	12	19278
NELP-VIII	32	22	10	6667
NELP-IX	19	4	15	13017.36
<b>Total</b>	<b>310</b>	<b>209</b>	<b>101</b>	<b>82604.22</b>
DSF Round	30	-	30	776.75
<b>G. Total</b>	<b>340</b>	<b>209</b>	<b>131</b>	<b>83380.97</b>

*Source: India's Hydrocarbon Outlook, 2017-18, Directorate General of Hydrocarbons.*

## RESERVES/RESOURCES

As on 1.4.2018, the total balance recoverable reserves of crude oil were estimated at 594.49 million tonnes, out of which 317.82 million tonnes (53.46%) are in onshore and 276.67 million tonnes (46.54%) in offshore areas. ONGC (nomination) has the largest share of 73% in reserves of crude oil with OIL (nomination) and PSC regime contributing 13% and 14%, respectively.

The balance recoverable reserves of natural gas as on 01.04.2018 were placed at 1,339.57 billion cu m, out of which 516.22 billion cu m (38.54%) are in onshore and 823.35 billion cu m (61.46%) in offshore areas. PSC regime has the largest share of 49% in natural gas reserves followed by ONGC (nomination) and OIL (nomination) at 42% and 9%, respectively (Table-2).

**Table – 2: Balance Recoverable Reserves of Crude Oil & Natural Gas in India including Offshore Areas (As on 1.4.2018)**

Area	(Crude oil in million tonnes) (Natural Gas in billion cu m)	
	Crude oil	Natural gas
<b>India</b>	<b>594.49</b>	<b>1339.57</b>
<b>Onshore*: Total</b>	<b>317.82</b>	<b>516.22</b>
<b>Offshore: Total</b>	<b>276.67</b>	<b>823.35</b>
Western offshore	236.25	312.52
Eastern offshore	40.42	510.83

*Source: Indian Petroleum & Natural Gas Statistics 2017-18, Ministry of Petroleum & Natural Gas, Government of India.*

*\* Reserves includes Coal-bed Methane in Jharkhand, Madhya Pradesh and West Bengal.*

## EXPLORATION ACTIVITIES

### Conventional Hydrocarbon

ONGC, GSI and other Public & Private Sector companies continued their efforts in respect of exploration for hydrocarbon in offshore region, both shallow and deep water, during 2017-18.

### Private Companies/Joint Ventures

During 2017-18, a total of 500 LKM of 2D seismic data was acquired, mostly of which is in offshore region and were carried out by Private/JVs. A total of about 5,059 SKM of 3D seismic data was acquired, majority of which was carried out by ONGC in its offshore nomination areas. A total of 144 exploratory wells and 445 developments wells were drilled in 2017-18 (Table -3).

**Table - 3: Exploratory & Development Efforts under Nomination & PSC Regime during 2017-18**

Sl. No.	Subject	Parameter	ONGC (Nomination)	OIL (Nomination)	Pvt/JVs	Total
1	2D seismic data acquired	Onland (GLKM)	5.36	139	355.50	499.86
		Offshore (GLKM)	-	-	-	-
		<b>Total 2D Seismic</b>	<b>5.36</b>	<b>139</b>	<b>355.50</b>	<b>499.86</b>
2	3D seismic data acquired	Onland (SKM)	1118.18	171.72	290.71	1580.61
		Offshore (SKM)	3478.42	-	-	3478.42
		<b>Total 3D Seismic</b>	<b>4596.6</b>	<b>171.72</b>	<b>290.71</b>	<b>5059.03</b>
3	Exploratory wells drilled	Onland	57	11	17	85
		Offshore	45	-	14	59
		<b>Total Exploratory Wells</b>	<b>102</b>	<b>11</b>	<b>31</b>	<b>144</b>
4	Exploratory Meterage drilled	Onland ('000 m)	164.33	52.26	48.39	265.00
		Offshore ('000 m)	117.44	-	31.22	148.66
		<b>Total Exploratory Meterage</b>	<b>281.77</b>	<b>52.28</b>	<b>79.61</b>	<b>413.66</b>
5	Development Wells drilled	Onland	277	28	36	341
		Offshore	104	-	-	104
		<b>Total Development Wells</b>	<b>381</b>	<b>28</b>	<b>36</b>	<b>445</b>
6	Development Meterage drilled	Onland ('000 m)	497.69	80.96	71.90	650.55
		Offshore ('000 m)	226.01	-	-	226.01
		<b>Total Development Meterage</b>	<b>723.70</b>	<b>80.96</b>	<b>71.90</b>	<b>876.56</b>

*Source: India's Hydrocarbon Outlook: 2017-18 — A report on exploration & production activities, Directorate General of Hydrocarbon, Ministry of Petroleum & Natural Gas.*

## Marine and Coastal Survey

### Marine Survey

GSI continued its offshore geoscientific studies both in Exclusive Economic Zone (EEZ) and Territorial Waters (TW) of India. Survey in the near-shore zones, i.e., 0 m to 10 m isobaths were carried out using hired mechanical boats.

Marine and Coastal Survey Division (M&CSD) has completed seabed mapping of 1,32,585 sq. km out of 1,50,000 sq. km in 5 km × 2 km grid within Territorial Water and 18,42,552 sq. km out of 18,64,900 sq. km in the Exclusive Economic Zone beyond Territorial Waters on reconnaissance scale. The total EEZ coverage including TW was 19,99,784 sq. km out of a total EEZ area of 20,14,900 sq. km. During field session 2017-18, R.V. Samudra Ratnakar carried out 56,130 sq. km of multibeam bathymetry. Seabed survey of an area of 6,650 sq. km utilising coastal launch RV Samudra Shaudhikama in the areas off Gujarat and 1,295 sq. km in contiguous zone off Kerala were completed besides other parametric surveys. A total of 854 LKM of multichannel seismic survey were also carried out. Nine cruises onboard of RV Samudra Ratnakar including one spill over from previous field session, seven cruises onboard of RV Samudra Kaustubh and RV Samudra Shaudhikama each, besides three coastal survey items and one RP item were taken up during 2017-18.

The following marine geoscientific surveys were carried out during 2017-18 field season:

#### RV Samudra Ratnakar

1. SR-026 (Spill over): Study of tectonic setup of Bay of Bengal and Andaman-Nicobar subduction complex within EEZ of India by systematic multi-channel seismic survey.
2. SR-031: Gas Hydrate investigation in Andaman Sea.
3. SR-032: Search for REY (Rare-earth Elements & Yttrium) in ferromanganese crust on the submerged ridges and surface/subsurface sediments east of

Chetlat Island around Lakshadweep Group of Islands, Arabian Sea.

4. SR-033: Preliminary search for phosphorite over sea mount (Calicut Mt.) off kozhikode, Kerala.
5. SR-034: Preliminary assessment of lime mud in the continental margin off Gujarat (Block IV).
6. SR-036: Preliminary assessment of lime mud in the continental margin off Gujarat (Block V).
7. SR-037: Swath bathymetric survey of the middle fan segment of Bengal Fan within the EEZ off Pentakota to Pudimadaka, Andhra Pradesh.
8. SR-038: Study of morphological and tectonic set up along with Geology of Andaman Sea within EEZ of India.
9. SR-039: Investigation for Rare-earth Elements & Yttrium (REY) in the Fe-Mn crust in the southern Part of the West Sewell Ridge.

#### RV Samudra Kaustubh

1. ST-259: Systematic shallow seismic surveys within the territorial waters in the shelf area off Dalhousie Island (Sunderban Delta), West Bengal.
2. ST-260: Systematic shallow seismic surveys within the territorial waters in the shelf area north of Shortt's Island, Odisha.
3. ST-262: Geophysical (Seismic) Survey within the Territorial Waters off Gangapatnam, Andhra Pradesh Coast, Bay of Bengal.
4. ST-263: Geophysical (Seismic) Surveys within the Territorial Waters off Ongole, Andhra Pradesh Coast, Bay of Bengal.
5. ST-258: Placer mineral and construction grade Sand resources evaluation in the territorial waters off Bheemunipatnam, Andhra Pradesh.
6. ST-261: Placer mineral resource evaluation in the territorial waters off Behuda River Mouth, Odisha.
7. ST-264: Search for both REE and Placer Mineral resource in the shelf area off Vedaranyam, Nagapattinam District, Tamil Nadu.

**RV Samudra Shaudhikama**

1. SD-276: Multi thematic mapping of Contiguous Zone by geological and geophysical surveys beyond Territorial Waters in Arabian Sea off Thiruvananthapuram, Kerala.
2. SD-277: Mapping of the seabed off Jakhau, Gujarat.
3. SD-278: Seabed mapping off Jhanjhmer, Gujarat (Block-IV) beyond TW of India.
4. SD-279: Seabed mapping off Alang, Gujarat (Block - V) beyond TW of India.
5. SD-280: Seabed mapping off Valsad, Gujarat (Block-VI) beyond TW of India.
6. SD-281: Evaluation of Heavy Mineral resources in marine sediments off Alang, Gujarat (Block 1).
7. SD-282: Multi thematic mapping of Contiguous Zone beyond territorial water in Arabian Sea off Kazhakuttam, Kerala.

**Airborne Geological Survey**

GSI pursued airborne geophysical survey for generating database by employing magnetic and radiometric techniques through Twin Otter Airborne Survey System (TOASS). The survey was followed by data processing, preparation of aerogeophysical maps and interpretations that help in ground evaluation and add information to geological maps and that which would aid prospecting and exploration for minerals. The data from the aerial surveys thus form an important backup for refining the geological understanding of an area, with focus on identification of favourable locales of mineralisation, crustal structure, etc.

During 2017-18, the airborne magnetic and radiometric surveys data processing and interpretation

over Alwar-Neem Ka Thana area in parts of Rajasthan, Haryana & Uttar Pradesh was in various stage of process. The study of this area included two field sessions, i.e., 2016-18. The significant anomalies noticed in the area were: (i) Magnetic anomalies of high frequencies along NE-SW occurring towards south of Dudu over the alluvium covered areas, appear to be due to the extension of causative sources of Archaean, i.e., Bhilwara Supergroup (BSG) comprising Sandmata and Mangalwar Complex; (ii) broad anomalies of low frequencies over the alluvium covered areas towards northeast of Dudu corresponding to deeper causative sources appear to indicate deeper basement features; and (iii) the anomalies of high frequencies with NE-SW trends observed towards northern part of the area around Shahpura, north of Duasa, west of Alwar and south of Narnaul indicating causative sources of shallower nature appear to be associated with the folded structures of Alwar basin, where several base metal prospects have been reported.

**Production**

Petroleum (crude) and natural gas (utilised) are the mineral items produced from Offshore region. (Table - 4).

**Gas Hydrates**

Gas hydrates are formed when gas and water mixtures are subjected to high pressure and low temperature conditions in the sea, usually in water depths of more than 800 m, within sediments just below the sea bottom. They are also formed in some permafrost region of the world. The gas hydrates also act as a cap under which natural gas can get accumulated. Gas hydrates can be an unconventional energy source of the future.

**Table – 4: Mineral Production in Offshore Regions, 2015-16 to 2017-18 (Excluding Atomic Minerals)**

Mineral	Unit	2015-16	2016-17	2017-18 (P)
		Quantity	Quantity	Quantity
Natural Gas (utilised)	m cu m	23012	22039	22008
Petroleum (crude)	'000t	19089	18421	18144

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In India, gas hydrate research and exploratory activities are being steered under National Gas Hydrate Programme (NGHP). Under NGHP, technically coordinated by Directorate General of Hydrocarbons (DGH), various R&D studies are in progress to develop vast resources of gas hydrates in western and eastern offshore and Andaman offshore areas.

NGHP-Expedition-01 exploration programme was carried out in 2006 for mapping gas hydrate zones in Krishna-Godavari, Kerala, Konkan, Mahanadi and Andaman offshore areas. A total of 39 holes were drilled at 21 sites and the physical presence of gas hydrate was established predominantly in Krishna-Godavari, Mahanadi and Andaman Basin in clay dominated complex geological settings.

NGHP-02 was conducted successfully in Eastern offshore from 09.03.2015 to 31.07.2015. A total of 42 wells were drilled at 25 sites in Krishna-Godavari and Mahanadi areas in sand reservoirs for gas hydrates. NGHP-02 has discovered significant gas-hydrate

bearing sand reservoir system in the Krishna-Godavari area. Further extensive studies are being carried out to assess the gas hydrate resource potential, reservoir characterisation, reservoir delineation & geo-stability and identification of sites for pilot production for testing. KG deep offshore contain gas hydrate accumulations which can be suitable sites for future gas hydrate production testing under NGHP Exp-03. NGHP-3 aims at carrying out pilot production testing of at least one site in Indian deepwater environment.

The challenges faced for commercial exploitation of gas from gas hydrates are more or less similar all over the world. Extracting methane from gas hydrate in marine environments is relatively a new path. Japan has taken a lead in this direction. From the progress being made by the Indian NGHP, steps are underway to mitigate anticipated challenges in the Indian context. The NGHP expeditions are an appropriate line of research investigation which could help the country move forward by harnessing this yet elusive resource.