India's Hydrocarbon Outlook : 2015-16

A Report on Exploration & Production Activities

DGH

Directorate General of Hydrocarbons

Ministry of Petroleum and Natural Gas

CREATION

DGH was formed through a Government of India resolution dated 08.04.1993 under the administrative control of Ministry of Petroleum & Natural Gas.

OBJECTIVE

To promote exploration and sound management of the petroleum & natural gas resources and also non-conventional hydrocarbon energy resources while having balanced regard for the environment, safety, technological and economic aspects.

भारत का हाइड्रोकार्बन परिदृश्य 2015–16
अन्वेषण व उत्पादन गतिविधियों पर एक रिपोर्ट

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हाइड्रोकार्बन महानिदेशालय
पेट्रोलियम एवं प्राकृतिक गैस मंत्रालय
भारत सरकार

Directorate General of Hydrocarbons
Ministry of Petroleum and Natural Gas
Government of India

धर्मेन्द्र प्रधान
ଧର୍ମେନ୍ଦ୍ର ପ୍ରଧାନ
राज्यमंत्री (स्वतंत्र प्रभार)
पेट्रोलियम एवं प्राकृतिक गैस मंत्रालय
भारत सरकार
शास्त्री भवन, नई दिल्ली–110001

सत्यमेव जयते

DHARMENDRA PRADHAN

Minister of State (I/C)
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Shastri Bhawan, New Delhi-110 001

MESSAGE

The world has experienced a sharp decline in oil prices since mid-2014 due to an oversupply in the oil market primarily on account of US shale oil revolution and OPEC's stand against curtailing oil production to protect market share and a simultaneous slowdown in demand in some of the erstwhile fastest growing economies of the world. This low crude oil price scenario has given a huge fillip to the public exchequer and has contributed to India being among the world's fastest growing economies and will remain so for years to come. The oil and gas sector is among the six core industries in India and plays a major role in influencing decision making for all the other important sections of the economy.

Since E&P of oil and gas is a capital intensive and high risk business, an immediate cutback in upstream spending is happening but little impact is seen on production. E&P companies in India had to strive to thrive in an oversupplied business environment by utilizing technological advancements with increased efficiency to squeeze out higher volumes with less investment.

In line with the vision of Hon'ble Prime Minister to cut down India's import dependence for domestic energy needs by 10% in the next 6-7 years, the Ministry has introduced landmark changes in the Indian Upstream E&P sector by launching a slew of policy initiatives. The launch of Discovered Small Fields Policy and Hydrocarbon Exploration and Licensing Policy are a few to name. The recent policy initiatives are a part of Government's "Ease of Doing Business" initiative to make Indian oil & gas sector fair, transparent and investor friendly through appropriate regulatory, fiscal and policy interventions. The World Bank declared that India has moved up 12 places (to 130th rank) in the Global Ease of Business rankings. Government has also identified hydrocarbon sector as one of the 25 priority areas for promotion of manufacturing under the "Make in India" campaign.

I am pleased to say that Directorate General of Hydrocarbons (DGH), the technical arm of Ministry of Petroleum and Natural Gas, has been successful in facilitating companies in Upstream Oil Industry by extending all possible help within the ambit of contractual terms. I compliment DGH on its Annual Publication "India's Hydrocarbon Outlook : 2015-16" that encapsulates the E&P activities in our country.

DHARMENDRA PRADHAN

कपिल देव त्रिपाठी
सचिव
भारत सरकार
पेट्रोलियम एवं प्राकृतिक गैस मंत्रालय
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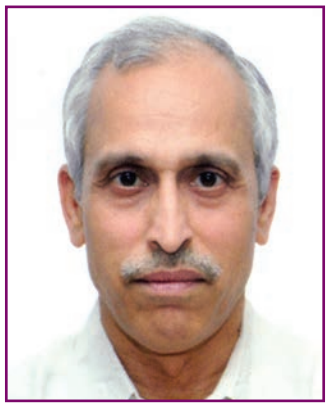


MESSAGE

Despite the slump in world oil and natural gas prices and the current downturn in the sector, the fiscal 2015-16 has experienced a watershed moment in the Indian Upstream Oil and Gas Industry. The landmark changes may be attributed to the recent policy reforms introduced in the sector by the Government. There has been a paradigm shift in the fiscal regime in the sector by moving towards a 'Revenue Sharing mechanism' from the existing 'Production Sharing' based on Investment Multiple and Cost Recovery.

The Discovered Small Fields policy has been launched in May 2015 with a framework that is tailor made to facilitate more investment in the sector by both E&P and non-E&P companies. It is estimated that the 46 discovered contract areas will evince interest from investors in India and abroad and boost the production in India within the next couple of years. In tune with Government's policy of 'Ease of Doing Business', launched in March 2016, Hydrocarbon Exploration and Licensing Policy in sync with Open Acreage Licensing Policy envisages to provide a uniform licensing system to explore and exploit all hydrocarbons such as Oil, Gas, Shale Gas/Oil, CBM, etc. under a single licensing framework while enabling E&P operators to choose their blocks.

Espousing Government's policy of 'Minimum Government Maximum Governance'; Marketing and Pricing freedom has been granted for new gas production from Deepwater, Ultra Deepwater and High Pressure-High Temperature Areas and a policy has been set-in-motion for grant of extension to the Production Sharing Contracts for small, medium sized and discovered fields.

The Government of India has adopted a multi-pronged strategy to achieve the goal of 10% import reduction by 2022 by accelerating indigenous efforts in enhancing domestic oil and gas production, supplementing the Unconventional hydrocarbon reserves base and by introducing path-breaking policy initiatives to smoothen existing bottlenecks and attract more investment in the sector.

Directorate General of Hydrocarbons (DGH) since the last 23 years has been engaged in the job of increasing the exploration acreage in India. DGH's annual publication "India's Hydrocarbon Outlook : 2015-16" has comprehensively encompassed all the major achievements made by India in the E&P sector in this fiscal year. The report is an indispensable read for those interested in participating in India's upstream Oil and Gas sector.

K.D. TRIPATHI

सत्यमेव जयते

ATANU CHAKRABORTY, IAS
DIRECTOR GENERAL

DIRECTORATE GENERAL OF HYDROCARBONS
Ministry of Petroleum & Natural Gas
Government of India

From The Director General's Desk

Dear All,

Shale gas revolution coupled with falling LNG prices and technological developments have brought the world oil and gas scenario at a point of inflexion wherein low crude prices have drastically reduced India's import bill of petroleum and petroleum products. India is now world's fastest growing economy clocking a GDP growth of 7.6% in 2015-16. The growing Indian economy has also presented an insatiable hunger for energy and corresponding increase in crude oil and natural gas demand. In line with Prime Minister's announcement to reduce India's Petroleum import bill by 10% (by 2022), proactive steps are being taken to increase domestic production of Crude Oil & Natural Gas.

Major policy reforms to propel investments in E&P sector are the introduction of Hydrocarbon Exploration Licensing Policy (HELP), Discovered Small Fields Policy, introduction of Uniform Licensing Policy and Revenue Sharing mechanism for future bidding of E&P contracts. The spirit behind the transition from NELP to HELP is creation of a transparent, easy to administer and investor friendly regime, incentivize investments in the E&P sector and boost domestic production. DGH is now trying to execute these policy reforms through a transparent and conducive operational framework. Though these reforms aim at facilitating investment environs in India by creation of a stable regulatory regime with appropriate fiscal incentives in place; there is also a need for a multi-pronged approach to increase the domestic crude oil and natural gas production that has remained near stagnant for the past few years. Accelerated indigenous exploration efforts are required to meet these targets to feed the Nation's energy needs for more than 1.2 billion population.

India's 26 sedimentary basins have not been exploited to optimum levels; to assist in the identification of new, unexplored and unapprised areas with hydrocarbons prospectivity, a plan has been formulated to conduct 2D seismic surveys in all sedimentary basins of India where no/scanty data is available. A project has been initiated by a Multi Organization Team (ONGC, OIL & DGH) to carry out re-assessment of hydrocarbon resources of India in all its 26 sedimentary basins based on geo-scientific data generated over past decades. Under the policy for Geo-scientific data generation for hydrocarbons in Indian Sedimentary Basins, through Non-exclusive Multi-client Geo-scientific surveys; data acquisition has commenced in West coast of India. Furthermore, to encourage E&P activities in the North East Region of India, Government of India carried out special study with consultant for framing Hydrocarbon Vision Document 2030 for NE India.

With an objective to increase the domestic production and to monetize the hydrocarbon resources locked for years, Government introduced the 'Discovered Small Field Policy-2015'. Under this policy, 67 oil and gas fields will be awarded in 46 contract areas estimated to hold over 625 Million Barrels of Oil and Oil Equivalent Gas (O+OEG) in-place and spread over 1,500 square kilometres in Onland, Shallow water and Deepwater areas. Furthermore, to enable optimal recovery of oil and gas reserves from fields of Pre-NELP discovered (small and medium) fields, Government has approved a policy for the grant of extension to the existing Production Sharing Contract. Also, recognizing the need to incentivize gas production from Deepwater, Ultra Deep water and High Pressure-High Temperature Areas, Government has notified marketing and pricing freedom for gas produced from all present and future discoveries in such areas which are yet to produce commercial production.

Unconventional hydrocarbon resources play a vital role in boosting domestic gas production in India. In FY 2015-16, Coal Bed Methane production has reached 1 MMSCMD and is poised to increase to 6 MMSCMD by 2018. India's shale gas reserves could be anywhere between 300 TCF (8.5 TCM) and 2,100 TCF (59.5 TCM). Under the current agreement, exploration of shale gas is being carried out by the Oil and Natural Gas Corporation (ONGC) alongside Oil India Limited. So far, 69 crores have been collected from 17 wells drilled by ONGC. While tight oil and shale gas are within the realm of possibility, gas hydrate, currently under research, has to reach a stage when we can think of commercial production. Natural Gas Hydrate Program (NGHP)-2 was successfully completed in July 2015 wherein 42 wells were drilled at 25 sites in Krishna Godavari and Mahanadi deepwater basin by hiring Japanese drillship CHIKYU. Significant gas hydrate bearing zones have been identified and pilot production testing is planned to be conducted under NGHP-3.

To highlight the E&P activities in FY 2015-16, a total of 7816.12 LKM of 2D seismic data and 6236.12 SQM of 3D seismic data was acquired. 138 exploratory wells were drilled in the year with an exploratory meterage of 403.72 km. 363 development wells were drilled with a cumulative meterage of 83.16 km. Total crude oil production in the country in FY 2015-16 is 36.95 MMT (69% from nomination regime and 31% from PSC regime) and cumulative natural gas production is 32.249 BCM (75% from nomination, 24% from PSC regime and 1% from CBM). As on March 2016, the in-place volume of crude oil is 7080 MMT and 4192 BCM for gas (11272 MMT O+OEG), there has been a cumulative accretion of in-place volume 46.64 MMT. Total 27 hydrocarbon discoveries were made in FY 2015-16 with 13 in nomination regime and 14 in PSC regime. National Data Repository (NDR) project has made commendable progress and is in advanced stage of completion. As on 31.03.2016, total 169144.77 LKM 2D Seismic data, 15716.28 SKM 3D Seismic data, 237 wells and their log data and 618 well reports have been loaded in NDR.

DGH is willing to walk the extra mile to tap prospective investors and make all out efforts to offer as many blocks as possible. DGH will endeavour to be the rightful contributor to maintain a progressive and conducive atmosphere for the E&P sector and will continue the role of a facilitator and ensure a level playing field. DGH also intends to resolve all contractual and technical issues within its ambit by a synergistic collaboration with the E&P fraternity. I thank Ministry of Petroleum and Natural Gas whose encouraging support and guidance have let us discharge our duties effectively.

DGH's Annual publication "India's Hydrocarbon Outlook : 2015-16" summarizes all important events and achievements of India's upstream sector in an informative and lucid manner. The publication will be a valuable guide to the future investors and the existing stakeholders.

ATANU CHAKRABORTY
Director General

सत्यमेव जयते

अतनु चक्रवर्ती, आई.ए.एस
महानिदेशक
हाईड्रोकार्बन महानिदेशालय
पेट्रोलियम एवं प्राकृतिक गैस मंत्रालय
भारत सरकार

महानिदेशक की कलम से

प्रियजनो,

शेल गैस क्रांति, लिक्विफाइड नेचुरल गैस की गिरती कीमतों तथा प्रौद्योगिकी विकास से विश्व में तेल और गैस का वैश्विक परिदृश्य ऐसे मोड़ पर पहुँच गया है जिससे कच्चे तेल की कीमतों में आई कमी के कारण भारत के पेट्रोलियम और पेट्रोलियम उत्पादों के आयात बिल में भारी कमी आई है। आज भारत की अर्थव्यवस्था विश्व में सबसे तेज़ी से बढ़ती हुई अर्थव्यवस्था है और 2015–16 में इसकी सकल घरेलू उत्पाद दर 7.6% हो गई है। तेज़ी से बढ़ती हुई अर्थव्यवस्था में ऊर्जा की मांग बढ़ी है जिससे कच्चे तेल और प्राकृतिक गैस की मांग में भी भारी वृद्धि हुई है। प्रधानमंत्री की वर्ष 2022 तक भारत के पेट्रोलियम आयात बिल में 10% तक कमी लाने संबंधी घोषणा को दृष्टिगत रखते हुए कच्चे तेल और प्राकृतिक गैस के घरेलू उत्पादन में और अधिक वृद्धि करने के लिए ठोस उपाय किए जा रहे हैं।

अन्वेषण और उत्पादन क्षेत्र में निवेश में तेज़ी लाने के लिए किए गए मुख्य नीति सुधार इस प्रकार हैं: हाईड्रोकार्बन अन्वेषण लाइसेंस नीति (हेल्प), अन्वेषित लघु क्षेत्र नीति, समान लाइसेंसिंग नीति अपनाना तथा अन्वेषण और उत्पादन भागीदारी संविदाओं की भावी बोलियों के लिए और राजस्व भागीदारी की व्यवस्था करना। नई अन्वेषण लाइसेंस नीति से हाईड्रोकार्बन अन्वेषण लाइसेंस नीति में परिवर्तन का मुख्य उद्देश्य पारदर्शिता लाना, सुचारू व्यवस्था करना और निवेशक हितैषी बनाना, अन्वेषण और उत्पादन क्षेत्र में निवेशकों को प्रोत्साहित करना और घरेलू उत्पादन बढ़ाना है। डी.जी.एच. पारदर्शी और प्रेरक क्रियाशील ढाँचा तैयार करके इन नीति सुधारों को कार्यान्वित करने का प्रयास कर रहा है। हालांकि, इन सुधारों का उद्देश्य सम्बद्ध स्थान पर समुचित राजस्व को प्रोत्साहित करते हुए एक स्थिर विनियामक परिवेश तैयार करके भारत में निवेश का वातावरण बनाना है तथापि, विगत कुछ वर्षों से घरेलू कच्चे तेल और प्राकृतिक गैस के सुस्त पड़े उत्पादन में बढ़ोतरी के

लिए एक बहुमुखी दृष्टिकोण अपनाने की भी आवश्यकता है। भारत की 1.2 बिलियन से अधिक आबादी की राष्ट्रीय ऊर्जा की आवश्यकताओं को पूरा करने के लिए स्वदेशी अन्वेषण प्रयासों में तेज़ी लाने की ज़रूरत है।

भारत के 26 अवसादी बेसिनों का ईष्टतम स्तर तक दोहन नहीं हुआ है; हाईड्रोकार्बन की संभावना वाले नए, गैर–अन्वेषित और अज्ञात क्षेत्रों की खोज में सहायता प्रदान करने के लिए, भारत के ऐसे सभी अवसादी बेसिनों के लिए 2डी भूकम्पी (सेस्मिक) सर्वेक्षण किए जाने के लिए एक योजना बनाई गई है, जहाँ के लिए आंकड़े या तो प्राप्त नहीं हुए अथवा बहुत ही कम आंकड़े प्राप्त हुए हैं। बहु–संगठन टीम (ओ.एन.जी.सी., ओ.आई.एल., डी.जी.एच.) ने विगत दशकों में प्राप्त भू–वैज्ञानिक आंकड़ो के आधार पर भारत में इन 26 अवसादी बेसिनों में हाईड्रोकार्बन संसाधनों के पुनर्मूल्यांकन की एक परियोजना शुरू की है। इस नीति के तहत अवसादी बेसिनों में हाईड्रोकार्बन के लिए भू–वैज्ञानिक आंकड़े तैयार करने हेतु नॉन–एक्सक्लूसिव मल्टी–क्लाइंट जियो–साइंटिफिक (भू–वैज्ञानिक) सर्वेक्षणों द्वारा भारत के पश्चिमी तट पर डाटा अधिग्रहण का कार्य प्रारंभ हो गया है। इसके अतिरिक्त, भारत के उत्तर–पूर्वी क्षेत्र मे अन्वेषण और उत्पादन गतिविधियों को प्रोत्साहन देने हेतु भारत सरकार ने उत्तर–पूर्वी भारत का हाईड्रोकार्बन विज़न डॉक्यूमेंट 2030 तैयार करने हेतु परामर्शदाताओं के साथ मिलकर विशेष अध्ययन किया है।

घरेलू उत्पादन में वृद्धि करने और वर्षों से इस्तेमाल न किए जा रहे हाईड्रोकार्बन संसाधनों के मौद्रीकरण के लिए सरकार ने 'अन्वेषित लघु क्षेत्र नीति–2015' तैयार की है। इस नीति के अंतर्गत अनुमानतः सम्बद्ध स्थान में 625 मिलियन बैरल तेल और तेल समकक्ष गैस (ओ.+ओ.ई.जी) धारित तल पर उथले और गहरे पानी में 1500 वर्ग किलोमीटर तक फैले 46 अनुबंध क्षेत्रों में 67 तेल और गैस क्षेत्र आवंटित किए जाएंगे। प्री–नेल्प अन्वेषित (लघु और मध्यम) क्षेत्रों से तेल और गैस की ईष्टतम भंडार प्राप्ति के लिए सरकार ने वर्तमान उत्पादन भागीदारी संविदा के विस्तार की मंजूरी संबंधी नीति को अनुमोदित किया है। साथ ही गहरे पानी, अत्यधिक गहरे पानी और उच्च दाब व उच्च तापमान क्षेत्रों से गैस के उत्पादन में वृद्धि की आवश्यकता को देखते हुए, सरकार ने ऐसे क्षेत्रों मे सभी वर्तमान और भावी खोजों से उत्पादित गैस के लिए विपणन और मूल्य निर्धारण की स्वतंत्रता को अधिसूचित किया है जहाँ वाणिज्यिक उत्पादन किया जाना है।

भारत में घरेलू गैस उत्पादन को बढ़ाने में अपरम्परागत हाईड्रोकार्बन संसाधनों की मुख्य भूमिका रही है। वर्ष 2015–16 में कोल बेड मीथेन उत्पादन 1 एम.एम.एस.सी.एम.डी. तक पहुँच गया है और 2018 तक 6 एम.एम.एस.सी.एम.डी. तक पहुँचाने के लिए प्रयासरत है। भारत में शेल गैस का भंडार लगभग 300 टी.सी.एफ. (8.5 टी.सी.एम.) और 2100 टी.सी.एफ. (59.5 टी.सी.एम.) के बीच हो सकता है। वर्तमान करार के अंतर्गत, शेल गैस अन्वेषण का कार्य ऑयल एंड नेचुरल गैस कॉरपोरेशन लिमिटेड और ऑयल इंडिया लिमिटेड द्वारा किया जा रहा है। ओ.एन.जी.सी. द्वारा वेधित 17 कूपों से अभी तक 69 करोड़ प्राप्त किये गये हैं हालांकि टाइट ऑयल और गैस की पूरी संभावना है, गैस हाइड्रेट की खोज करके हमें ऐसे स्तर पर पहुँचना है कि हम वाणिज्यिक उत्पादन करने के बारे में सोच सकें। हमने जुलाई 2015 में प्राकृतिक गैस हाइड्रेट कार्यक्रम (एन.जी.एच.पी.)–2 सफलतापूर्वक पूरा कर लिया है। इस कार्यक्रम के तहत जापान ड्रिलशिप 'चिक्यू' के द्वारा कृष्णा गोदावरी और महानदी के गहरे पानी के बेसिन में 25 स्थलों पर 42 कूपों को वेधित किया गया था। महत्वपूर्ण गैस हाइड्रेट युक्त क्षेत्रों की पहचान की गई है और एन.जी.एच.पी. –3 के अंतर्गत प्रायोगिक उत्पादन परीक्षण करने की योजना बनाई गई है।

वित्त वर्ष 2015–16 में अन्वेषण एवं उत्पादन गतिविधियों को प्रदर्शित करने के लिए 2डी भूकंपीय डाटा का 7816.12 एल.के.एम. और 3डी भूकंपीय डाटा का 6236.12 एस.क्यू.एम. प्राप्त हुआ था। वर्ष के दौरान 138 अन्वेषणीय कूपों को वेधित किया गया था और इसका अन्वेषणीय मीटरेज़ 403.72 किलोमीटर था। 83.16 किलोमीटर के संचयी मीटरेज़ के साथ 363 विकास कूपों को वेधित किया गया था। वित्त वर्ष 2015–16 में भारत में कच्चे तेल का कुल उत्पादन 36.95 मिलियन मीट्रिक टन (69% मनोनीत क्षेत्र से और 31% पी.एस.सी. क्षेत्र से) और संचयी प्राकृतिक गैस का उत्पादन 32.249 बी.सी.एम. (75% मनोनीत, 24% पी.एस.सी. और 1% सी.बी.एम. क्षेत्र से) रहा। मार्च 2016 को अंतः स्थल (इन्प्लेस) में कच्चे तेल की मात्रा 7080 मिलियन मीट्रिक टन और गैस 4192 बी.सी.एम. (11272 मिलियन मीट्रिक टन ओ.+ओ.ई.जी) है। सम्बद्ध स्थान मात्रा 46.64 मिलियन मीट्रिक टन की कुल अभिवृद्धि हुई है। वित्त वर्ष 2015–16 में मनोनीत क्षेत्र में 13 और पी.एस.सी. क्षेत्र में 14 को मिलाकर कुल 27 हाईड्रोकार्बन खोज की गईं। राष्ट्रीय आंकड़ा आधान (एन.डी.आर.) परियोजना ने सराहनीय प्रगति की है और अब यह पूरा होने के कगार पर है। दिनांक 31.03.2016 तक एन.डी.आर. में कुल 169144.77 एल.के.एम 2डी भूकंपीय डाटा, 15716.28 एस.के.एम. 3डी भूकंपीय डाटा, 237 कूप तथा उनका लॉग डाटा और 618 कूप रिपोर्टें दर्ज की गई हैं।

डी.जी.एच संभावी निवेशकों को आकर्षित करने का प्रयास कर रहा है और यथासंभव आधिकाधिक ब्लॉक के प्रस्तावों को पेश करने की कोशिश कर रहा है। डी.जी.एच. अन्वेषण और उत्पादन क्षेत्र में प्रगतिशील और प्रेरक उत्पादन परिवेश बनाए रखने में पूरा सहयोग देने के लिए तत्पर है और हमेशा रहेगा तथा एक अच्छा प्लेटफॉर्म सुनिश्चित करेगा। डी.जी.एच. अन्वेषण और उत्पादन तंत्र की सहायता से अपनी कार्यसीमा में आने वाले सभी अनुबंधात्मक और तकनीकी मुद्दों को सुलझाएगा। मैं पेट्रोलियम और प्राकृतिक गैस मंत्रालय का आभारी हूँ जिनके भरपूर सहयोग और मार्गदर्शन से हम अपना कर्तव्य बखूबी निभा पाए।

डी.जी.एच. के वार्षिक प्रकाशन ''भारतीय हाईड्रोकार्बन परिदृश्य 2015–16'' में भारत के इस उभरते हुए क्षेत्र (अपस्ट्रीम सेक्टर) की सभी महत्वपूर्ण गतिविधियों और उपलब्धियों की सूचनावर्धक एवं पारदर्शी जानकारी संक्षेप में दी गई है। यह प्रकाशन भावी निवेशकों और विद्यमान हिताधिकारियों के लिए एक महत्वपूर्ण मार्गदर्शक साबित होगा।

अ. चक्रवर्ती

अतनु चक्रवर्ती
महानिदेशक

Indian Exploration & Production

Sector at a Glance

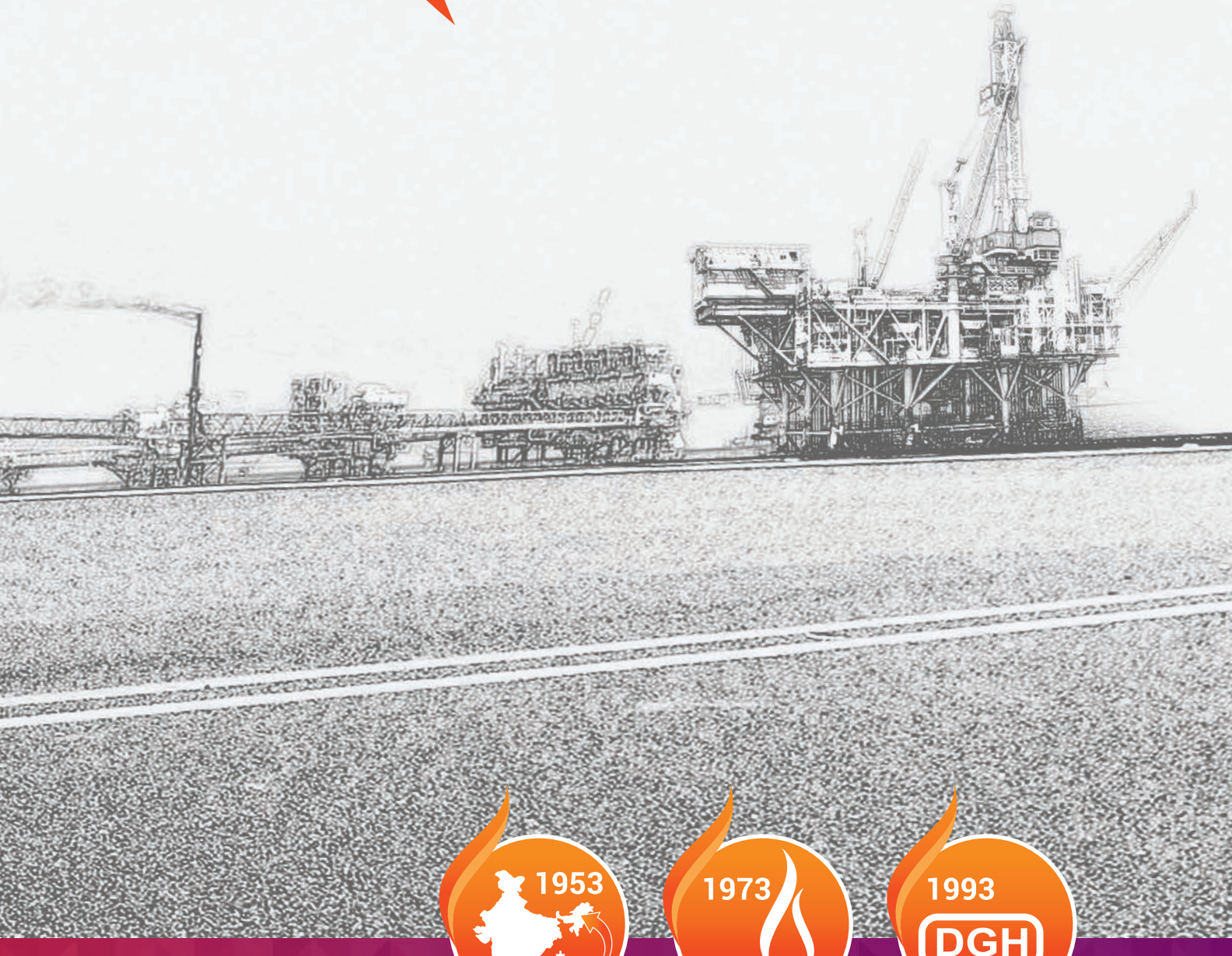
- **27 Hydrocarbon Discoveries**
  13 in nomination regime and 14 in PSC regime
- **36.95 MMT**
  Crude Oil Production in 2015-16
- **32.249 BCM**
  Natural Gas Production in 2015-16
- **42.72 MMT [O+OEG]**
  Inplace Accretion in 2015-16
- **66.71 MMT [O+OEG]**
  Accretion of Reserves in 2015-16
- **3 Declaration of Commerciality**
  Approved by Management Committee in 2015-16 under PSC regime
- **5 Field Development Plan**
  Approved by Management Committee in 2015-16 under PSC regime
- **122 Active PSCs**
  12 Pre-NELP, 84 NELP & 26 Small & Medium Size Field PSCs
- **377 Active Nomination Acreages**
  15 PEL & 362 PML acreages
- **7816 LKM & 6236 SKM**
  2D and 3D Seismic Data Acquired in 2015-16
- **501 Wells**
  Exploratory & Development Wells Drilled in 2015-16

Table of Contents

Chapter 1

Evolution

of Upstream Indian Oil and Gas Industry



1953
1st Oil discovery in independent India

1973
Eocene Gas discovered in Tengakhat, Assam

1993
DGH
DGH Established

1 Evolution of Upstream Indian Oil and Gas Industry

The story of Oil exploration in India began in the dense jungles and swamps and river-valleys of the north-eastern corner of the country. Lt. R. Wilcox, Major A. White, Capt. Francis Jenkins, Capt. P.S. Hanny, W. Griffith, W.Licut Bigge–they all saw at different times petroleum seepages from the banks of river Dihing. Mr. C.A. Bruce (1828) and Mr. H.B. Medicott (1865) of the Geological Survey of India also saw oil seepages while prospecting for coal in upper Assam.

Barely seven years after Edwin L. Drake drilled the world's first Oil well in 1859 at Titusville, Pennsylvania, USA, in 1866, Mr. Goodenough of McKillop, Stewart and Company, Calcutta, drilled a hand-dug well of 102 feet at Nahorpung near Jaipur area of Upper Assam but failed to establish satisfactory production. In his second attempt on 26 March 1867, Oil was struck at merely 118 feet (35.97-m) in Asia's first mechanically drilled well at Makum near Margherita area of Upper Assam.

However, the first well dug at Digboi field in Assam in September 1889 and completed in November 1890 at depth of 662 feet by Assam Railways and Trading Company Limited (AR&T Co. Ltd.), registered at London, is regarded as the first commercially successful Oil discovery (200 gallons per day). To add color to geological reasoning, legend was created that during the construction of a railway line by AR&T, in the year 1867, a herd of logging elephants returned to camp with their feet covered in oil after a night time excursion to find food and water. This led men to trail to the salt lick where seepages were prolific. Looking at this, the elated English owner cried out to his men, "Dig boy, dig". Probably the name Digboi itself came from that word.

AR&T subsequently acquired a 77.7 square kilometer petroleum-rights concession in the Makum area of Assam, and by 1893 had drilled 10 wells at Digboi producing 757.08 liters/day. AR&T established Assam Oil Company (AOC) in 1899 with a capital of £310,000 to take over the petroleum interests of AR&T, including the Digboi and Makum concessions and set up a small refinery at Margherita (Upper Assam) with a capacity of 500 bopd to refine the Digboi-Oil. Thereafter, systematic drilling began in 1891 and few years later in 1901, Asia's first Oil refinery was set up at Digboi. It is still functional and the world's oldest operating refinery.

Failure to utilize Geological reasoning, promiscuous wild catting, misguided investment and nonchalance of the management towards technical support led to compounding of errors by AOC which made the company technically and financially impotent. Later on UK based Burma Oil Company (BOC) arrived in 1911 in Upper Assam (Surma Valley) and in 1915, after acquiring Oil interest from Budderpore Oil Co. Ltd. (formed by a syndicate of Budderpore tea garden during 1911-13) began testing option in the Badarpur structure in the Surma valley (Upper Assam). Gradually by 1921, in a phase-wise manner, BOC acquired petroleum interests of AOC.

'Torsion balance' which was successfully adapted for geophysical surveys of Oil was used at Bordubi (Assam) by a geophysical team in 1925. The Indian Co. "TATA Engineering Co." has also drilled several wells in Jagatia, Gujarat and produced small amount of gas in 1930s. In 1937, BOC jointly with British Petroleum (then Anglo Iranian Oil Co.) and Shell proposed to Govt. of India to carry out a geophysical survey of the important plain areas of India. The proposal was accepted and a new form of grant known as geophysical license was issued by Assam Government. In Assam, successful seismic survey was carried out in Nahorkatiya during 1937-39, triggering new enthusiasm in Oil search and it became forerunner of discoveries in Assam basin and others also. The successful outcome of well NHK-1 in 1937 was vindication for geophysical method in Oil exploration.

The world knew importance of Oil and after Independence, Indian leaders realized its utility for rapid industrialization and security of nation. The company rules which were earlier framed to satiate the raw material need of British Empire were re-framed.

While framing industrial policy–1948, the development of petroleum industry in the country was given top priority.

By 1948, Geological Survey of India (GSI) had started geophysical survey in Cambay area. The first Oil discovery in independent India was made by AOC on 1953 in Nahorkatiya and then in Moran in 1956 both in Upper Assam. The Oil industry, after independence, remained operated by a foreign company for a considerable period Burma Oil Company (BOC) kept its position as the largest company in India till the end of its operation.

In 1955-56, a delegation led by Mr. K.D. Malviya, Minister of Natural Resources, visited several European countries to study status of Oil industry in those countries and facilitate training of Indian professionals. Foreign experts also visited India to share their know-how. Erstwhile USSR helped to draw a detail plan for geological and geophysical survey and drilling plan in 2nd five year plan (1956-57 & 1960-61).

With the intention of intensifying and spreading exploration to various parts of the country, a separate Oil and Natural Gas Directorate (ONGD) was set up in 1955, as a subordinate office under the then Ministry of Natural Resources and Scientific Research. The department ONGC was constituted with a nucleus of geoscientists from GSI. But soon after its formation it was realized that the directorate cannot function efficiently with its limited financial and administrative liberty and in early 1956 its status was changed to a commission. In October 1959, ONGC was made a statutory body by an act of parliament delegating it more power but it remained under Ministry. The job of ONGC was defined as "to plan, promote, organize and implement programs for development of Petroleum Resources and the production and sale of petroleum and petroleum products produced by it, and to perform such other function as the central government may, from time to time, assign to it".

ONGC systematically started its geophysical surveys on area considered prospective on the basis of global analogy. Further, thrust was given for survey in area of Himalayan foothills and adjoining Ganga plains, alluvial tracts of Gujarat, upper Assam and basins of Bengal. The exploratory drilling carried out in Himalayan foothill during 1957, remained unsuccessful. Within a year of being formed, ONGC discovered Oil at Cambay, the giant Ankleshwar field in the state of Gujarat in 1960, Kalol in 1961, Lakwa in 1964, Geleki in 1968 and Gas discovery - Manhar Tibba in Rajasthan in 1969 were discovered subsequently.

Meanwhile, on 18th February 1959, for development and production of Nahorkatiya and Moran prospects and to increase the pace of exploration in Assam, Oil India Private Limited was incorporated as a rupee company to take over BOCs affairs in Assam. The company was owned 2/3rd by AOC/BOC and 1/3rd by Government of India and in 1961 they became equal partners by transforming OIL into a JV Company. OIL discovered Kusijan Oilfield in 1969 and Jorajan Oilfield in 1972. Later, Eocene gas was discovered by OIL in Tengakhat field of Assam in 1973.

Offshore exploration was initiated by ONGC in the form of experimental seismic survey in 1962 in Gulf of Cambay and later in western offshore. Detailed seismic surveys in western offshore resulted in a discovery of large structure on Bombay-offshore in 1972-73 and drilling lead to India's biggest commercial discovery - Bombay High. Encouraged by this discovery, exploration was furthered in entire western offshore including Kerala-Konkan basin and eastern offshore area. This led to large discovery of Bassein and Neelam in Western offshore and PY-3 & Ravva in Eastern offshore. OIL also ventured from Assam to Odisha both in onshore and offshore. During 1979-89, it went to Andaman offshore and Rajasthan onshore. By the end of 1980s, ONGC and OIL had together drilled nearly 3100 wells totaling 4.9 million metres.

ONGC's geoscientific survey spread out to UP, Bihar, Tamil Nadu, Rajasthan, J&K, Kutch and Andhra Pradesh. By mid 1980s, ONGC successfully discovered prospects in Cauvery and KG basin. Kharsang Oilfield was discovered by OIL in 1976 and in the same year ONGC discovered one of India's biggest gas finds of 283.17 BCM in the Bassein fields of Mumbai's coast. Other gas fields discovered by ONGC were mid-Tapti, South Tapti and B-55. In 1978, OIL ventured out of Assam into Odisha offshore and onshore. OIL also ventured into offshore Andamans in 1979-89 and onshore Rajasthan.

Till the end of 1970s, Indian E&P industry was dominated by the two National Oil Companies (NOCs)-ONGC and OIL to whom PELs were granted on nomination basis. Exploration was primarily confined to onland and shallow offshore. In 1979, Government of India took the strategic initiative to attract foreign investment, technology and capital to deal with future commitment and challenges of Indian Oil economy by offering 32 exploration blocks (17 offshore & 15 onshore). Government started offering block systematically through bidding. These rounds are also known as Pre-NELP Exploration rounds. The three rounds during 1980-1986 were not very successful.

By 1981 Government took over OIL and it became a full-fledged PSU. In 1982, ONGC made its biggest gas discovery in Gandhar, (Cambay basin, Gujarat) and by 1986 KG basin was put in global map with several substantial discoveries made. By the end of 1986, 3rd round of international bidding for exploration blocks was offered. OIL and ONGC were offered 40% stake in JV if field was found viable. Few foreign companies participated but there was no

committed exploration or breakthrough discovery. The foreshore terminal of IOC was commissioned in Madras (Chennai). However, OIL and ONGC's efforts continued in several parts of India and by 1989, OIL discovered gas in Tanot (Mata Temple) in Rajasthan and ONGC discovered South Heera in Mumbai offshore.

In 1990, 4th round of bidding was invited and for the first time, Indian companies were allowed to participate with foreign companies. However, no major discovery was made with these partnerships. In 1991, Government of India (GoI) adopted liberalized economic policy that led to de-licensing of core group including petroleum sector and partial disinvestment of government share including other measures. As a result, ONGC was re-organized as a Limited company (under the Company's Act, 1956) from Oil and Natural Gas Commission to Oil and Natural Gas Corporation Limited. To give momentum to Petroleum sector in India, GoI came up with more lucrative offers in 1994. However, this also led to disagreement in Production Sharing agreement. In couple of years, ONGC ventured into CBM in Damodar valley and explored EOR options in Heavy Oil belt of North Gujarat. By 1996, Government conducted 5 round of bidding and offered 126 blocks having area in the range of 1 sq. km to 50,000 sq. km. Besides National Oil Companies and Indian Private Companies, some foreign companies like Shell, Enron, Amoco and Occidental participated in exploration and contracts were awarded to them.

Government's efforts, particularly during 1991-1996, gave required thrust for opening up Oil and Gas sector in India. After this, the process of opening the sector became more streamlined. Many private players also joined in development of this industry. Hindustan Oil Exploration Company (HOEC) which started its E&P venture in 1991, was among few such initial domestic private players.

In view of the liberalized policy adopted by GoI, a need for an independent upstream regulatory body called the Directorate General of Hydrocarbons (DGH) was envisaged to oversee and review the Oilfield development programs so as to conform to sound reservoir engineering practices in line with national interests. Thus, DGH was formed vide GoI resolution dated 08.04.1993.

After the Nomination era till late 1970s, Pre-NELP Exploration era (1980-95 and Pre-NELP Field rounds (1992-93), Government of India formulated a policy called as New Exploration Licensing Policy in 1997. The main objective was to attract significant risk capital from Indian and Foreign companies, state-of-the-art technologies, new geological concepts and best management practices to explore Oil and Gas resources in the country to meet rising demands of Oil and Gas. NELP policy was approved in 1997 and it became effective in February, 1999. Since then, licenses for exploration are being awarded only through a competitive bidding system and National Oil Companies (NOCs) are required to compete on an equal footing with Indian and Foreign companies to secure Petroleum Exploration Licenses (PELs). Nine rounds of bids have so far been concluded under NELP, in which production sharing contracts for 254 exploration blocks have been signed.

With huge scope of activities and development in Oil and Gas sector in India, a lot of history in this sector is yet to be written.


DGH
Revenue Sharing
Licensing Policy
E&P Governance
Investments
Unconventional
Production Sharing Contracts
Monitoring

Chapter 2

DGH

Framework and Role

Award Oil/Gas Blocks

Technical Advisory MoP&NG

Development of Hydrocarbon Resources

2 DGH : Framework and Role

2.1 FORMATION AND FRAMEWORK OF DGH

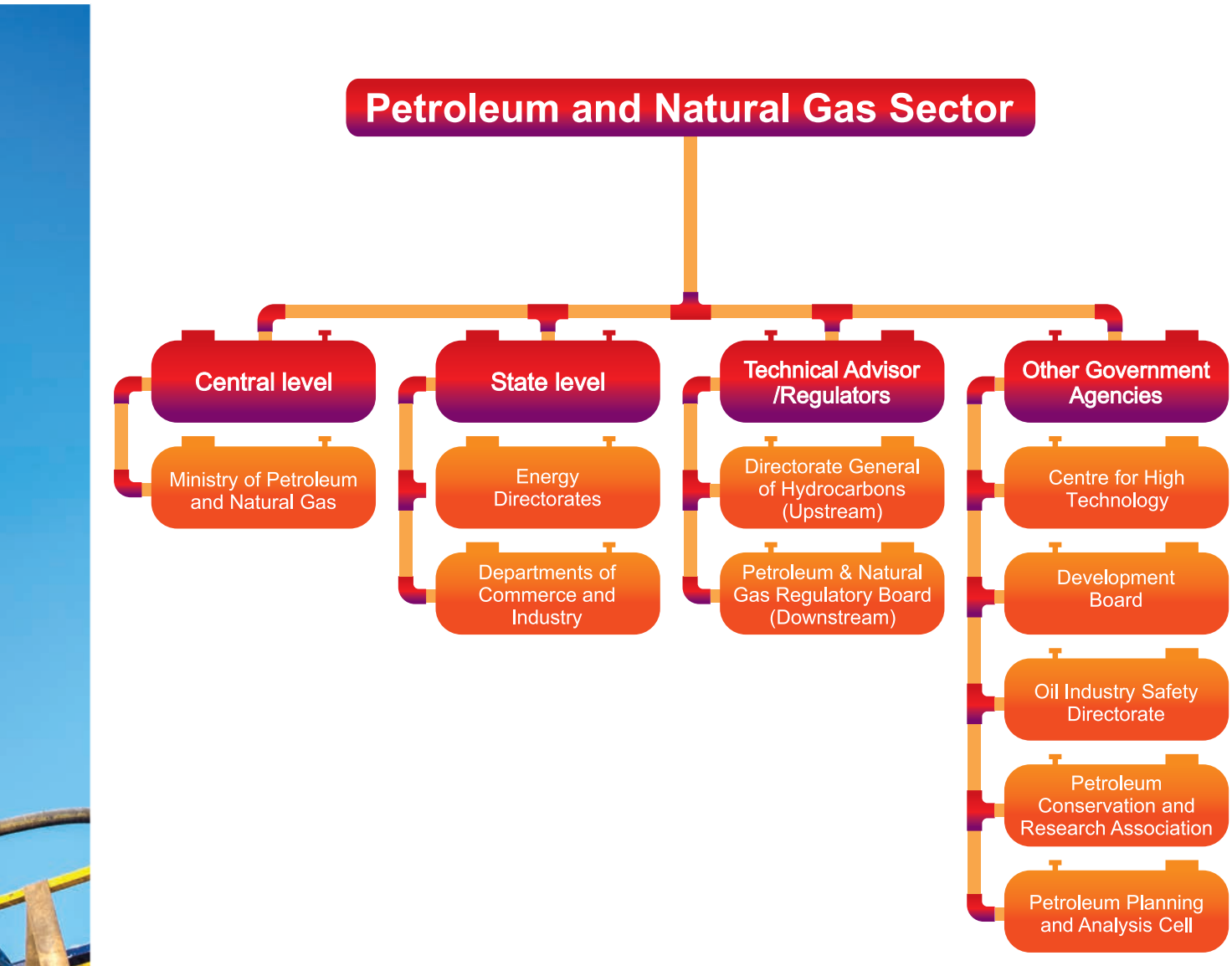
The liberalized economic policy adopted by the Government of India (GoI) in July 1991 sought to de-regulate and de-license the core sectors (including the petroleum sector) with partial disinvestments of government equity in Public Sector Undertakings along with other measures. The upstream petroleum sector was largely a monopoly of public sector companies till then and the sector was being increasingly opened up to new operating companies in the private and joint sectors. Thus, a need was felt to establish an agency that could effectively supervise the activities of all these companies in the national interest. The same was elucidated by the committee headed by late Dr. A. B. Dasgupta, which recommended for creation of an autonomous conservation board to oversee and review oilfield development programs for sound reservoir engineering practices in line with national interests. Subsequently, a committee was constituted in 1992 under the chairmanship of late Shri P. K. Kaul, former Cabinet Secretary, to examine the need for restructuring ONGC's organizational structure. This committee also recommended for establishment of an independent regulatory body called the Directorate General of Hydrocarbons (DGH) for discharging the regulatory functions of leasing and licensing, safety and environment and also development, conservation and reservoir management of Hydrocarbon resources in India. Accordingly, Directorate General of Hydrocarbons was set up through GoI resolution No. O-20013/2/92/ONG-III dated 08.04.1993 under the administrative control of the Ministry of Petroleum and Natural Gas.

2.2 OBJECTIVE OF DGH

The objective of DGH is to promote sound management of the Indian Petroleum and Natural Gas resources having a balanced regard for the environment, safety, technological and economic aspects of the petroleum activity.

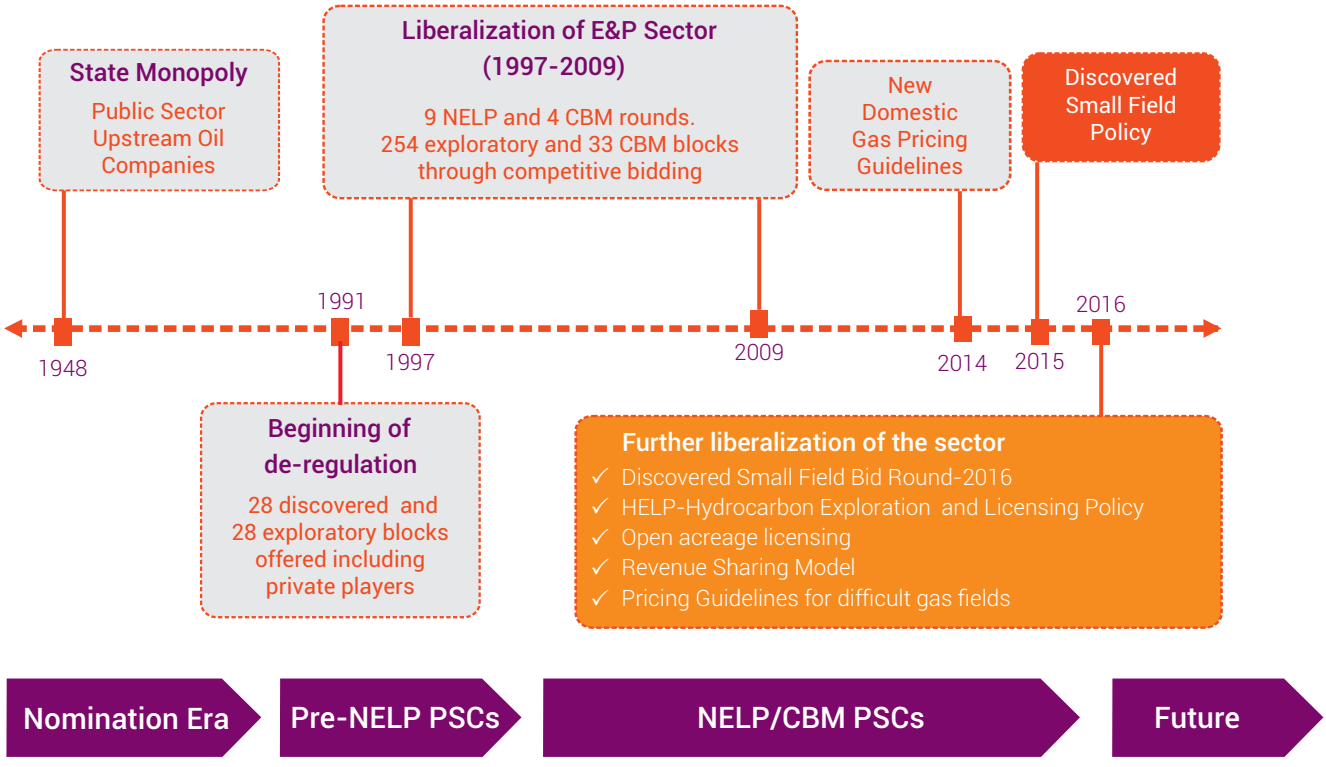
2.3 ROLE & FUNCTIONS

- A nodal agency for implementation of NELP and CBM policy on behalf of Ministry of Petroleum & Natural Gas
- To advise Ministry of Petroleum & Natural Gas on Exploration Strategies & Production Policies
- To provide technical advice to the Ministry of Petroleum and Natural Gas on issues relevant to the exploration and optimal exploitation of hydrocarbons in the country
- To review the exploration programs of companies operating under Petroleum Exploration Licenses granted under the Oilfields (Regulation and Development) Act, 1948 and the Petroleum and Natural Gas Rules, 1959 with a view to advising Government on the adequacy of these programs
- To evaluate the hydrocarbon reserves discovered and estimated by the operating companies



- To advise the Government on the offering of acreages for exploration to companies as well as matters relating to relinquishment of acreage by companies
- To review the development plans for commercial discoveries of hydrocarbon reserves proposed by the operating companies and advise Government on the adequacy of such plans and the exploitation rates proposed and matters relating thereto
- To review and audit concurrently the management of petroleum reservoirs by operating companies and to advise on any mid-course correction required to ensure sound reservoir management practices in line with the optimal exploitation of reserves and the conservation of petroleum resources
- To regulate the preservation, upkeep and storage of data and samples pertaining to petroleum exploration, drilling, production of reservoirs etc. and to cause the preparation of data packages for acreage on offer to companies
- All other matters incidental thereto and such other functions as may be assigned by Government from time to time
- Assist Government in Contract management functions
- Exploration & Development of unconventional hydrocarbon resources like Gas Hydrate, Shale Gas/Oil and Oil Shale
- Issue Essentiality Certificate for importing goods and services used in E&P sector to avail custom duty concessions

Exploration and Production Regime in India



2.4 ADVISORY & ADMINISTRATIVE COUNCIL OF DGH

Advisory Council

Directorate General of Hydrocarbons has an Advisory Council, which is appointed by the Government comprising of Chairman and members, who are eminent persons in the field of hydrocarbon exploration and production. The Advisory Council is serviced by the Directorate which is headed by a Director General who is also the Member Secretary to the Council.

Administrative Council

Government of India set up an Administrative Council on 02.02.2001 to guide and to take care of all administrative aspects of the functioning of DGH, through Office Memorandum No. O-32012/1/95-ONG-III dated 02.02.2001. The Administrative Council, in particular, takes decisions on various matters concerning establishment, budget and also undertakes periodical review of the functioning of DGH. It is headed by Secretary (P&NG) and has the following composition:

Table 2.1 : Composition of Administrative Council

Name	Designation
Secretary, MoP&NG	Chairman
Additional Secretary, MoP&NG	Member
AS&FA, MoP&NG	Member
Joint Secretary (Exploration), MoP&NG	Member
Secretary, OIDB	Member
Director General, DGH	Member - Convener

2.5 AWARD PROCESS UNDER PRE-NELP AND NELP REGIME

Petroleum Exploration Licenses (PEL) for domestic exploration & production of crude oil and natural gas were granted under four different regimes over a period of time.

I. Nomination Basis:

Till the end of 1970s, Indian E&P industry was dominated by the two National Oil Companies (NOCs) - ONGC and OIL to whom PELs were granted on nomination basis. Exploration was primarily confined to onland and shallow offshore.

II. Pre-NELP Exploration Blocks:

28 Exploration blocks were awarded to private companies between 1980 and prior to implementation of NELP where ONGC and OIL have the rights for participation in the blocks after hydrocarbon discoveries.

Table 2.2 : Brief details of the Pre-NELP Exploration blocks:

PRE-NELP					
Year	Rounds	Description	Contracts signed		
			Offshore	Onshore	Total
1980	1st Exploration round	PSC signed with Chevron, USA and 3 wells were drilled without success, block area was relinquished in 1985	1	0	1
1982	2nd Exploration round	No PSC signed	0	0	0
1986	3rd Exploration round	-	0	0	0
1991	4th Exploration round	-	2	3	5
1992	-	First development round	-	-	-
1993	5th Exploration round	Second development round	4	2	6
-	6th Exploration round	First speculative survey round	2	3	5
1994	7th Exploration round	-	2	3	5
-	8th Exploration round	Second speculative survey round	1	3	4
1995	9th Exploration round	Joint Venture Speculative Survey Round (JVSSR)	1	1	2
TOTAL			**13**	**15**	**28**

In 1993, GoI offered blocks for geophysical and other surveys to update the information on hydrocarbon potential of India's unexplored sedimentary basins. Once the surveys on these blocks were completed, they were to be offered in subsequent rounds of exploration. The Second speculative survey round was launched in 1994 and the third round in 1995. The third round was called as Joint Venture Speculative Survey Round (JVSSR) with a provision of risk participation/cost sharing by DGH up to 50%.

III. Pre-NELP Discovered Field or Development Rounds:

Government offered Petroleum Mining Lease (PML) of small/medium sized discovered fields (proven reserves were discovered by ONGC and OIL) to the private sector in August 1992. Production Sharing Contracts (PSCs) awarded during 1991-1993 had the distinctive feature of operators as private companies with ONGC/OIL as having participating interest. These rounds received overwhelming response from various private E&P operators.

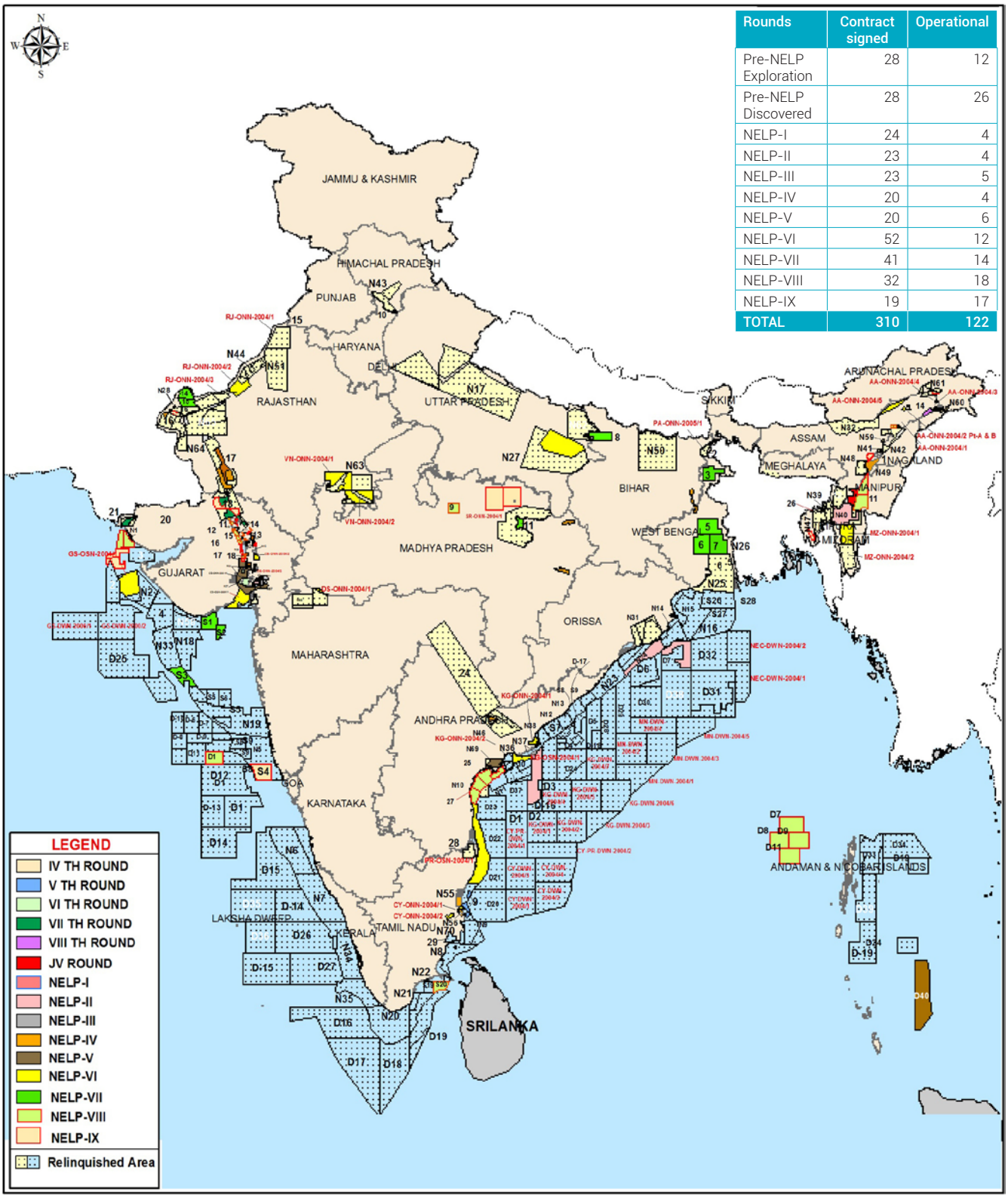
Table 2.3 : Pre-NELP Discovered Field or Development Rounds

Month/Year of award	Round	Blocks offered in Medium sized field Round		Blocks offered in Small sized field Round		Contracts signed
		Offshore	Onshore	Offshore	Onshore	
August 1992	1	6	6	10	21	18
October 1993	2	2	6	4	29	10
Total Contracts signed:						**28**

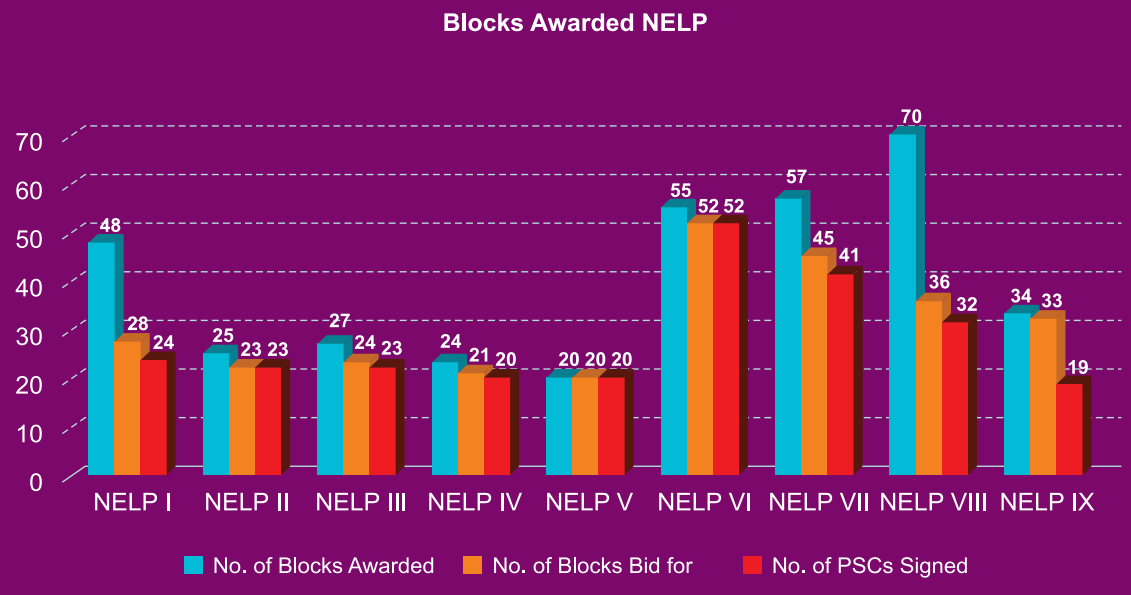
PRE-NELP & NELP EXPLORATION BLOCKS UNDER OPERATION BY NOC'S & Pvt/JV COMPANIES

(AS ON 01-04-2016)

Rounds	Contract signed	Operational
Pre-NELP Exploration	28	12
Pre-NELP Discovered	28	26
NELP-I	24	4
NELP-II	23	4
NELP-III	23	5
NELP-IV	20	4
NELP-V	20	6
NELP-VI	52	12
NELP-VII	41	14
NELP-VIII	32	18
NELP-IX	19	17
TOTAL	310	122



Blocks Awarded Under NELP

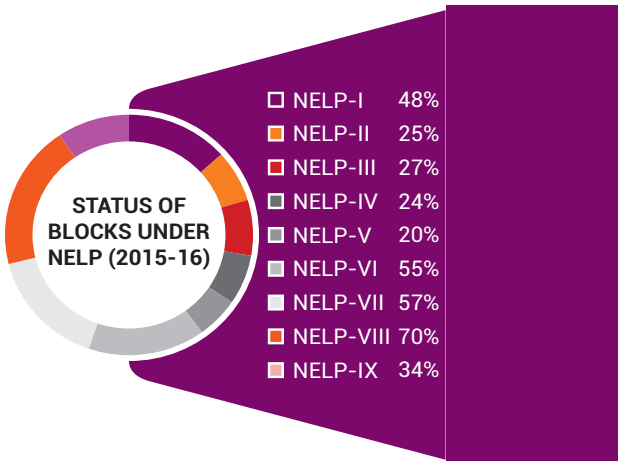


IV. New Exploration Licensing Policy (NELP):

Under NELP, blocks were awarded to Indian, private and foreign companies through International Competitive Bidding process where NOCs viz. ONGC and OIL are also competing on equal footing.

Government has taken number of measures to bring in healthy competition and public participation by introducing NELP for exploration & production of oil & gas in the country. NELP has not only accelerated the quest for hydrocarbon exploration, but has also brought the state-of-the-art technology and efficiency of operations / management to the country.

Government of India has signed 28 contracts for blocks offered under Pre-NELP Exploration regime and 28 contracts (1 PSC for Panna Mukta–PM) for 29 discovered fields under Pre-NELP Discovered (Small and Medium size fields) regime and 254 contracts under NELP regime with National Oil Companies and Private (Both Indian and foreign)/ Joint Venture companies. At present, out of 310 contracts signed so far under various bidding rounds 122 are operational.



The awarded 254 blocks under NELP regime are located in onland (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. Till date, 232 hydrocarbon discoveries (119 Oil and 113 Gas) have been made under various regimes and most of the gas discoveries have been made in offshore - shallow (44) and deepwater blocks (40).

NELP bidding rounds have attracted many Private and Foreign Companies in addition to PSUs. Before the NELP, a total 35 E&P Companies (5 PSUs, 15 Private and 15 Foreign) were working in Nomination and Pre-NELP regime. After the conclusion of nine rounds of NELP bidding, the total number of companies has increased to 117 (11 PSUs, 58 Private and 48 Foreign Companies as Operators and Non-operators/Consortium Partners). Major Private Companies were RIL, Jubilant and Essar. The major foreign companies were British Gas, British Petroleum, the then Cairn Energy (now Cairn India), ENI, Santos and BHP Billiton.

Public Sector Undertakings (PSUs) IOCL, GAIL, BPCL working under MOP&NG and their subsidiaries like Bharat Petro Resources Ltd (Subsidiary of BPCL), Prize Petroleum Company Limited (Subsidiary of HPCL), have participated in various NELP bidding rounds and have been awarded exploration blocks in various NELP bidding rounds. In addition to central PSU, state PSU like GSPC have participated in various NELP bidding rounds and have been awarded exploration blocks.

The domestic crude oil/gas production in the country consists of oil production from Nomination Blocks/Fields under ONGC and OIL and from the discovered fields and producing Pre-NELP and NELP blocks under the Production Sharing Contract (PSC) regime. The average oil and gas production under the PSC regime during the current year (April'15 – March'16) is to the tune of 227,430 barrels /day (BOPD) and 794.54 Million Standard Cubic feet per day (MMSCFD) respectively.

Table 2.4 : Status of Blocks under NELP (2015-16)

Round	Offered	Awarded				Relinquished				Operational			
		Deep water	Shallow water	Onland	Total	Deep water	Shallow water	Onland	Total	Deep water	Shallow water	Onland	Total
NELP-I	48	7	16	1	24	4	15	1	20	3	1	0	4
NELP-II	25	8	8	7	23	8	6	5	19	0	2	2	4
NELP-III	27	9	6	8	23	8	5	5	18	1	1	3	5
NELP-IV	24	10	0	10	20	10	0	6	16	0	0	4	4
NELP-V	20	6	2	12	20	5	1	8	14	1	1	4	6
NELP-VI	55	21	6	25	52	21	2	17	40	0	4	8	12
NELP-VII	57	11	7	23	41	11	4	12	27	0	3	11	14
NELP-VIII	70	8	11	13	32	7	5	2	14	1	6	11	18
NELP-IX	34	1	3	15	19	1	0	1	2	0	3	14	17
TOTAL	**360**	**81**	**59**	**114**	**254**	**75**	**38**	**57**	**170**	**6**	**21**	**57**	**84**

Table 2.5 : Chronology of NELP Bidding Rounds

Round	Launch Year	Signing Year
Pre-NELP Exploration	1980	1980-1995
Pre-NELP Field	1992	1992-1993
NELP-I	1999	2000
NELP-II	2000	2001
NELP-III	2002	2003
NELP-IV	2003	2004
NELP-V	2005	2005
NELP-VI	2006	2007
NELP-VII	2007	2008
NELP-VIII	2009	2010
NELP-IX	2010	2012

Table 2.6 : Investment made in NELP blocks in FY 2015-16

NELP Bidding Round	NELP Committed Investment	Actual Investment as on 31.03.2016		
	Exploration Investment Commitment	Actual Exploration Investment	Actual Development Investment	Total Investment
NELP-I	1082.23	4720.58	7822.22	12542.81
NELP-II	775.41	908.73	33.94	942.67
NELP-III	978.18	3347.13	1849.50	5196.63
NELP-IV	1135.05	2095.64	4.54	2100.18
NELP-V	847.22	1005.42	0.37	1005.80
NELP-VI	3570	2571.53	1.72	2573.25
NELP-VII	1504.61	815.19	0.00	815.19
NELP-VIII	1102.25	439.14	0.00	439.14
NELP-IX	733.66	119.31	0.00	119.31
Grand Total	**11728.61**	**16022.68**	**9712.29**	**25734.98**

Table 2.7 : Salient Features of Four Main Regimes in Indian Oil and Gas Industry

The prominent features of the four regimes viz. Nomination, Pre-NELP Exploration, Pre-NELP Discovered and NELP rounds is as below :

Item	Nomination	Pre-NELP Exploration Blocks
Bonus	NA	No signature or production bonus
Royalty	For Crude Oil: 20% for onshore 10% for offshore 10% for deep water Natural Gas: 10% for all onshore and offshore	No royalty payment OR No royalty payment No custom duty
Government of India (GoI) interest	Government owned	GoI or its nominee will have carried interest of 30% from the date of signing of contract, with the option to convert it into a working interest after the decision to proceed with the development and production of discovered hydrocarbons has been taken GoI or its nominee may also acquire 10% working interest in any block it chooses at the time of signing of contract, thereby sharing 10% of exploration cost OR ONGC or OIL will have a participating interest of between 25% to 40% in the JV from the date of signing of contract, thereby sharing the exploration cost in proportion to their participating interest
Pricing of Crude Oil and Natural Gas	As per prevailing rate and subsidy arrangement	International market price for oil produced The pricing formula for associated gas would be on a cost plus basis, while for non-associated gas it would be related to the international price of fuel oil, the exact relationship being negotiable. The price payable for both associated and non-associated gas would not exceed the price paid to the producing National Oil Companies (exclusive of cess, taxes and royalty) OR The pricing formula for gas would be on internationally accepted principles Arrangement for marketing of the gas produced would be negotiable between GoI and the Company OR The JV will have freedom to make arrangements for marketing the gas
Sharing of profit	In the pattern of shareholding	Profit oil shall be bid based on sliding scale tied to post tax rates of return or multiples of investment recovered
Minimum expenditure	NA	No minimum expenditure commitment No ring fencing of blocks for corporate tax purposes
Operatorship	NOC (ONGC/OIL)	Company will be operator for exploration and appraisal period Time of transfer of operatorship to GoI or its nominee during development and production phase is negotiable OR Operatorship is negotiable Time of transfer of operatorship to ONGC/OIL during development and production phase is also negotiable OR NA

	Pre-NELP Discovered Fields (Small or Medium or Discovered)	NELP (1999 till date)
	Signature/production bonuses payable by companies to ONGC and OIL OR Signature/production bonuses payable by coventures	No signature, discovery or production bonus
	All statutory levies including royalty, cess, customs duties, etc. payable by Contractor OR All statutory levies, including royalty, cess, customs duties, sales tax, etc. payable by Coventure	Royalty : For Crude Oil- 12.5% for onshore 10% for offshore 5% for deep water For Natural Gas- 10% onshore 10% offshore 5% for deep water ad valorem applicable to all companies No custom duty on imports for Petroleum Operations Income Tax holiday of 7 years for Mineral Oil
	ONGC/OIL would have no participating or carried interest in the Contract. NOCs not allowed to bid OR ONGC/OIL will have up to 40 % Participating Interest OR ONGC/OIL will have up to 40 % Participating Interest in medium size fields ONGC/OIL would have no participating or carried interest in the Contracts of small fields. NOCs not allowed to bid for small size fields	No State participation or any carried interest NOCs to compete for acreage with Private
	First right of refusal to Government of India in respect of purchase of crude oil produced. International market price for oil produced OR In case of natural gas, related to international price of fuel oil for Non associated gas and determined on a cost plus basis for associated gas OR Domestic market would have the first call on natural gas produced, arrangements for marketing of gas produced would be negotiable between GoI and Company. The pricing would be based on internationally accepted principles	International Crude Oil price at arm's length Gas pricing requires approval of GoI
	Sharing of the profit oil shall be bid, based on a sliding scale tied to post tax rates of return or multiples of investment recovered and shall be specified in each Contract OR NA OR Sharing of the profit oil/gas would have to be indicated in the offer, based on a sliding scale tied to post tax rates of return or multiples of investment recovered as in the Rounds of bidding for exploration blocks	Sharing of Profit Petroleum with Govt. on biddable pre-tax investment multiple NELP I to VI: Step ladder based system of Investment multiple for GoI Share NELP VII to IX: Linear based system of Investment multiple for GoI Share
	Percentage of annual production of crude oil expected to be allocated for recovery of costs should be indicated in the offer OR Preferential treatment to companies taking up exploration blocks under round the year bidding scheme of the Government of India OR Flexibility of negotiations: The terms and conditions are indicative and companies can state in their bids the specific assumptions made in respect of these terms. While the Govt. of India has a flexible approach to these terms, it reserves to itself the right to accept or reject any bid in its sole discretion	No ring fencing of expenditures Tax Incentives for Site Restoration Fund Scheme (SRFS)
		As per Article 7 of PSC

Table 2.8 : Details of Fiscal Terms under which Blocks were Offered under Various Pre-NELP Exploration Rounds in India

Item	Round,1991	Round,1993	Round,1993
Bonus	No signature or production bonus	No signature or production bonus	No signature or production bonus
Royalty	No royalty payment	No royalty payment No custom duty	No royalty payment
GoI interest	GoI or its nominee will have carried interest of 30% from the date of signing of contract, with the option to convert it into a working interest after the decision to proceed with the development and production of discovered hydrocarbons has been taken. GoI or its nominee may also acquire 10% working interest in any block it chooses at the time of signing of contract, thereby sharing 10% of exploration cost	GoI or its nominee will have carried interest of 30% from the date of signing of contract, with the option to convert it into a working interest after the decision to proceed with the development and production of discovered hydrocarbons has been taken. GoI or its nominee may also acquire 10% working interest in any block it chooses at the time of signing of contract, thereby sharing 10% of exploration cost	GoI or its nominee will have carried interest of 30% from the date of signing of contract, with the option to convert it into a working interest after the decision to proceed with the development and production of discovered hydrocarbons has been taken. GoI or its nominee may also acquire 10% working interest in any block it chooses at the time of signing of contract, thereby sharing 10% of exploration cost
Pricing of crude oil and natural gas	International market price for oil produced. The pricing formula for associated gas would be on a cost plus basis, while for non-associated gas it would be related to the international price of fuel oil, the exact relationship being negotiable. The price payable for both associated and non-associated gas would not exceed the price paid to the producer National Oil Companies (exclusive of cess, taxes and royalty)	International market price for oil produced. The pricing formula for associated gas would be on a cost plus basis, while for non-associated gas it would be related to the international price of fuel oil, the exact relationship being negotiable. The price payable for both associated and non-associated gas would not exceed the price paid to the producer National Oil Companies (exclusive of cess, taxes and royalty)	International market price for oil produced. The pricing formula for gas would be on internationally accepted principles. Arrangement for marketing of the gas produced would be negotiable between the GoI and the Company
Sharing of profit	Profit oil shall be bid based on sliding scale tied to post tax rates of return or multiples of investment recovered	Profit oil shall be bid based on sliding scale tied to post tax rates of return or multiples of investment recovered	Profit oil and profit gas share based on sliding scale tied to post tax rates of return or multiples of investment recovered
Minimum expenditure	No minimum expenditure commitment No ring fencing of blocks for corporate tax purposes	No minimum expenditure commitment No ring fencing of blocks for corporate tax purposes	No minimum expenditure commitment during the exploration period No ring fencing of blocks for corporate tax purposes
Operatorship	NA	Company will be operator for exploration and appraisal period. Time of transfer of operatorship to GoI or its nominee during development and production phase is negotiable	Company will be operator for exploration and appraisal period. Time of transfer of operatorship to GoI or its nominee during development and production phase is negotiable

	Round,1994	Round,1994	JV Exploration Program,1995
	No signature or production bonus	No signature or production bonus	No signature or production bonus
	No royalty payment	No royalty payment	No royalty payment/cess payment
	GoI or its nominee will have carried interest of 30% from the date of signing of contract, with the option to convert it into a working interest after the decision to proceed with the development and production of discovered hydrocarbons has been taken. GoI or its nominee may also acquire 10% working interest in any block it chooses at the time of signing of contract, thereby sharing 10% of exploration cost	GoI or its nominee will have carried interest of 30% from the date of signing of contract, with the option to convert it into a working interest after the decision to proceed with the development and production of discovered hydrocarbons has been taken. GoI or its nominee may also acquire 10% working interest in any block it chooses at the time of signing of contract, thereby sharing 10% of exploration cost	ONGC or OIL will have a participating interest of between 25% to 40% in the JV from the date of signing of contract, thereby sharing the exploration cost in proportion to their participating interest
	International market price for oil produced. The pricing formula for gas would be on internationally accepted principles. Arrangement for marketing of the gas produced would be negotiable between the GoI and the Company	International market price for oil produced. The pricing formula for gas would be on internationally accepted principles. Arrangement for marketing of the gas produced would be negotiable between the GoI and the Company	International market price for oil produced. The JV will have freedom to make arrangements for marketing the gas
	Profit oil and profit gas share based on sliding scale tied to post tax rates of return or multiples of investment recovered	Profit oil and profit gas share based on sliding scale tied to post tax rates of return or multiples of investment recovered	Sharing of Profit petroleum based on sliding scale tied to post tax rates of return or multiples of investment recovered
	No minimum expenditure commitment during the exploration period No ring fencing of blocks for corporate tax purposes	No minimum expenditure commitment during the exploration period No ring fencing of blocks for corporate tax purposes	No minimum expenditure commitment during the exploration period No ring fencing of blocks for corporate tax purposes
	Company will be operator for exploration and appraisal period. Time of transfer of operatorship to GoI or its nominee during development and production phase is negotiable	Company will be operator for exploration and appraisal period. Time of transfer of operatorship to GoI or its nominee during development and production phase is negotiable	Operatorship is negotiable Time of transfer of operatorship to ONGC/OIL during development and production phase is also negotiable

Table 2.9 : Details of Fiscal Terms under which Blocks were Offered under Various Pre-NELP Field Rounds in India

Item	Small fields,1992
Bonus	Signature/production bonuses payable by companies to ONGC and OIL
Royalty	All statutory levies including royalty, cess, customs duties, etc. payable by Contractor
GoI interest	ONGC/OIL would have no participating or carried interest in the Contract. NOCs not allowed to bid.
Pricing of crude oil and natural gas	First right of refusal to Government of India in respect of purchase of crude oil produced. International market price for oil produced.
Sharing of profit	Sharing of the profit oil shall be bid, based on a sliding scale tied to post tax rates of return or multiples of investment recovered and shall be specified in each Contract
Minimum expenditure	Percentage of annual production of crude oil expected to be allocated for recovery of costs should be indicated in the offer

Table 2.10 : Progressive Modifications of Terms & Conditions in Different NELP Rounds

Item	NELP-I to V	NELP-VI
Categorization of blocks	» Blocks categorized as Deepwater blocks, shallow offshore blocks and onland blocks. » No sub-categorization of blocks.	» Each category is sub-categorized as Type A and Type B.
Exploration phases	Three exploration phases	Two exploration phases
Work Program	No mandatory work program	Mandatory work specified in the NIO for some of the blocks.
Bid Evaluation Criteria	1. Technical Capability 2. Financial Capability 3. Work Program 4. Fiscal Package	1. Technical Capability 2. Work Program 3. Fiscal Package
Investment Multiple and GoI share	Stair-step based system of Investment multiple for GoI Share	Stair-step based system of Investment multiple for GoI Share
Part Relinquishment	Part area relinquishment, after phase –I and after phase-II	Part area relinquishment, after phase–I
Liquidated Damages	No Liquidated Damages (LD) specified. Penalties for unfinished work program computed case-to-case basis.	No Liquidated Damages (LD) specified. Penalties for unfinished work program computed case-to-case basis.
Bank Guarantee	Bank Guarantee @ 35% of Annual work program.	Bank Guarantee @ 35% of Annual work program.
Bid Bond	No Bid bond to be furnished at the time of submission of bids.	No Bid bond to be furnished at the time of submission of bids.

	Medium fields,1992	Discovered fields,1993
	Signature/production bonuses payable by coventures	Signature/production bonuses payable by coventures
	All statutory levies, including royalty, cess, customs duties, sales tax, etc. payable by Coventure	All statutory levies, including royalty, cess , customs duties, etc. payable
	ONGC/OIL will have up to 40% Participating Interest	ONGC/OIL will have up to 40% Participating Interest in medium size fields ONGC/OIL would have no participating or carried interest in the Contracts of small fields. NOCs not allowed to bid for small size fields.
	First right of refusal to Government of India in respect of purchase of crude oil & natural gas produced International market price for oil produced and in case of natural gas, related to international price of fuel oil for Non-associated gas and determined on a cost plus basis for associated gas	First right of refusal to Government of India in respect of purchase of crude oil produced. International market price for oil purchased by GoI Domestic market would have the first call on natural gas produced; arrangements for marketing of gas produced would be negotiable between GoI and Company. The pricing would be based on internationally accepted principles
	NA	Sharing of the profit oil/gas would have to be indicated in the offer, based on a sliding scale tied to post tax rates of return or multiples of investment recovered as in the rounds of bidding for exploration blocks
	Preferential treatment to companies taking up exploration blocks under round the year bidding scheme of the Government of India.	Flexibility of negotiations: The terms and conditions are indicative and companies can state in their bids the specific assumptions made in respect of these terms. While the Govt. of India has a flexible approach to these terms, it reserves to itself the right to accept or reject any bid on its sole discretion

	NELP-VII	NELP-VIII & IX
	» Sub-categories Type A and Type B continued » New category Type S with small onland blocks of size less than 200 sq. km. introduced » For Type S blocks, Technical capability is not considered for pre-qualification or evaluation.	» Type A & B classification among onland, shallow water and deep water blocks removed. » Category Type S continued.
	Two exploration phases	Two exploration phases
	Mandatory work specified in the NIO for some of the blocks.	Mandatory work specified in the NIO for some of the blocks.
	1. Technical Capability 2. Work Program 3. Fiscal Package	1. Technical Capability 2. Work Program 3. Fiscal Package
	Linear based system of Investment multiple for GoI Share	Linear based system of Investment multiple for GoI Share
	Part area relinquishment, after phase–I	No part area relinquishment after phase-I
	No Liquidated Damages (LD) specified. Penalties for unfinished work program computed case-to-case basis.	Liquidated Damages (LD) specified upfront for unfinished work program
	Bank Guarantee @ 35% of Annual work program.	One time BG introduced @ 7.5% of total committed work program.
	No Bid bond to be furnished at the time of submission of bids.	Bid bond to be submitted at the time of submission of bids.

Table 2.11 : Fiscal Terms of Previous Round of Offering

Item	Nomination	Round,1991
Bonus	NA	No signature or production bonus
Royalty	Royalty : For Crude Oil: 20% for onshore,10% for offshore, 10% for deep water Natural Gas: 10% for all onshore and offshore	No royalty payment
GoI interest	Government owned	GoI or its nominee will have carried interest of 30% from the date of signing of contract, with the option to convert it into a working interest after the decision to proceed with the development and production of discovered hydrocarbons has been taken. GoI or its nominee may also acquire 10% working interest in any block it chooses at the time of signing of contract, thereby sharing 10% of exploration cost
Pricing of crude oil and natural gas	As per prevailing rate and subsidy arrangement	International market price for oil produced. The pricing formula for associated gas would be on a cost plus basis, while for non-associated gas it would be related to the international price of fuel oil, the exact relationship being negotiable. The price payable for both associated and non-associated gas would not exceed the price paid to the producer National Oil Companies (exclusive of cess,taxes and royalty)
Sharing of profit	In the pattern of shareholding	Profit oil shall be bid based on sliding scale tied to post tax rates of return or multiples of investment recovered
Minimum expenditure	NA	No minimum expenditure commitment No ring fencing of blocks for corporate tax purposes
Operatorship	NOC (ONGC/OIL)	NA

Table 2.12 : Fiscal Terms of Previous Round of Offering

Item	Round,1994
Bonus	No signature or production bonus
Royalty	No royalty payment
GoI interest	GoI or its nominee will have carried interest of 30% from the date of signing of contract, with the option to convert it into a working interest after the decision to proceed with the development and production of discovered hydrocarbons has been taken. GoI or its nominee may also acquire 10% working interest in any block it chooses at the time of signing of contract, thereby sharing 10% of exploration cost
Pricing of crude oil and natural gas	International market price for oil produced. The pricing formula for gas would be on internationally accepted principles. Arrangement for marketing of the gas produced would be negotiable between the GoI and the Company
Sharing of profit	Profit oil and profit gas share based on sliding scale tied to post tax rates of return or multiples of investment recovered
Minimum expenditure	No minimum expenditure commitment during the exploration period No ring fencing of blocks for corporate tax purposes
Operatorship	Company will be operator for exploration and appraisal period. Time of transfer of operatorship to GoI or its nominee during development and production phase is negotiable

Pre-NELP	
Round,1993	**Round,1993**
No signature or production bonus	No signature or production bonus
No royalty payment No custom duty	No royalty payment
GoI or its nominee will have carried interest of 30% from the date of signing of contract, with the option to convert it into a working interest after the decision to proceed with the development and production of discovered hydrocarbons has been taken. GoI or its nominee may also acquire 10% working interest in any block it chooses at the time of signing of contract, thereby sharing 10% of exploration cost	GoI or its nominee will have carried interest of 30% from the date of signing of contract, with the option to convert it into a working interest after the decision to proceed with the development and production of discovered hydrocarbons has been taken. GoI or its nominee may also acquire 10% working interest in any block it chooses at the time of signing of contract, thereby sharing 10% of exploration cost
International market price for oil produced. The pricing formula for associated gas would be on a cost plus basis, while for non-associated gas it would be related to the international price of fuel oil, the exact relationship being negotiable. The price payable for both associated and non-associated gas would not exceed the price paid to the producer National Oil Companies (exclusive of cess,taxes and royalty)	International market price for oil produced. The pricing formula for gas would be on internationally accepted principles. Arrangement for marketing of the gas produced would be negotiable between the GoI and the Company
Profit oil shall be bid based on sliding scale tied to post tax rates of return or multiples of investment recovered	Profit oil and profit gas share based on sliding scale tied to post tax rates of return or multiples of investment recovered
No minimum expenditure commitment No ring fencing of blocks for corporate tax purposes	No minimum expenditure commitment during the exploration period No ring fencing of blocks for corporate tax purposes
Company will be operator for exploration and appraisal period. Time of transfer of operatorship to GoI or its nominee during development and production phase is negotiable	Company will be operator for exploration and appraisal period. Time of transfer of operatorship to GoI or its nominee during development and production phase is negotiable

Round,1994	**JV Exploration Programme,1995**
No signature or production bonus	No signature or production bonus
No royalty payment	No royalty payment/cess payment
GoI or its nominee will have carried interest of 30% from the date of signing of contract, with the option to convert it into a working interest after the decision to proceed with the development and production of discovered hydrocarbons has been taken. GoI or its nominee may also acquire 10% working interest in any block it chooses at the time of signing of contract, thereby sharing 10% of exploration cost	ONGC or OIL will have a participating interest of between 25% to 40% in the JV from the date of signing of contract, thereby sharing the exploration cost in proportion to their participating interest
International market price for oil produced. The pricing formula for gas would be on internationally accepted principles. Arrangement for marketing of the gas produced would be negotiable between the GoI and the Company	International market price for oil produced. The JV will have freedom to make arrangements for marketing the gas
Profit oil and profit gas share based on sliding scale tied to post tax rates of return or multiples of investment recovered	Sharing of Profit petroleum based on sliding scale tied to post tax rates of return or multiples of investment recovered
No minimum expenditure commitment during the exploration period No ring fencing of blocks for corporate tax purposes	No minimum expenditure commitment during the exploration period No ring fencing of blocks for corporate tax purposes
Company will be operator for exploration and appraisal period. Time of transfer of operatorship to GoI or its nominee during development and production phase is negotiable	Operatorship is negotiable Time of transfer of operatorship to ONGC/OIL during development and production phase is also negotiable

Table 2.13 : Fiscal Terms of Previous Round of Offering

Sl. No.	Item	Small fields,1992	Medium fields,1992	Discovered fields,1993	NELP (1999 till date)
1	**Bonus**	Signature/production bonuses payable by companies to ONGC and OIL	Signature/production bonuses payable by coventures	Signature/production bonuses payable by coventures	No signature, discovery or production bonus
2	**Royalty**	All statutory levies including royalty, cess, customs duties, etc. payable by Contractor	All statutory levies, including royalty, cess, customs duties, sales tax, etc. payable by Coventure	All statutory levies, including royalty, cess , customs duties, etc. payable	Royalty : Oil- 12.5% for on-shore,10% for offshore, 5% for deep water; Gas- 10% onshore, 10% offshore, 5% for deep water ad valorem applicable to all companies No custom duty on imports for Petroleum Operation Income Tax holiday of 7 years for Mineral Oil
3	**GoI interest**	ONGC/OIL would have no participating or carried interest in the Contract. NOCs not allowed to bid	ONGC/OIL will have upto 40% Participating Interest	ONGC/OIL will have upto 40% Participating Interest in medium size fields ONGC/OIL would have no participating or carried interest in the Contracts of small fields. NOCs not allowed to bid for small size fields.	No State participation or any carried interest, NOCs to compete for acreage with Private
4	**Pricing of crude oil and natural gas**	First right of refusal to Government of India in respect of purchase of crude oil produced. International market price for oil produced.	First right of refusal to Government of India in respect of purchase of crude oil & natural gas produced International market price for oil produced and in case of natural gas, related to international price of fuel oil for Non-associated gas and determined on a cost plus basis for associated gas	First right of refusal to Government of India in respect of purchase of crude oil produced. International market price for oil purchased by GoI Domestic market would have the first call on natural gas produced, arrangements for marketing of gas produces would be negotiable between GoI and Company. The pricing would be based on internationally accepted principles	International Crude Oil price at arm's length Gas pricing requires approval of GoI
5	**Sharing of profit**	Sharing of the profit oil shall be bid, based on a sliding scale tied to post tax rates of return or multiples of investment recovered and shall be specified in each Contract	NA	Sharing of the profit oil/gas would have to be indicated in the offer, based on a sliding scale tied to post tax rates of return or multiples of investment recovered as in the Rounds of bidding for exploration blocks	Sharing of Profit Petroleum with Govt. on biddable pre-tax investment multiple NELP I to VI :Step ladder based system of Investment multiple for GoI Share NELP VII to IX: Linear based system of Investment multiple for GoI Share
6	**Minimum expenditure**	Percentage of annual production of crude oil expected to be allocated for recovery of costs should be indicated in the offer	Preferential treatment to companies taking up exploration blocks under round the year bidding scheme of the Government of India	Flexibility of negotiations: The terms and conditions are indicative and companies can state in their bids the specific assumptions made in respect of these terms. While the Govt. of India has a flexible approach to these terms, it reserves to itself the right to accept or reject any bid in its sole discretion	No ring fencing of expenditures Tax Incentives for Site Restoration Fund Scheme (SRFS)
7	**Operatorship**				As per Article 7 of PSC

Cairn India's Ravaa Offshore facility

Chapter 3

Investors' Pick

3 Investors' Pick

Major policy drives and initiatives have been ushered by the Government in upstream hydrocarbon segment in India in the last couple of years to give a boost to the investment climate and domestic production and many others are under consideration. All such policies/guidelines being considered or implemented by the Government in the interest of the upstream Oil and Gas sector are listed below:

3.1 POLICY IMPLEMENTATION

1. Discovered Small Field (Marginal) Policy

To reduce the import dependency of hydrocarbons, it is pertinent to effectively exploit the established reserves and increase the indigenous production. It was observed that many discoveries made in Nomination blocks have not been monetized and are categorized as Marginal fields. Government of India in October 2015 announced Marginal Field Policy which was later rechristened to Discovered Small Field Policy. This policy will help to monetize more than 85 MMT (O+OEG) reserves. It will boost production and provide increased revenue to both government and contractor. Highlights of this policy are as follows:

- **Revenue Sharing contract:** A simple and easy to administer contractual model in line with Government's effort to promote 'Ease of doing business' requiring minimum regulatory burden for field monetization
- **Single license for Conventional & Non-conventional hydrocarbon:** Single license to explore and extract all hydrocarbon resources, including CBM, Shale gas/oil, tight gas, gas hydrates and other resources to be identified in future
- **No restriction on exploration activity during contract period:** Contractor will be allowed to carry out exploration during entire contract duration
- **Eligibility for Bidding :** Up to 100% participation by foreign companies, Joint Ventures will be allowed. No mandatory state participation and no carried interest by ONGC and OIL are envisaged
- **Crude Oil & Gas Pricing and Sale:** Contractor will be free to sell the Crude Oil and Natural Gas exclusively in domestic market through a transparent bidding process at arm's length
- **Oil Cess & Royalty:** No Oil Cess will be applicable on Crude Oil production however, Royalty rates will be as under NELP regime.
- **Customs Duty:** Customs duty exemptions for specified goods and services will be available for contract areas

Details pertaining to the Discovered Small Field policy is available in public domain at URL: http://58.68.49.84/DSF

2. Marketing and Pricing freedom for new gas production from Deepwater, Ultra Deep water and High Pressure-High Temperature Areas

Much of unexploited oil and gas resources are in the Deepwater, Ultra Deep water and High Pressure-High Temperature Areas and recognizing the need for incentivizing gas production from such difficult areas, Government of India on 21.03.2016 notified marketing including pricing freedom for gas produced from all discoveries which are yet to produce commercial production as on 01.01.2016 and to all future discoveries in such areas. Continuing the further reforms in pricing on 21.03.2016 government approved marketing and pricing freedom for Gas discoveries in Deepwater and Ultra Deepwater areas which are yet to commence commerical production as on 01.01.2016 and all such future discoveries. This shall incentivize exploration and production in Deep/Ultra Deep/High Pressure High-Temperature (HPHT) areas and will unlock huge hydrocarbon potential. Further, the policy aims to improve the economic viability of discoveries already made in such difficult areas and would lead to early monetization of future discoveries as well. Details

pertaining to this policy is available in public domain at URL: http://petroleum.nic.in/docs/exp/mkt_freedom.pdf

3. **New Domestic Natural Gas Pricing Guidelines:**

In order to strengthen the developing Gas market in the country, Government of India started pricing reforms for the natural gas sector by approving new gas pricing scheme in October 2014. This policy is based on the prevailing hub prices of United States, Mexico, Canada, European Union and Russia. The price has revision cycle of six months and will be applicable to all sectors uniformly.

With a view to protect the interests of the consuming sector as well as paying heed to the requests from producing sector, a ceiling based on the landed cost of the alternate fuel has been imposed. The ceiling price in US $ per MMBTU (GCV) shall be calculated as lowest of the (i) Landed price of imported fuel oil (ii) Weighted average import landed price of substitute fuels and (iii) Landed price of imported LNG. The landed price-based ceiling wil be calculated once in six months and applied prospectively for the next six months.

Details pertaining to the New Domestic Natural Gas Pricing Guidelines policy is available in public domain at URL: http://petroleum.nic.in/docs/NewNaturalGasPricingGuidelines.pdf

4. Hydrocarbon Exploration and Licensing Policy (HELP)

On 10 March 2016, Government approved Hydrocarbon Exploration and Licensing Policy (HELP) which is based on new contractual model i.e. Revenue Sharing. As the model is centered around a matrix of biddable revenue share vis-a vis level of production by the Contractor itself, it is expected to eliminate the areas of disputes related to cost recovery, Investment multiple calculation, cost of unfinished work program, rigidities of timelines, delays in implementation of FDP, etc. The implementation of Revenue Sharing Contract (RSC) model is envisaged to minimize regulatory burden for the sake of ease of doing business, and increase the ease of business in India for both National and International contractors. Major highlights of HELP are as follows:

- Open Acreage Policy – option to select the exploration blocks without waiting for formal bid round.
- Revenue Sharing Model – simple, easy to administer- no cost recovery - no micro-management by the Government - operational freedom to the operator
- Pricing and Marketing Freedom – Major incentive for investment
- Single License for exploration and production of conventional as well as non-conventional hydrocarbon resources
- Exploration allowed throughout the contract period .
- Increase in exploration phase – Exploration Phase for onshore areas have been increased from 7 years to 8 years and for offshore increased from 8 years to 10 years.
- Reduced Royalty rates for offshore blocks

Details pertaining to the Hydrocarbon Exploration Licensing Policy is available in public domain at URL: http://petroleum.nic.in/docs/HELP.pdf

5. Policy for extension of Production Sharing Contracts (PSCs):

To enable optimal recovery of oil and gas reserves from fields after expiry of PSC, Government of India on 10 March 2016 has approved a policy for the grant of extension to the Production Sharing Contracts for 28 Pre-NELP discovered (small and medium size) fields. The policy aims at bringing out clear terms of extension so that the resources can be expeditiously exploited in the interest of energy security of the country and improving the investment climate.

This policy provides for a uniform, non-discretionary framework for extension of contract for a period of 10 years both for Oil and Gas. During the extension period, it is proposed to increase the Government take by way of charging normal royalty and cess in place of concessional royalty and cess charged during the original contract period. The profit petroleum during extension period will also be 10 percent higher than the normal percentage.

Detail pertaining to the Policy for extension of Production Sharing Contracts for small and medium size fields is available at URL: http://pib.nic.in/newsite/PrintRelease.aspx?relid=137637

6. Policy for testing requirement:

Government has approved a policy on testing requirements for discoveries made under New Exploration and Licensing Policy (NELP) Blocks on 29.04.2016 in order to resolve the disputes related to testing requirements and to monetize the stuck up discoveries. This decision was implemented on 13.05.2015. The contractors are now allowed to carry out the pending drill stem test on the discoveries and submit the results in a specified time line. Testing is being carried out on all concerning/ applicable discoveries which were stuck up earlier.

7. Policy Framework for Relaxations, Extensions and Clarifications at the Development and Production stage under PSC regime for early Monetization of hydrocarbon discoveries:

To address various issues and concerns regarding PSCs, the policy framework for relaxation, extensions and clarifications at the Development and Production Stage under the PSC Regime was notified in November 2014. As a result of implementation of these guidelines, more than 40 long pending PSC related issues have been resolved.

8. **Exploration in Mining Lease Areas:**

Government of India has formulated a policy to allow exploration in Mining Lease Areas with cost recovery subject to establishment of commerciality. Till 31.03.2016, 15 hydrocarbon discoveries (14 Oil & 1 Gas) have been notified in the Mining Lease (ML) areas after announcement of above policy. Document of Commerciality (DoC) for one discovery D-55, from the Block KG-DWN-98/3 is submitted.

9. **Policy Guidelines of Exploration and Exploitation of Shale Gas and Oil:**

Shale Gas and Oil Policy was announced on 14 October 2013 and under this Policy the right to exploration and exploitation of Shale Gas & Oil has been granted to the National Oil Companies (NOCs) holding Petroleum Exploration License (PEL)/Petroleum Mining Lease (PML) granted under the nomination regime. NOCs have identified 55 blocks for Assessment Studies during the Phase-I of three years. Currently 18 wells have been drilled by ONGC and results are encouraging. Further, NOCs will identify 80 blocks under Phase-II of three years and 55 blocks in Phase-III. Each Phase will culminate in a development and production phase depending on the results of the Assessment Phase.

10. **Policy framework for development of Underground Coal Gasification in coal and lignite bearing areas in India:**

The Union Cabinet, chaired by the Prime Minister in December 2015 has approved a policy framework for development of Underground Coal Gasification (UCG) in coal and lignite bearing areas in India . UCG is a method of extraction of energy from coal/lignite resources which are otherwise regarded as uneconomical to work through conventional mining methods. A policy on lines broadly similar to the existing policy for Coal Bed Methane (CBM) development on revenue sharing basis will be adopted for offering the blocks through competitive bidding.

3.2 POLICY INITIATIVES

1. **Site Restoration Guidelines on Petroleum Operations:**

Government of India has constituted a committee for formulation of Site Restoration guidelines for petroleum operations. An internationally reputed consultant was hired. The consultant had submitted draft report, which was reviewed by the committee members. Recommendation of committee members is finalized, adopted and submitted to Ministry for notification.

2. **Standing Committee on Petroleum Industry Practices:**

Government of India has constituted Standing Committee on Petroleum Industry Practices, to identify the areas requiring codification of "Good International Petroleum Industry Practices (GIPIP)" and to prepare national codes for petroleum operations. An internationally reputed consultant has been hired. The consultant had submitted the report in 2015. Subsequent to several deliberations with all stakeholders, the report was suitably modified and Standing Committee has approved, adopted the report and submitted to Ministry for notification.

3. **Encouraging E&P activities in North-East India:**

To encourage hydrocarbon exploration and production activities in the North-East (NE) Region of India, Government of India carried out special study with consultant for framing Hydrocarbon Vision Document 2030 for NE India. The vision document was released at Guwahati on 09.02.2016. This vision document aims to prepare a roadmap for the next 15 years to increase the production of oil and gas in north-east India and outline the necessary investment in the hydrocarbon sector to increase exploration activities, expand the Piped Natural Gas (PNG) network and ensure availability of petroleum products, including LPG, in the remotest corners of the region. The vision rests on the following five pillars viz. People, Policy, Partnerships, Projects and Production. For implementation of the action plans emerged from this vision documents, an Executive Council is formed consisting of government officials and industry stakeholders.

3.3 OTHER INITIATIVES

1. **Make in India- Oil & Gas:**

'Make in India week' was hosted in the 'financial hub', Mumbai, between February 13 to 18, 2016 sharing Honorable Prime Minister's vision for economic transformation and self reliance of our country in the manufacturing sector. Event regarding Indian Oil and Gas sector was held on 15 February, addressed by Minister of State (I/C) about enhancing the exploratory coverage and enhancement of Oil & Gas production through process and technical improvements. The event was attended by a badge of prospective investors from India and abroad and representatives from all the segment of hydrocarbon value chain, i.e. upstream, midstream and downstream.

2. **Multi-client Geo-scientific surveys:**

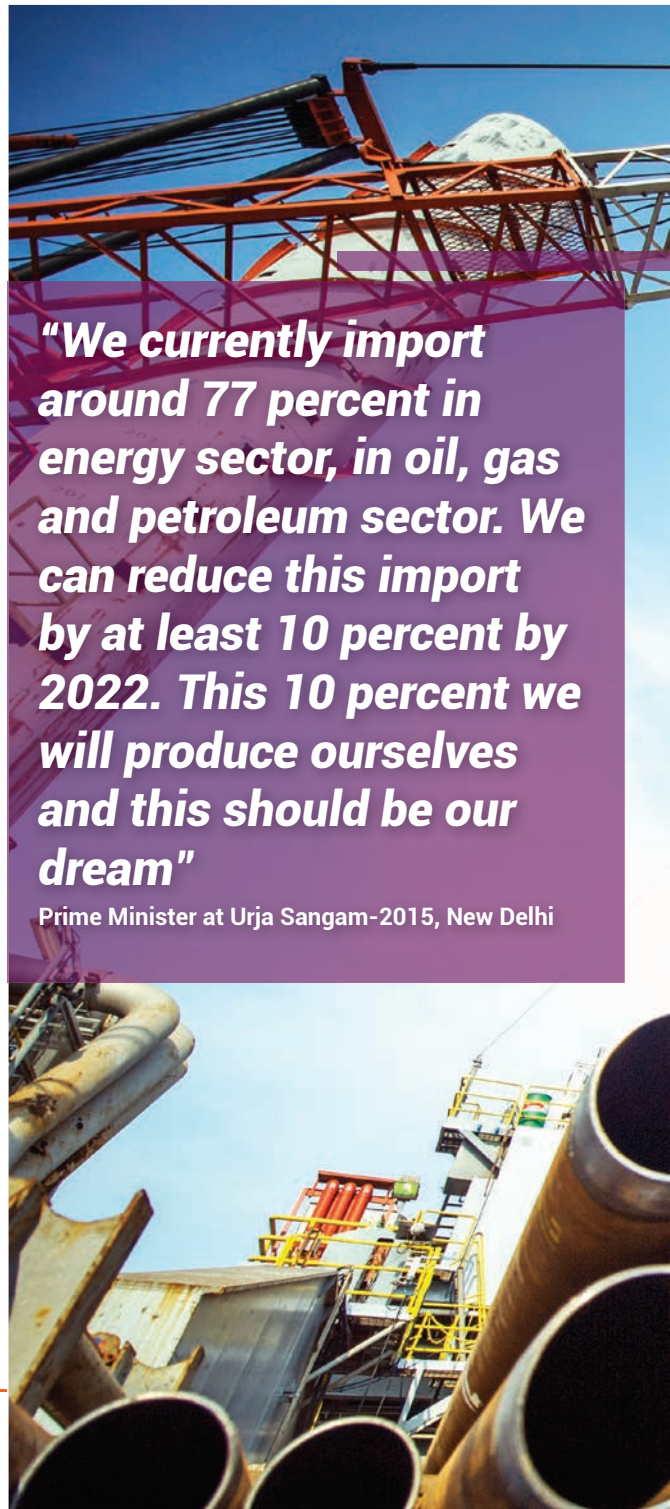
Seven proposals have been received for generation of approx 107,386 LKM 2D Seismic data, under the policy for Geo-scientific data generation for hydrocarbons in Indian sedimentary basins, through Non-exclusive Multi-client Geo-scientific surveys/ activities. All the seven proposals have received clearances from Ministry of Defence (MoD) and Ministry of Home Affairs (MoHA). M/s Electromagnetic Geoservices ASA, Norway, started data acquisition in West Coast of India.

3. **Re-assessment of prognosticated hydrocarbon resources of India:**

A Multi-Organization Team (MOT has been constituted to carry out re-assessment of hydrocarbon resources of India in all its 26 sedimentary basins. The project is to be carried out by ONGC in association with OIL and DGH. Work has been initiated at seven work centres of ONGC for eight priority basins. Entire work for all 26 sedimentary basins is expected to be completed by November, 2017.

4. **Appraisal of Un-appraised Sedimentary areas:**

Out of total sedimentary area of 3.142 Million Sq. Km, an area of 1.502 Million Sq. Km is yet to be appraised. Appraisal of sedimentary basin has been defined as the status of knowledge building efforts for evaluating hydrocarbon prospectivity of the basin though Geological studies, Geophysical surveys and exploratory drilling. To appraise un-appraised areas, MoP&NG has formulated a plan to conduct 2D seismic surveys in all sedimentary basins of India where no/scanty data is available. ONGC and OIL have been entrusted with the task of surveying these areas. OIL has been assigned to carry out 2D seismic API of 7408 LKM falling in North Eastern part of India and ONGC has been assigned to carry out 2D seismic API of approx. 40835 LKM seismic data in onland part of 22 sedimentary basins



"We currently import around 77 percent in energy sector, in oil, gas and petroleum sector. We can reduce this import by at least 10 percent by 2022. This 10 percent we will produce ourselves and this should be our dream"

Prime Minister at Urja Sangam-2015, New Delhi

of India. Currently, the tendering work for carrying out seismic surveys is under progress.

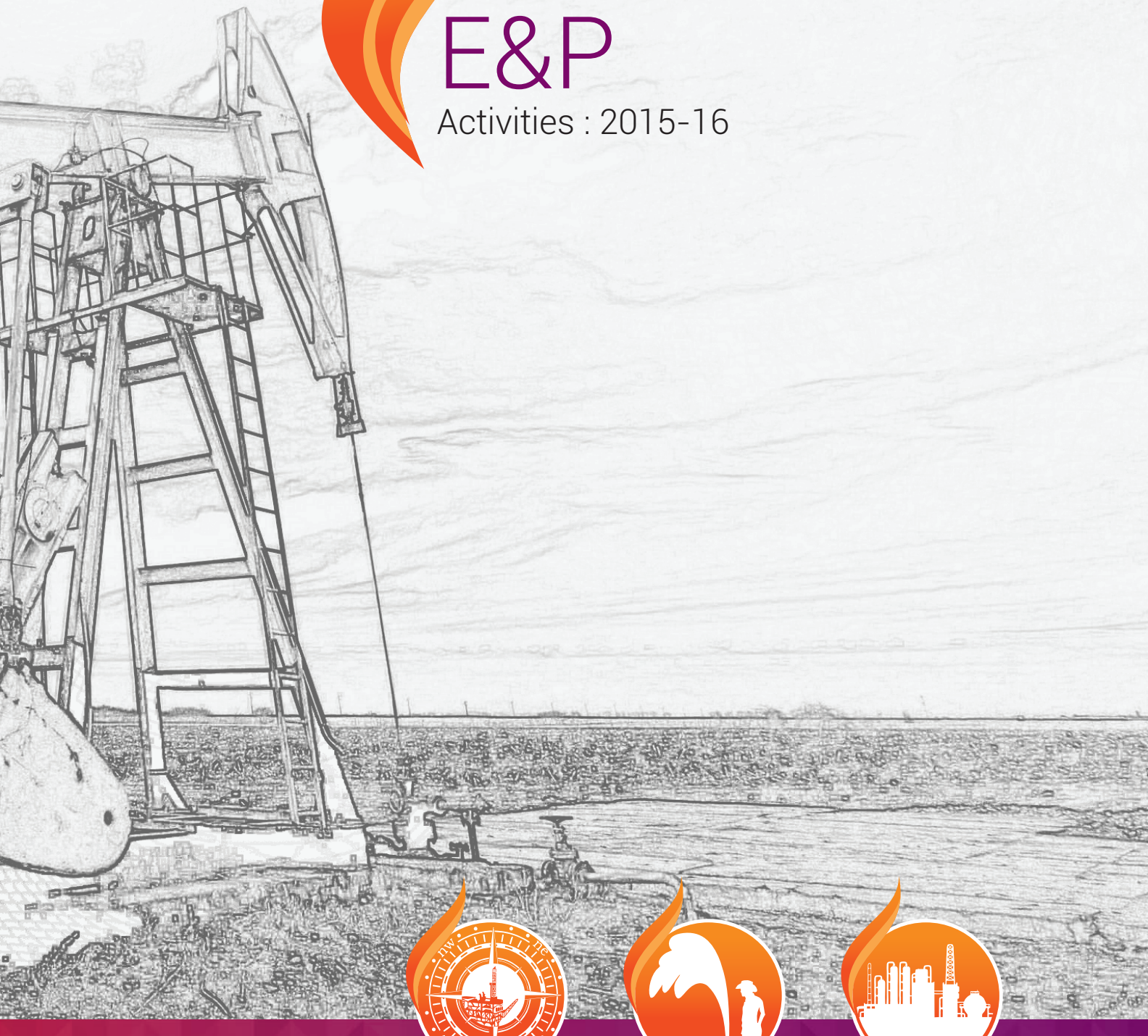
5. National Data Repository (NDR):

To consolidate and store all the Geo-scientific data available in the country and to create a base for Open Acreage Licensing Policy, GoI has taken initiative to build National Data Repository (NDR) for Oil and Gas Industry in India. Site preparation work for NDR project at DGH office, Noida and commissioning of hardware and integration of software at the site has been completed. Initial population of data is in progress and the priority data pertaining to reassessment of 26 sedimentary basins is being loaded. As on 31.03.2016, total 169144.77 LKM 2D Seismic data, 15716.28 SKM 3D Seismic data, 237 wells and logs data and 618 wells report is loaded in NDR.

Chapter 4

E&P

Activities : 2015-16



E&P Activities

Major Discoveries

Oil and Gas Production

4 E&P Activities : 2015-16

Oil and Gas companies operating in upstream Exploration and Production (E&P) sector have to make continuous efforts for discovery of oil and gas in order to satiate the ever-rising demand in the country and this underscores the need for increasing indigenous production. It is observed that in the last three years, country's Reserves Replacement Ratio (RRR) is more than 1 due to consistent exploratory activities carried out by National Oil Companies, Private and Foreign companies.

In the post-independence era, most of the hydrocarbon E&P activities in the country have been carried out by National Oil Companies (ONGC and OIL). Consequent upon liberalization in petroleum sector in 1990s, the participation of foreign and private Indian companies in the exploration and development activities has supplemented the efforts made by NOCs. The companies operating in various Oil and Gas blocks under Production Sharing Contract (PSC) regime [i.e. Pre-NELP & NELP] has to undertake Minimum Work Program (MWP). MWP comprises exploration surveys like 2D, 3D seismic, Gravity, Magnetic, Geo-chemical surveys and Seismic processing & interpretation, etc. along with drilling of exploratory wells.

Brief summary of Exploration activities (data-2D, 3D, Exploratory wells drilled, Exploratory meterage drilled) carried out in FY 2015-16 by NOCs (in Nomination as well as in PSC regime), Private and Foreign companies under PSC regime is provided in Table 4.1

4.1 EXPLORATION ACTIVITIES IN NOMINATION AND PSC REGIME

In FY 2015-16, 7816 LKM of 2D seismic data was acquired mostly in offshore region by Private/JVs. 6236 SQM of 3D seismic data was acquired majority of which was carried out by ONGC in its offshore nomination ML areas. A total of 138 exploratory wells were drilled in this year.

The Company wise exploratory input for FY 2015-16 is provided in Table 4.2.

Table 4.1 : Exploratory efforts in FY 2015-16 under Nomination & PSC regime

Sl. No.	Subject	Parameter	ONGC* (Nomination)	OIL* (Nomination)	Pvt/JVs	Total
1	2D seismic data acquired	Onland (GLKM)	256.8	175.8	535.96	968.56
		Offshore (GLKM)	-	0	6847.56	6847.56
		Total 2D Seismic	**256.8**	**175.8**	**7383.52**	**7816.12**
2	3D seismic data acquired	Onland (SKM)	1309.12	1.13	791.16	2101.41
		Offshore (SKM)	4134.71	0	0	4134.71
		Total 3D Seismic	**5443.83**	**1.13**	**791.16**	**6236.12**
3	Exploratory wells drilled	Onland	52	11	40	103
		Offshore	20	0	15	35
		Total Exploratory Wells	**72**	**11**	**55**	**138**
4	Exploratory Meterage drilled	Onland ('000)	152.396	60.211	101.2	313.759
		Offshore ('000)	49.593	0	40.4	89.9648
		Total Exploratory Meterage drilled	**201.989**	**60.211**	**141.5238**	**403.7238**

* As per inputs received from ONGC & OIL

Table 4.2 : Exploratory efforts by various Companies operating under PSC regime in FY 2015-16

Operator	2D (LKM)	3D (SKM)	Exploratory Wells
Indian Private			
Cairn India Ltd.	1581	434.39	0
Essar Oil Ltd.	0	0	1
Focus Energy Ltd.	5266.56	356.77	13
Jubilant Oil & Gas Private Limited.	27.14	0	0
Mercator Petroleum Private Limited.	0	0	3
Omkar Naturals Resources Pvt. Ltd.	0	0	1
Selan Expl. Tech. Ltd.	0	0	1
Sintex Oil & Gas Pvt. Ltd.	0	0	2
Indian Private Total	**6874.7**	**791.16**	**21**
Public Sector Undertaking			
Bharat Petro Resources Ltd.	0	0	2
National Thermal Power Corporation	340	0	6
Oil and Natural Gas Corporation Ltd.	168.82	0	21
Oil India Ltd.	0	0	5
PSU Total	**508.82**	**0**	**34**
Grand Total	**7383.52**	**791.16**	**55**

4.2 DEVELOPMENT ACTIVITIES

4.2.1 Development Wells Drilled & Meterage in FY 2015-16

In FY 2015-16, 363 development wells were drilled by NOCs (ONGC & OIL) and Private/JVs which accounts for a development meterage of 695.8 m. Majority of the development wells were drilled by ONGC in its offshore Nomination ML areas.

Table 4.3 : Development activities in FY 2015-16

Subject	Parameter	ONGC (Nomination	Oil (Nomination)	Pvt/JVs	Total
Development Wells Drilled	Onland	218	33	70	321
	Offshore	34	0	8	42
	Total	**252**	**33**	**78**	**363**
Development Meterage Drilled	Onland ('000 m)	403.298	82.55	102.823	588.67
	Offshore ('000 m)	85.339	0	21.79	103.022
	Total	**488.637**	**82.55**	**124.61**	**695.8**

4.2.2 MAJOR DISCOVERIES IN DEVELOPMENT PHASE IN FY 2015-16

There are six major discoveries which have entered development phase. The details of these discoveries are as under:

a. D-34 Discovery

The Dhirubhai-34 (D-34) gas discovery is in the southern part of block KG-DWN-98/3 (KGD-6) in the Krishna-Godavari basin. RIL is the operator of this block. D-34 discovery was notified in well D6-R1 which struck two gas reservoirs i.e. Middle and Late Miocene sequences. There are six gas reservoirs, in Late Miocene and Late Pliocene sequences in addition to the appraisal of the Mid Miocene reservoir in the area adjoining the discovery well D6-R1. In total, there are eight reservoirs in this area which are referred together as "R-cluster".

Block	KG-DWN-98/3
Location	KG Basin (Offshore)
Round	NELP-I
Development Area	530 sq. Km (ML area)
Consortium	RIL (60%), BP (30%), NIKO/NECO(10%)
Operator	RIL

b. Four Satellite Gas Fields (D-2, D-6, D-19 and D-22)

Four Satellite Gas Fields D-2, D-6, D-19 and D-22 have entered development phase in the block KG-DWN-98/3. The D-2 field was discovered as a result of drilling the exploratory well DD-6-C1-ST1 in July 2002 at a water depth of 1332-m which subsequently led to discoveries of D-6, D-19 and D-22. These isolated discoveries are collectively referred as Dhirubhai Four Satellite Gas Fields. Hydrocarbons found in these fields are of Late Miocene to Pliocene age.

The major reservoir systems identified are submarine channel-fan complexes, mostly sinuous with multiple channels stacked together resulting in both vertical and lateral aggradations. A number of Facies sequence viz. Channel/Levee, muddy turbidite, debris flows have been identified in the wells drilled indicating excellent to moderate reservoir potential and good reservoir quality in terms of net pay, effective porosity, permeability and shale volume.

Block	KG-DWN-98/3
Location	KG Basin (Offshore)
Round	NELP-I
Development Area	229 sq. Km (ML area)
Consortium	RIL (60%), BP (30%), NIKO/NECO(10%)
Operator	RIL

c. Madnam-3, 5 & 6 Discoveries

Madnam discovery is made in block CY-ONN-2002/2 of Cauvery Basin. In Madnam, both oil & gas discoveries were made. The discovery of hydrocarbon is from fractured basement which is an unconventional reservoir of Precambrian age and from Kamalapuram formation. The Basement high is trending major NE-SW and NW-SE normal faults with steeply dipping flanks. Kamalapuram formation deposited during Paleocene-Eocene in the passive margin set up and these sediments drape over the Madnam Horst, thus forms structural entrapment for the hydrocarbon migration.

Block	CY-ONN-2002/2
Location	Cauvery Basin (Onland)
Round	NELP-IV
Development Area	140 Sq. Km
Consortium	ONGC (60%) & BPRL (40%)
Operator	ONGC

d. Cluster-IIA (A2,P1,M3,M1,M4 & G-2-2) and Cluster-IIB (R1,U3,U1 & A1) Discoveries

There are five oil discoveries and four gas discoveries in Cluster-II area have entered into development phase of block KG-DWN-98/2. Hydrocarbon found in these discoveries is of Miocene to Pliocene age. The major depositional elements are incised slope channel, constructional levied channels, distributary channel complexes and distributary lobes.

Block	KG-DWN-98/2
Location	Krishna Godavari Basin (Offshore)
Round	NELP-I
Development Area	764 Sq. Km
Operator	ONGC (100% PI)

e. Dirok Discovery

Dirok gas discovery is made in block AAP-ON-94/1 of Assam-Arakan Basin. Dirok structure is bounded between the Kumchai & Margherita thrusts. Discovery is found in Girujan formation of Miocene age. Multiple sands have been encountered in existing wells.

Block	AAP-ON-94/1
Location	Assam-Arakan Basin (Onland)
Round	Pre-NELP
Development Area	110 Sq. Km
Consortium	HOEC(40.323%), OIL (16.129%) & IOC(43.548%)
Operator	HOEC

f. Vadatal-3 &5 Discoveries

Vadatal-3 & 5 discoveries are made in block CB-ONN-2004/2 of Cambay Basin. Hydrocarbon accumulation in Vadatal-3 discovery is in Chhatral pay and in Vadatal -5, it is in both Chhatral pay & EP-IV. Chhatral member belongs to upper Cambay shale formation.

Block	CB-ONN-2004/2
Location	Cambay Basin (Onland)
Round	NELP-VI
Development Area	282.49 Sq. Km
Consortium	ONGC(55%) & GSPC (45%)
Operator	ONGC

4.3 OIL AND GAS DISCOVERIES IN 2015-16

Table 4.4 : Summary of New Prospect/Pool discoveries made by ONGC during 2015-16

Name of ML/PEL (Basin)	Date of Notification	Well Name	Oil/Gas
KG-OSN-2004/1 [NELP-VI] (KG Offshore)	28.04.2015	Sarangi-1 (KGOS041NASG#1)	Gas
Tatipaka-Pasarlapudi PML (KG Onshore)	23.06.2015	Komarada-3 (KRAC)	Oil & Gas
KG-DWN-98/2 (NELP-I) (KG Offshore)	08.08.2015	KG-DWN-98/2-F-1(E-AB)	Oil & Gas
Sirikattapali-Pasarlapudi-24 & Gopavaram PML (KG Onshore)	12.08.2015	Ravulapalem-1 (RVPAA)	Gas & Cond.
BOFF PML (Mumbai Offshore)	04.11.2015	B-127N-1 (B-127N-A)	Oil & Gas
KG-OSN-2004/1 [NELP-VI] (KG Offshore)	05.11.2015	KGOSN041 NAML1 (Malhar-1)	Gas
MB-OSN-2005/3 (NELP-VII) (Mumbai Offshore)	02.02.2016	MBS053NAA-1 (MBS053NAA-A)	Gas
BOFF PML (Mumbai Offshore)	22.03.2016	B-66-2 (B-66-B)	Oil & Gas
GK-OSN-2010/1 [NELP-IX] (Kutch Offshore)	31.03.2016	GKS101NAA-1 (NAA-A)	Gas
	25.04.2015	KGD982NA-M-4 (KG982NA-M-AD)	Oil & Gas
KG-DWN-98/2 (NELP-I) (KG Offshore)	28.07.2015	Gojalia-14 (GOAF)	Gas
	08.08.2015	North Kovilkalappal-6 (NKKAC)	Oil & Gas
L-II (Cauvery Onshore)	30.09.2015	RO#62 (ROBD)	Gas
Godavari Onshore (KG Onshore)	08.12.2015	West Penugonda-1 (WPGAA)	Oil & Gas
Adavipalem-Ponnamanda PML (KG Onshore)	14.12.2015	Kesanapalli West-47 (KWDM)	Gas
GK-28 PML (Kutch Offshore)	25.01.2016	GK-28-10 (GK-28-L)	Gas
GS-OSN-2004/1 [NELP-VI] (Saurashtra Offshore)	31.03.2016	GSS041NAA-2 (GSS041NAA-B)	Gas

Table 4.5 : Summary of New Prospect/Pool discoveries made by OIL during 2015-16

Name of ML/PEL (Basin)	Date of Notification	Well Name	Oil/Gas
Moran ML	–	Moran Structure/Moran-78 (Loc. MBT)	Gas
Baghjan ML	–	Baghjan Structure/ Baghjan-7 (Loc- BGE)	Gas
Nahorkatiya Extension ML	–	South Chalakataki Structure/NHK-173 (Loc. NDC)	Gas
Dumduma ML	–	Sapkaint Structure /Sapkaint-2 (Loc DGK)	Oil

	Testing Result	Zone/Formation/Age
	Obj-I (1737-1727 m): Flowed gas @ 401203 m3/d through 40/64" choke	Object - I / Godavari Clay Formation / Plio-Pleistocene
	Obj-I (3043.5-3040.5 m): Flowed oil @ 31.9 m3/d & gas @ 1,23512 m3/d through 6 mm bean	Object-I / Vadaparru Formation - Vadaparu Play/ Middle Eocene
	Obj-I (1812.5-1814.5 m): Flowed oil @ 732 bpd & gas @ 13,155 m3/d with FTHP. 548 psi through 24/64" choke	Object - I / Godavari Clay Formation / Plio-Pleistocene
	Obj-I (1979.5-1975.5 m): Flowed gas @ 13,350 m3/day through 6 mm bean. Obj-II (1698-1695 & 1688-1685 m): Flowed gas @ 83,200 m3/d & condensate @ 7.3 m3/d with through 7.0 mm bean	Object - I & II / Vadaparru Formation - Vadaparu Play/ Middle Eocene
	Obj-I (3035-32, 3030.5-28.5, 3027-23.5 m): Flowed oil @ 148 bpd & gas @ 66,426 m3/d through ½"choke Obj-II (3005.5-03, 2992-85, 2980-78.5, 2976.5-73 & 2971-69 m): Flowed oil @ 258 bpd & gas @ 1,78,253 m3/d & little water through ½"choke Obj-III (2963-60, 2958.5-56.5, 2955-53, 2952-49, 2946-43 & 2940-39 m): Flowed oil @ 102 bpd, gas @ 1,38,749 m3/d & water @ 39 bpd through ½"choke.	Object -I, II & III / Panna Formation/ Paleocene-Early Eocene
	Obj-I (1958.5-57, 1954-47, 1941-39.5, 1929-25 & 1918.5-1917 m): Flowed gas @ 4,47,461 m3/day at FTHP. 2800 psi via ½" choke	Object - I / Mio-Pliocene Sequence
	Obj-I (938-932 m): Flowed gas @ 47,128 m3/d, FTHP. 340 psi, FTHT: 76oF through ½" choke. Obj-II (589-585, 583-581 m): Flowed gas @ 21,282 m3/day, FTHP. 140psi & FTHT: 73°F through 1/2" choke	Object - I & II / Chinchini Formation of Early Langhian / Middle Miocene
	Obj-III (1720-38 m): Flowed gas @ 57,696 m3/day, Ql: 547 bpd (78% oil, 10% water, 12% sediments)	Object-III/ Lower Bassein /Lr-Middle Eocene
	Obj-II (1300-1291 m): Flowed gas @ 45,873 m3/d at FTHP. 250 psi and FTHT: 80° F through ½" choke	4483-4459 & 4434-4422 m/ Mesozoic Sequence
	Obj-I (2908-2900 m): Flowed oil @ 3157 bpd & gas @ 319483 m3/d through 40/64" choke	Object-I / Godavari Clay Formation / Plio-Pleistocene
		1627-1631 m/ Upper Bhuban/ GS-I-IVA/ Middle Miocene
	Obj-II (2143-2134 m): Flowed oil @ 13.4 m3/d & water @ 5.7 m3/d through 6 mm bean Obj-IIIB (2098-2078 m): Flowed oil @ 50 m3/d & gas @ 9,500 m3/d with water @ 4 m3/d through 6 mm bean	2165-2179 m/ Andimadam Formation /Pre-Albian to early Albian
		2437-2440 m/ Middle Bhuban / KP-54
	Object-I (3090-88, 3080.5-77.5, 3066.5-65 & 3063-3054 m): Flowed @ 3.4 m3/d and gas @ 71,275 m3/d at FTHP. 2100 PSI through 6.0 mm bean	Object-I / Raghavapuram Formation / Early Cretaceous
	Object-I (2338.5-2335 m): Flowed gas @ 30,000 m3/d and traces of condensate through 5.0 mm bean	Object-I / Matsyapuri Formation / Miocene
	Obj-I (1452-1520 m): Flowed gas @ 1,26,226 m3/day, FTHP- 850 psi, FTHT-86 °F through ½" Choke size	Object - I / Deccan Traps/ Late cretaceous
	Obj-V (4483-59, 4434-22 m): Flowed gas @ 1,56,563 m3/d, water @ 4771 bpd, FTHP. 3750 psi at FTHT: 112°C through ½" choke	Object - V / Mesozoic sequence / Early Eocene

	Testing Result	Zone/Formation/Age
	Produced gas @40,000 SCMD through 5mm bean	Barail Extra Sand / Oligocene
	Produced gas @90,000 SCMD through 5mm bean	Object 1: 3809.5-3821m/ Narpuh Sand/ Eocene
	Produced gas @24000 SCMPD through 5.5 mm bean	Object:- 1377.0-1379.5 m/ Girujan Sand/ Miocene age
	Produced oil@33 KLPD through 4mm bean	Object: 3237.0-3241.0 m & 3235.0-3236.0 m / Lower Tipam Sand / Miocene age.

ASSAM-ARAKAN BASIN

MRN - 78

Table 4.6 : Moran-78 (Moran M/L) **Operator : OIL**

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
Moran Structure /Moran-78 (Loc. MBT)	Object:- 3187.5-3203m Produced gas @40,000 SCMD through 5mm bean during Testing from Barail Extra Sand of Oligocene age.	The discovery of gas in this well has opened up new avenues for exploration and exploitation of hydrocarbon in Barail Extra Formation in Moran Structure. The areal extent of the structure is about 0.3sq. km. Accretion to EUR for MRN-78 is around 126.4773 MMSCM.

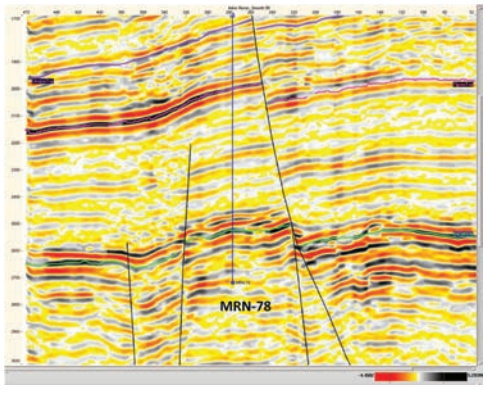


Fig. 4.1: Seismic Section- IL- 99 across Moran Structure well Moran-78 (Loc MBT)

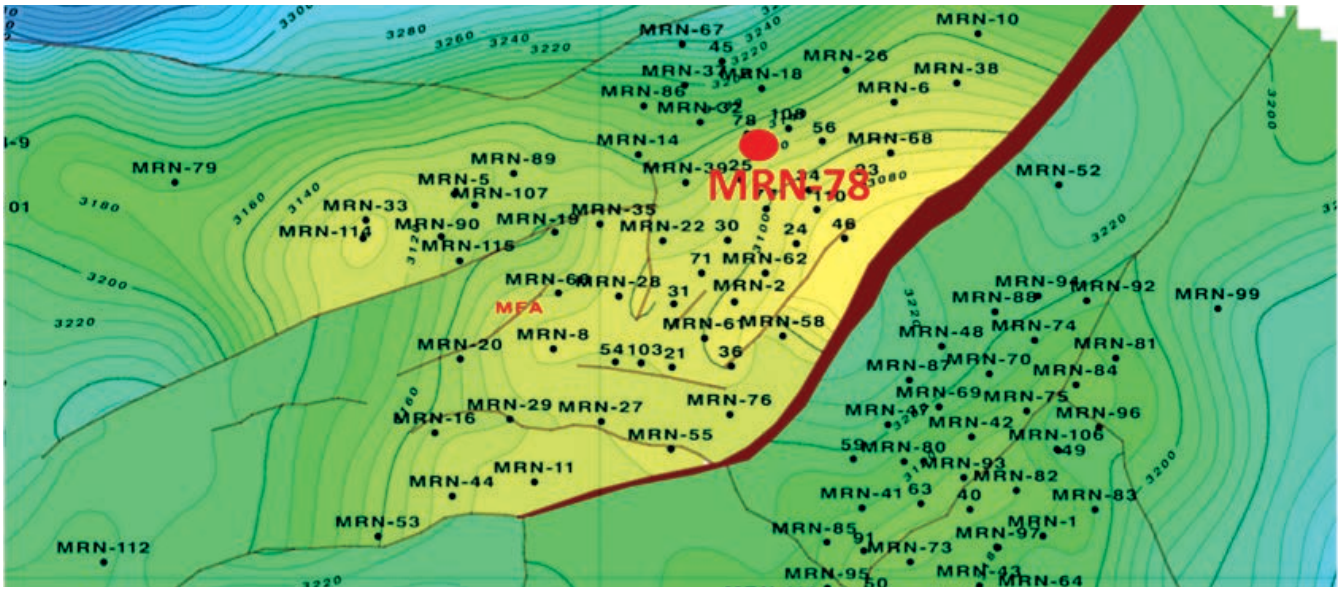


Fig. 4.2 : Depth Contour map close to the top of Barail.

Table 4.7 : Baghjan-7 (Baghjan M/L)

Operator : OIL

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
Baghjan Structure/ Baghjan-7 (Loc-BGE)	Object 1: 3809.5-3821m (Narpuh Sand/ Eocene) Produced gas @90,000 SCUMD through 5mm bean. SITP. 4400 psi	The discovery of gas in this well has opened up new avenues for exploration and exploitation of hydrocarbon in Narpuh Formation in Baghjan Structure. The areal extent of the structure is about 8.15 sq.km. Accretion to EUR for BGN07 is around 2903.9858 MMSCM.

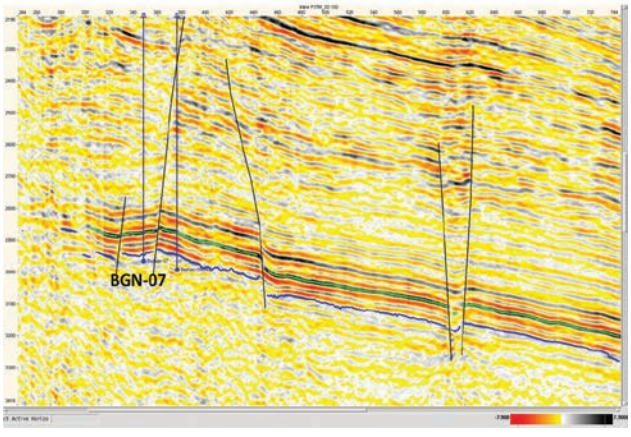


Fig. 4.3 : Seismic Section- IL-150 across Baghjan Structure well BGN-7(BGE)

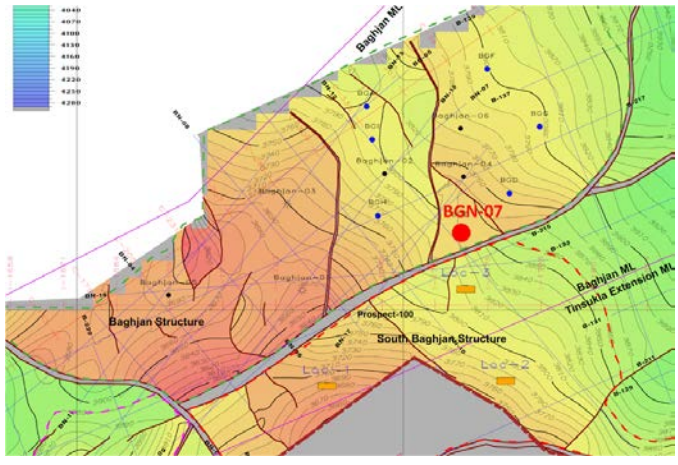


Fig. 4.4 : Depth Contour map close to Langpar Top

Table 4.8 : NHK-173 (Nahorkatiya Extension M/L)

Operator : OIL

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
South Chalakataki Structure/NHK-173 (Loc. NDC)	Object:- 1377.0-1379.5 m Produced gas @24000 SCUMPD through 5.5 mm bean from Girujan Sand of Miocene age.	The discovery of gas in this well has opened up new avenues for exploration and exploitation of hydrocarbon in Girujan Formation in South Chalakataki Structure.

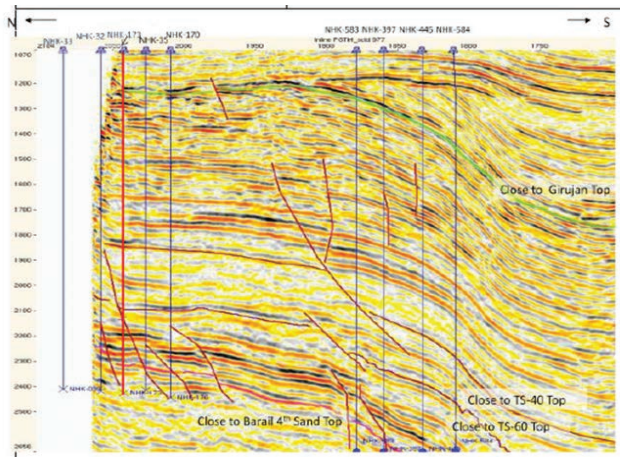


Fig. 4.5 : Seismic Section-IL-977 across South Chalakataki structure well NHK-173 (Loc. NDC)

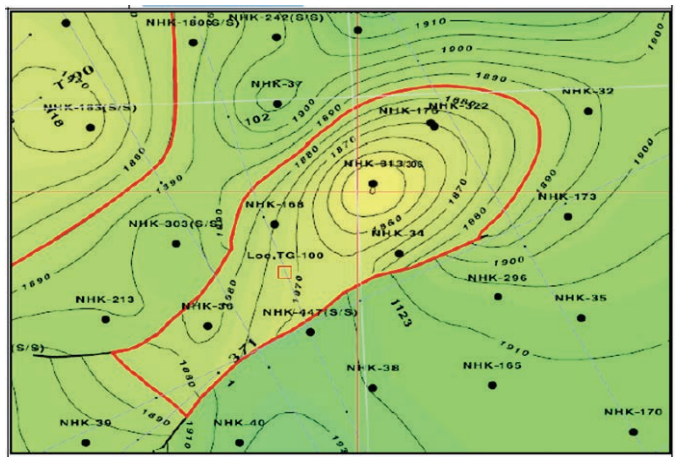


Fig. 4.6 : Depth Contour map close to Langpar Top

Table 4.9 : Sapkaint-2 (Dumduma M/L)

Operator : OIL

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
Sapkaint Structure / Sapkaint-2 (Loc DGK)	Object: 3237.0-3241.0 m & 3235.0-3236.0 m produced oil@33 klpd through 4mm bean from Lower Tipam Sand of Miocene age.	The discovery of oil in this well has opened up new avenues for exploration and exploitation of hydrocarbon in Lower Tipam Formation in Sapkaint Structure. The areal extent of the structure is about 2.85 sq. km. Accretion to in-place volume of O+OEG in 2P category is around 1.3313 MMT.

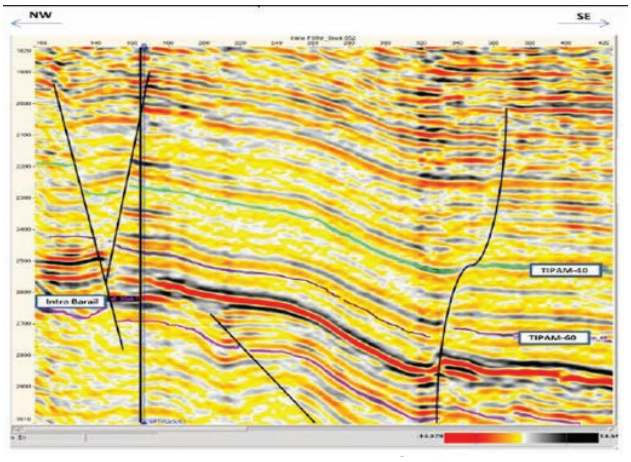


Fig. 4.7 : Seismic Section-IL-652 across Sapkaint Structure well Sapkaint-2 (Loc DGK)

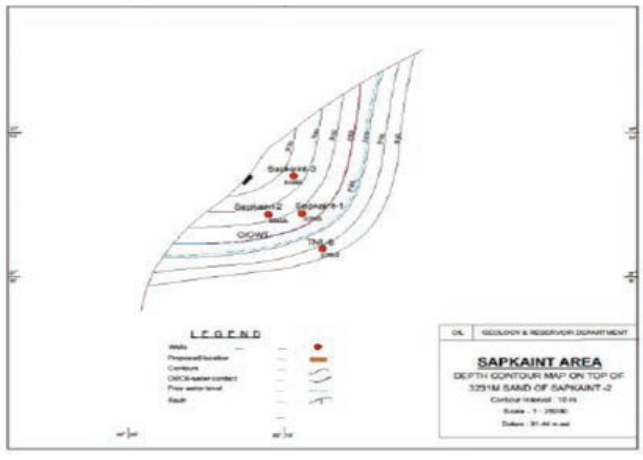


Fig. 4.8 : Depth Contour map on the top of Lower Tipam of Sapkaint-2

Table 4.10 : A&AA (Tripura) / (Konaban Field PML)

Operator : ONGC

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
Konaban / ROBD / RO-62	Obj-IIIA (2440-2437m): Flowed gas @ 93,350 m3/day through 8 mm bean from New pool, KP-54 pay sand of M. Bhuban Formation of M. miocene age	This new pool discovery within Middle Bhuban Formation has established hydrocarbon prospectivity of Middle Bhuban Sands in the western flank of Konaban Structure in Tripura.

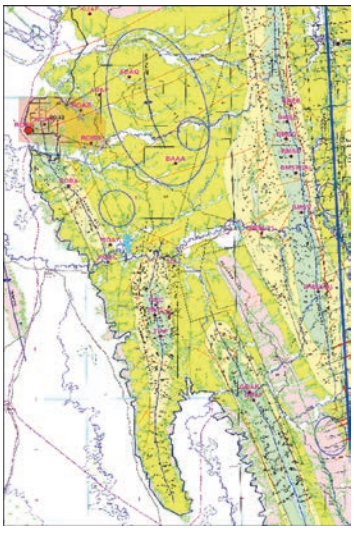


Fig. 4.9 : Location Map

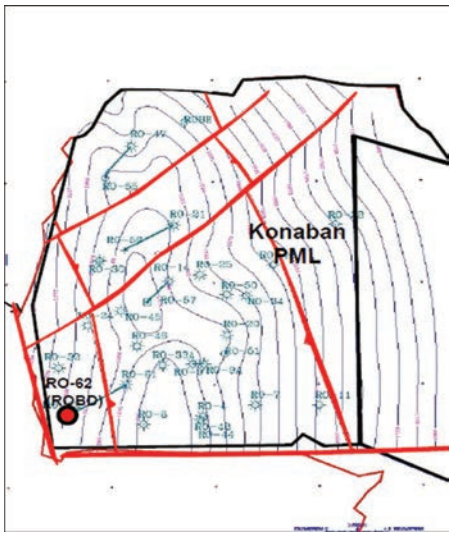


Fig. 4.10 : Time Structure Map close to SU-3 (Middle Bhuban) - Konaban

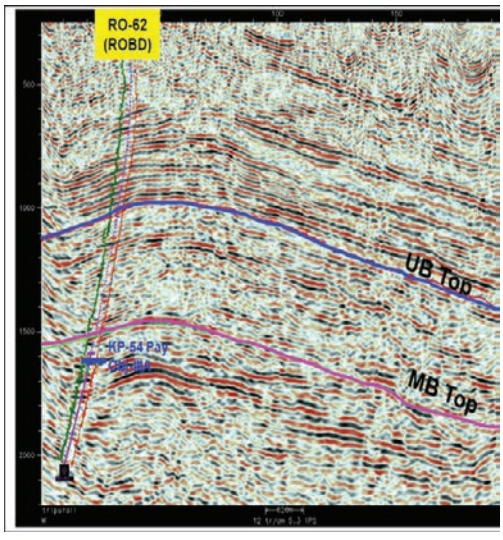


Fig. 4.11 : 2D Seismic Line TR32-14 RO-62 (RODB)

CAUVERY BASIN

Table 4.11 : Cauvery Onshore /(L-II, 7 Year PML)

Operator : ONGC

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
North Kovilkalappal/ NKKAC / North Kovilkalappal-6	Obj-II (2143-2134 m): Flowed oil @ 13.4 m3/d & water @ 5.7 m3/d through 6 mm bean. Obj-IIIB (2098-2078 m): Flowed oil @ 50 m3/d & gas @ 9,500 m3/d with water @ 4 m3/d through 6 mm bean. Both the object flowed oil from E. Cretaceous Bhuvanagiri Formation	Oil and Gas entrapment in Bhuvanagiri Formation was encountered for the first time in this area. Presence of multiple pay sands within the Formation in the area will enhance the prospectivity of the area for further exploration.

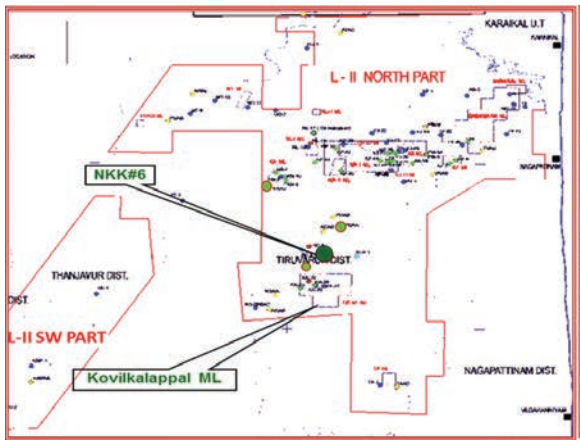


Fig. 4.12 : Location Map of well NKK#6

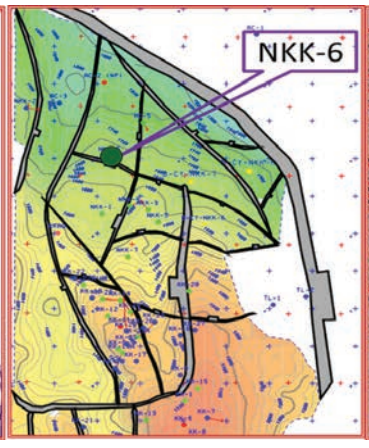


Fig. 4.13 : Time Structure Contour Map close to KK Main

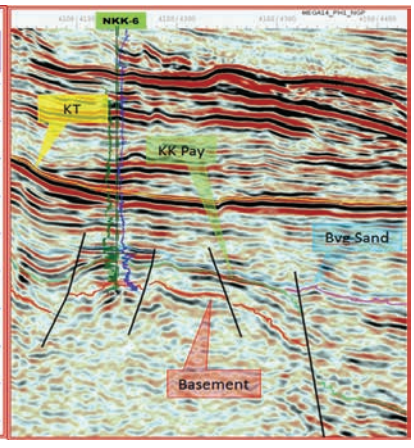


Fig. 4.14 : Inline 4108 thru NKKAC (Interpreted)

MUMBAI

Table 4.12 : Mumbai Offshore /(BOFF PML)

Operator : ONGC

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
B-127N/ B-127N-A B-127N-1	Obj-I (3035-32, 3030.5-28.5, 3027-23.5 m): Flowed oil @ 148 bpd & gas @ 66,426 m3/day through ½"choke Obj-II (3005.5-03, 2992-85, 2980-78.5, 2976.5-73 & 2971-69 m): Flowed oil @ 258 bpd & gas @ 1,78,253 m3/day & little water through ½"choke Obj-III (2963-60, 2958.5-56.5, 2955-53, 2952-49, 2946-43 & 2940-39 m): Flowed oil @ 102 bpd, gas @ 1,38,749 m3/day & water @ 39 bpd through ½"choke. All objects produced hydrocarbon from Panna Formation of Paleocene age.	This new Prospect discovery in multiple layers of Panna Formation (older sands) has opened up a huge area for further exploration in the surrounding areas.

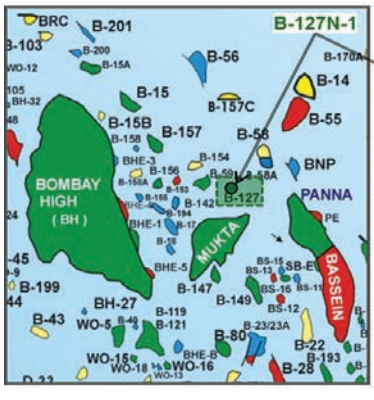


Fig. 4.15 : Map showing location of well, B-127N-1

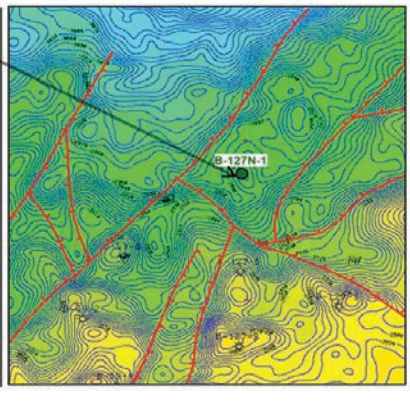


Fig. 4.16 : Depth Structure map on top of PANNA (H4)

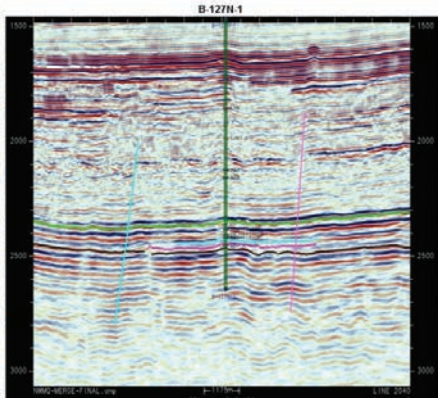


Fig. 4.17 : Inline 2040 passing through well, B-127N-1

Table 4.13 : Mumbai Offshore /(BOFF PML)

Operator : ONGC

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
B-66/ B-66-B/ B-66-2	Obj-III (1738-1720 m): Flowed gas @ 57,696 m3/day, Ql: 547 bpd (78% oil, 10% water, 12% sediments), FTHP. 590-610 psi, through ½" choke from Lower Bassein of Middle to Late Eocene age.	New prospect discovery in Lower Bassein in well B-66-B has imparted great impetus for future exploration and has opened up large area.

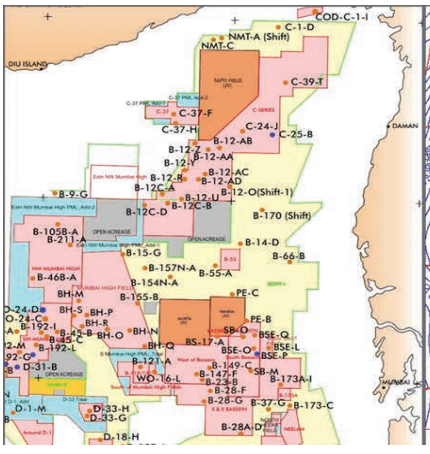


Fig. 4.18 : Location map showing well, B-66-2

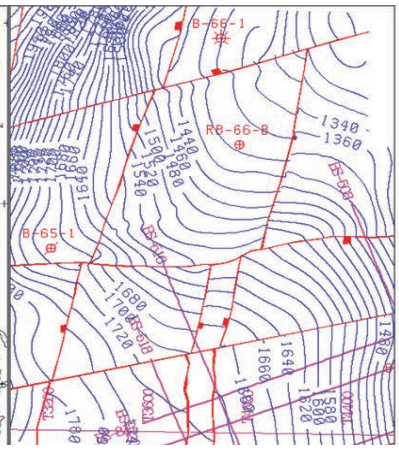


Fig. 4.19 : Time Structure Map at H3B (Bassein) Top

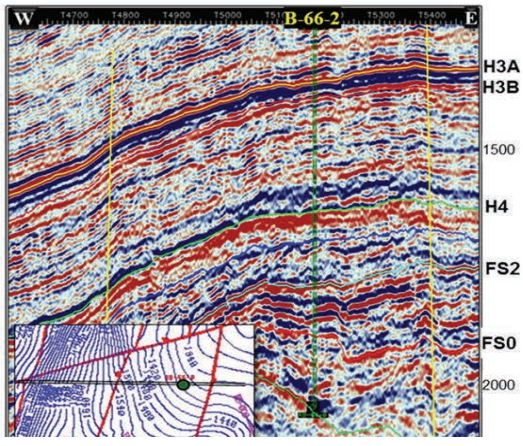


Fig. 4.20 : In Line 1140 passing through well, B-66-2

Table 4.14 : Mumbai Offshore /(MB-OSN-2005/3)/NELP-VII

Operator : ONGC

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
MBOS053NAA/ MBOS053NAA-A/ MBOS053NAA-1	Obj-I (938-932 m): Flowed gas @ 47,128 m3/d, FTHP. 340 psi, FTHT: 76oF through ½" choke. Obj-II (589-585, 583-581 m): Flowed gas @ 21,282 m3/day, FTHP. 140 psi & FTHT: 73°F through 1/2" choke from Chinchini formation of E. Langhian to M. Miocene age.	The discovery in shallow Pliocene Chinchini Formation in NELP block, MB-OSN-2005/3 is the first discovery by ONGC beyond shelf edge of Mumbai Offshore and has opened up a new exploration target.

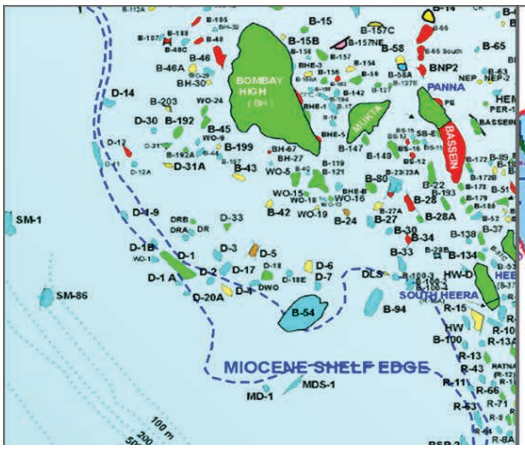


Fig. 4.21 : Location map showing well, B-66-2

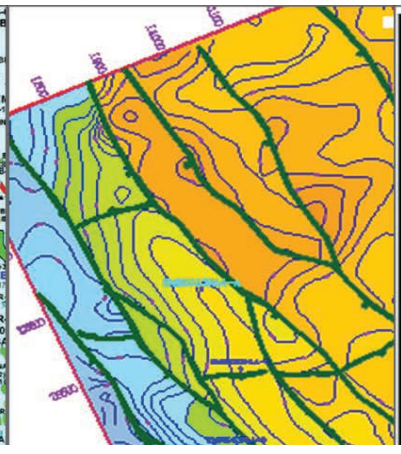


Fig. 4.22 : Time Structure Map at H3B (Bassein) Top

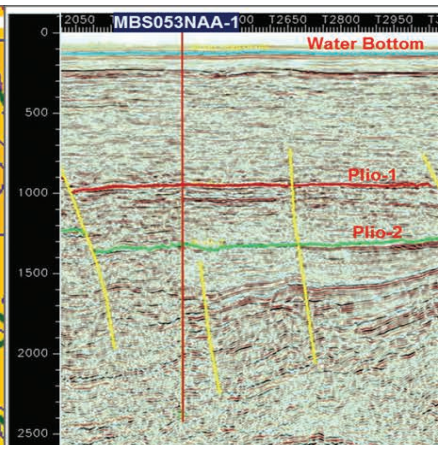


Fig. 4.23 : In Line 1140 passing through well, B-66-2

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Table 4.15 : Mumbai Offshore /(MB-OSN-2005/3)/NELP-VII

Operator : ONGC

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
Komarada/KRAC /Komarada-3	Obj-I (3043.5-3040.5 m): Flowed oil @ 31.9 m3/d & gas @ 1,23512 m3/d through 6 mm bean from Eocene sequence of Vadaparru Formation .	This discovery in Eocene sequence of Vadaparru Formation in the area South of Mori-Komarada Fault has opened up the entire fault block and also given lead to explore the prospective corridors within Eocene sequence.

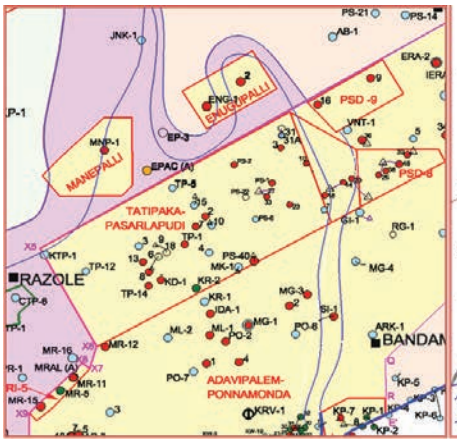

Fig. 4.24 : Location map showing well, B-66-2

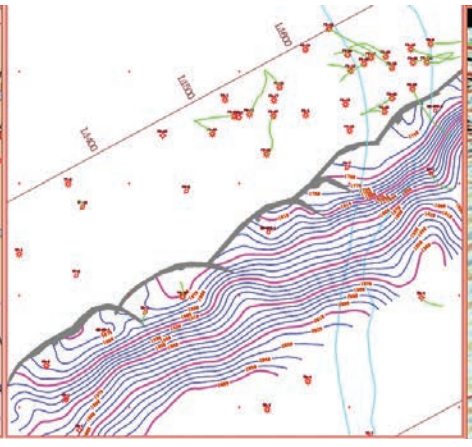

Fig. 4.25 : Time Structure Map at H3B (Bassein) Top

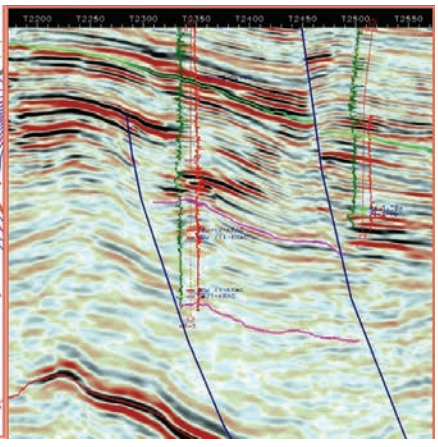

Fig. 4.26 : In Line 1140 passing through well, B-66-2

Table 4.16 : Mumbai Offshore /(MB-OSN-2005/3)/NELP-VII

Operator : ONGC

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
Ravulapalem/ RVP-AA/ Ravulapalem-1	Obj-I (1979.5-1975.5 m): Flowed gas @ 13,350 m3/day through 6 mm bean. Obj-II (1698-1695 & 1688-1685 m): Flowed gas @ 83,200 m3/d & condensate @ 7.3 m3/d with through 7.0 mm bean. Both the object flowed oil from Eocene Vadaparru Formation	This discovery from Eocene sequence of Vadaparru Formation in the area South of Mori-Komarada Fault has opened up the entire fault block and also given a lead to explore the prospective corridors within Eocene sequences

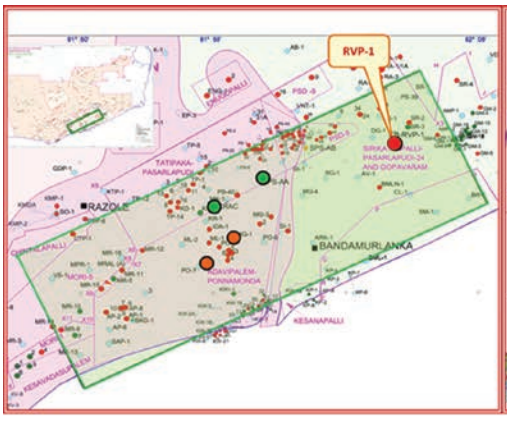

Fig. 4.27 : Location Map of well Ravulapalem-1

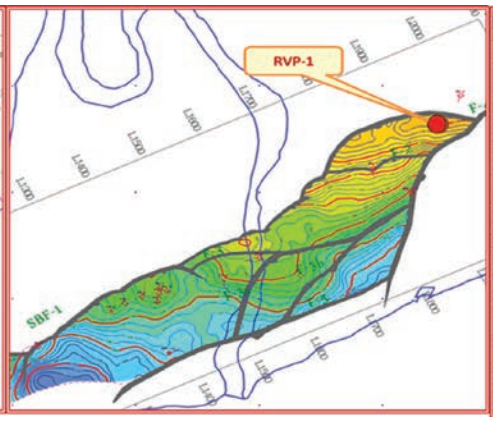

Fig. 4.28 : Structure Map close to Ponnamanda Pay Equivalent Top

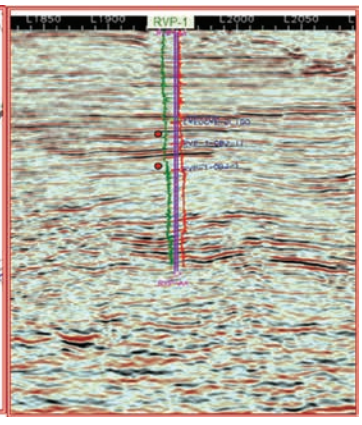

Fig. 4.29 : Trace 1049 passing through Ravulapalem-1

Table 4.17 : KG Onshore / (Godavari Onshore 7 year PML)

Operator : ONGC

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
West Penugonda/ WPGAA/ West Penugonda-1	Obj-I (3090-88, 3080.5-77.5, 3066.5-65 & 3063-3054 m): Flowed @ 3.4 m3/d and gas @ 71,275 m3/d at FTHP. 2100 PSI through 6.0 mm bean from Raghavapuram formation of Late Cretaceous age.	The discovery of hydrocarbon accumulation in Raghavapuram Formation has opened a huge corridor in the axial low to the south of Tanuku Horst for Raghavapuram exploration.

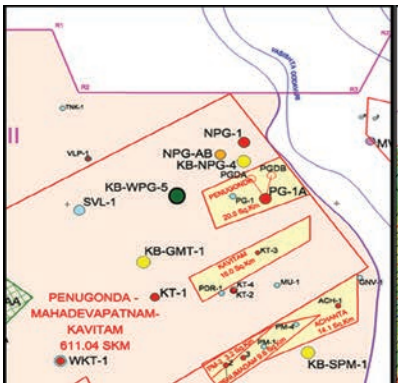

Fig. 4.30 : Location map of well WPG-1

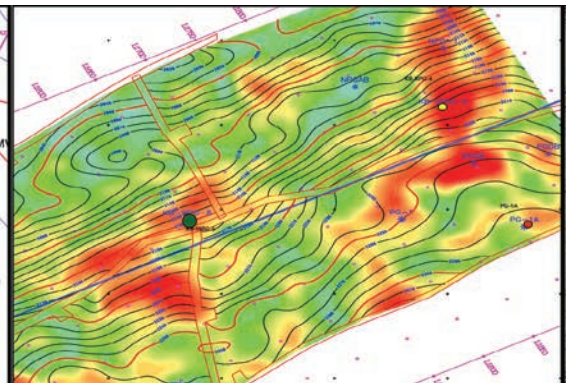

Fig. 4.31 : TWT map on top of PG-1A pay superimposed on its RMS amplitude

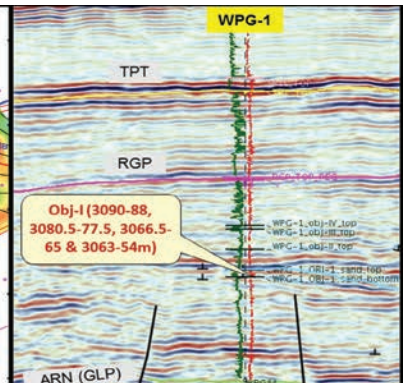

Fig. 4.32 : Inline 640 passing through well WPG-1

Table 4.18 : KG Onshore / (Adavipalem-Ponnamanda PML)

Operator : ONGC

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
West Kesanapalli/ KWDM/ West Kesanapalli-47	Obj-I (2338.5-2335 m): Flowed gas @ 30,000 m3/d and traces of condensate through 5.0 mm bean from Matsyapuri formation of Oligo-Miocene age.	The new pool discovery assumes importance as it is different from the established reservoir sands in West Kesanapalli area and will help in furtherance of exploration.

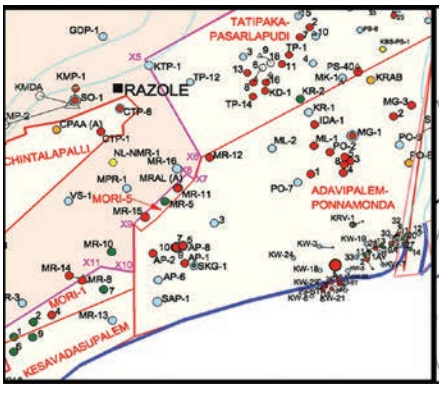

Fig. 4.33 : Location map of well, KW-47

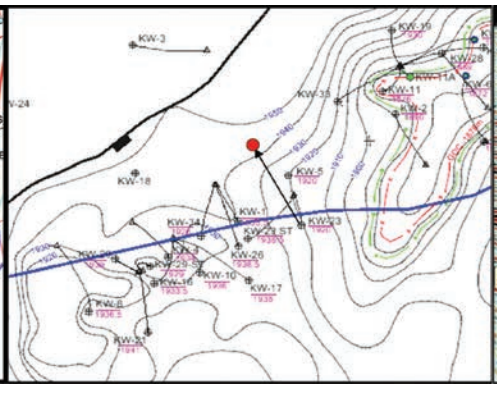

Fig. 4.34 : Depth Structure map on top of Sand-17A

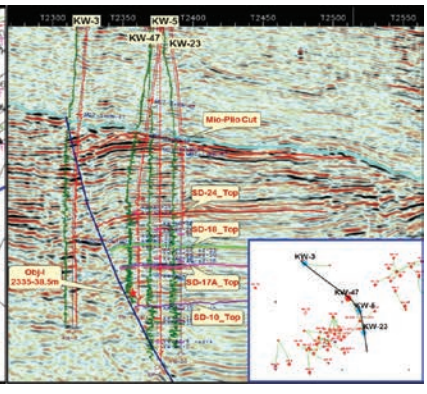

Fig. 4.35 : Inline 10779 passing through well, KW-47

Table 4.19 : KG Offshore/(KG-DWN-98/2)/NELP-I

Operator : ONGC

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
KG982NA-M-AD/ KG982NA-M-4	Obj-I (2908-2900 m): Flowed oil @ 3157 bpd & gas @ 319483 m3/d through 40/64" choke from Godavari Clay formation of Plio-Pleistocene age.	This discovery has enhanced the commerciality of the block and has opened up further area for exploration and appraisal.

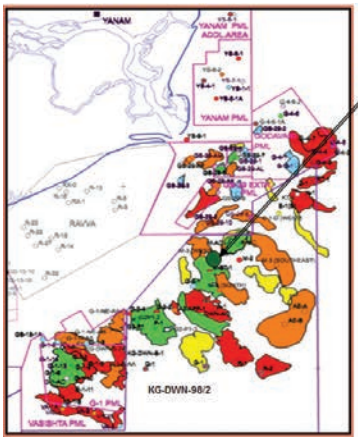

Fig. 4.36 : Location map showing part of KG-DWN-98/2 Block

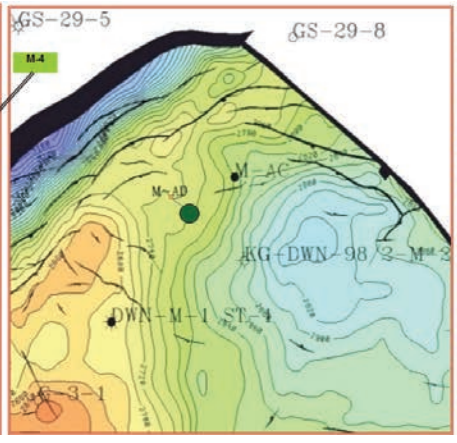

Fig. 4.37 : Time Structure Map of Horizon 4.1 (Zoomed)

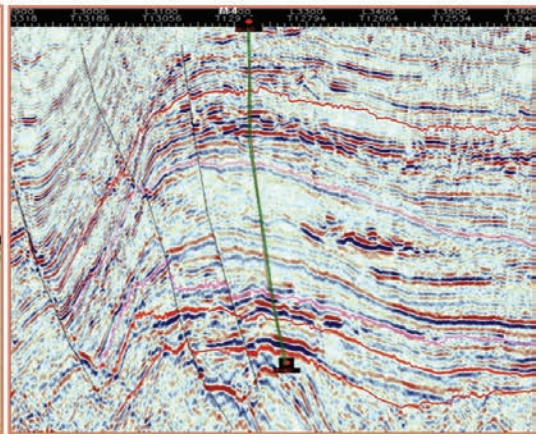

Fig. 4.38 : Line passing through Well KGD982NA-M4

Table 4.20 : KG Offshore /(KG-OSN-2004/1)/NELP-VI

Operator : ONGC

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
KGOSN041NASG/ KGOSN041NASG-1 (Sarangi-1)	Obj-I (1737-1727 m): Flowed gas @ 401203 m3/d through 40/64" choke from Godavari Clay formation of Plio-Pleistocene age.	This is the sixth discovery in the block, KG-OSN-2004/1 and has improved the potential of the block. It will also help in early monetization of other discoveries in the block (cluster development scheme).

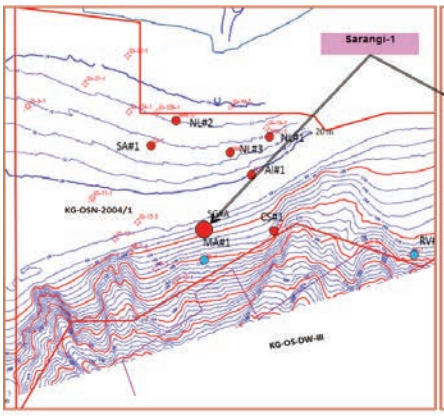

Fig. 4.39 : KG Offshore /(KG-OSN-2004/1)/NELP-VI

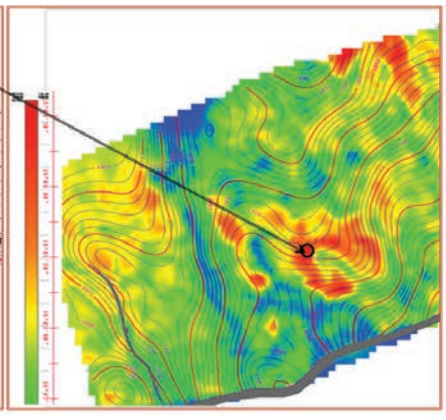

Fig. 4.40 : Depth map near pay Top of well SG-1

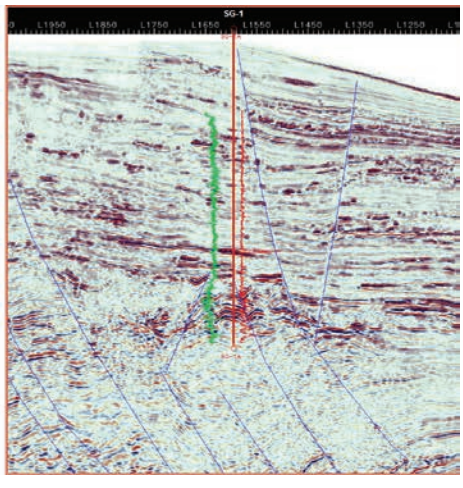

Fig. 4.41 : Trace: 3887 passing through well SG-1

Table 4.21 : KG Offshore/KG-DWN-98/2/NELP-I

Operator : ONGC

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
F-1 (E-1-D-West) / KGD982NA-E-AB / KGD982NA-F-1	Obj-I (1814.5-1812.5 m): Flowed oil @ 732 bpd & gas @ 13,155 m3/d with FTHP. 548 psi through 24/64" choke from Godavari Clay formation of Plio-Pleistocene age..	This discovery has opened up scope for further exploration of oil & gas in Pliocene section and has improved prospectivity perception of the northern part of the block.

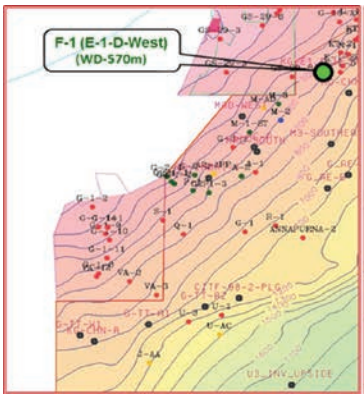

Fig. 4.42 : Location Map of well F-1

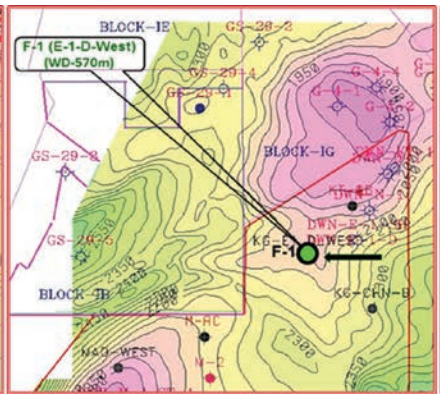

Fig. 4.43 : Time Structure Contour Map on Top of Horizon 5.0

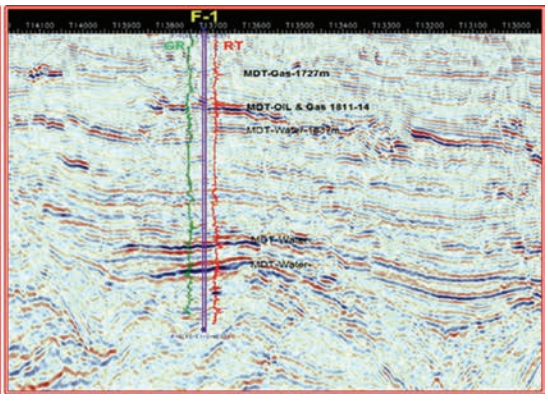

Fig. 4.44 : Inline 3838 through well F-1

Table 4.22 : KG Offshore /(KG-OSN-2004/1) /NELP-VI

Operator : ONGC

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
KGOSN041NAML-1 (Malhar-1)	Obj-I (1958.5-57, 1954-47, 1941-39.5, 1929-25 & 1918.5-1917 m): Flowed gas @ 4,47,461 m3/day at FTHP. 2800 psi via ½" choke from Mio-Pliocene sequence.	This is the seventh discovery in the block (KG-OSN-2004/1) and has improved the potential of the block. It will also help in early monetization of other discoveries in the block (cluster development scheme).

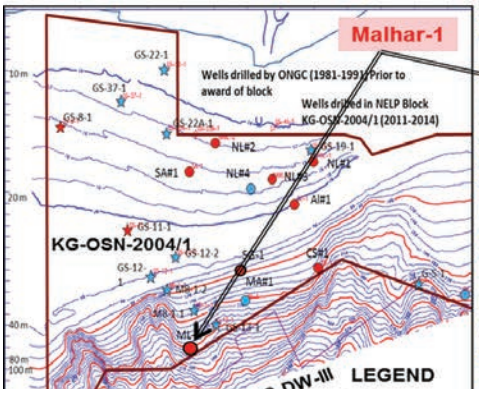

Fig. 4.45 : Location Map of well Malhar-1

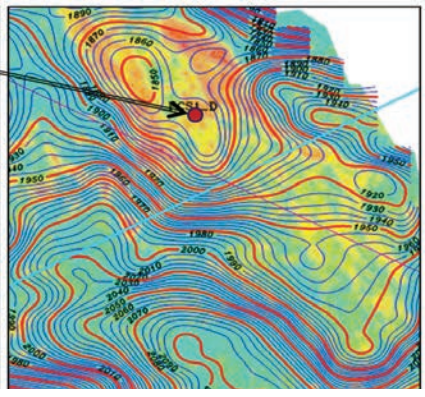

Fig. 4.46 : Depth Map near to Miocene target with RMS amplitude (+150ms) overlay

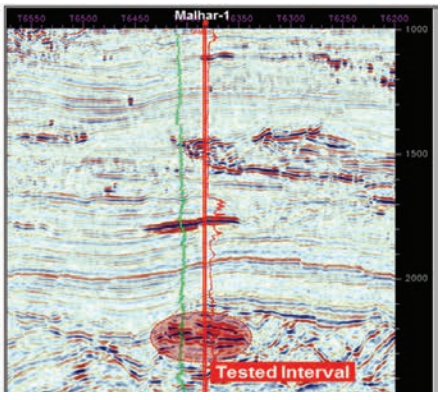

Fig. 4.47 : Inline 1274 passing through well Malhar-1

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Table 4.23 : Kutch Offshore /GK-28 PML

Operator : ONGC

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
GK-28/ GK-28-L GK-28-10	Obj-I (1452-1520 m): Flowed Gas @ 1,26,226 m3/day, FTHP- 850 psi, FTHT-86° F through ½" Choke size from Deccan traps of Late Cretaceous age.	The discovery of hydrocarbon accumulation in Deccan Traps has opened up a large area for further exploration of Basement in Kutch offshore. This will also augment gas reserve for development of GK-28/42 area.

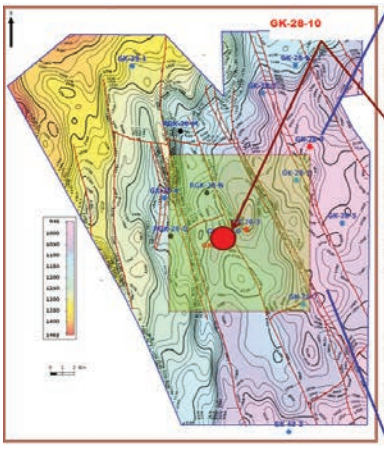


Fig. 4.48 : Location map of well GK-28-10 within GK-28 PML

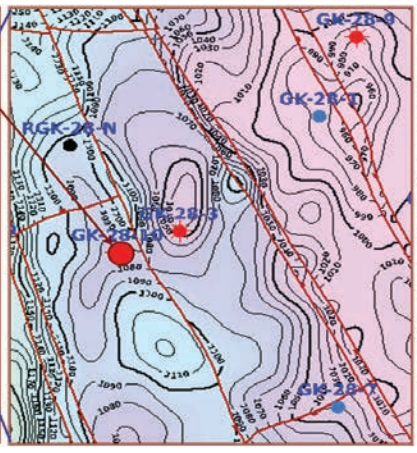


Fig. 4.49 : TWT map at Trap Top

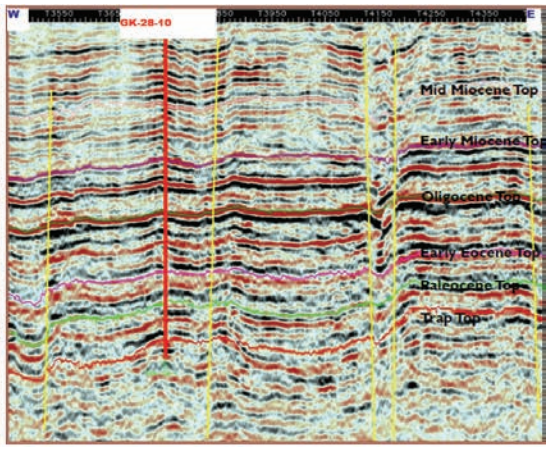


Fig. 4.50 : Inline 1860 passing the well GK-28-10 (L)

Table 4.24 : Kutch Offshore /(GK-OSN-2010/1)/NELP-IX

Operator : ONGC

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
GKS101NAA/ GKS101NAA-A/ GKS101NAA-1	Obj-II (1300-1291 m): Flowed gas @ 45,873 m3/d at FTHP. 250 psi and FTHT: 80° F through ½" choke from Jakhau formation of Early Eocene age	This discovery in NELP block, GK-OSN-2010/1 has established presence of Hydrocarbon in Early Eocene Jakhau Formation in the area and has opened up the area for exploration

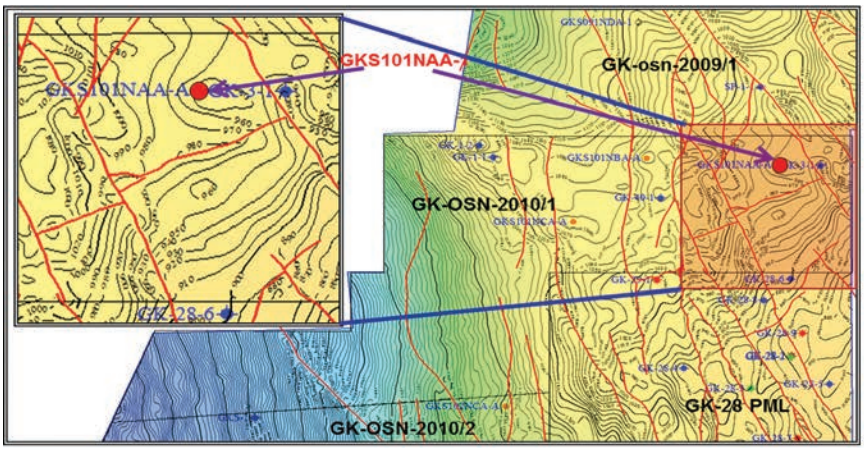


Fig. 4.51 : Location map of well GK-28-10 within GK-28 PML

Fig. 4.52 : TWT map at Trap Top

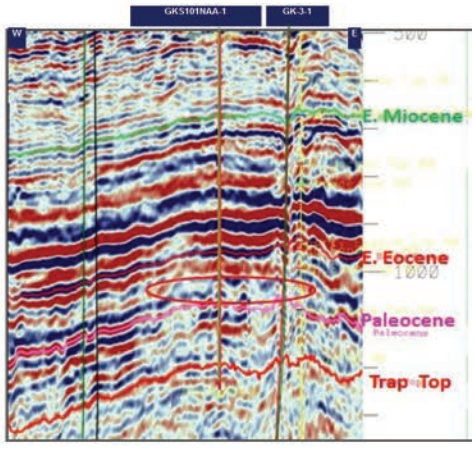


Fig. 4.53 : Inline 1860 passing the well GK-28-10 (L)

Table 4.25 : Saurashtra Offshore /(GS-OSN-2004/1)/NELP-VI

Operator : ONGC

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
GSS041NAA/ GSS041NAA-B/ GSS041NAA-2	Obj-V (4483-59, 4434-22 m): Flowed gas @ 1,56,563 m3/d, water @ 4771 bpd, FTHP. 3750 psi at FTHT: 112°C through ½" choke from Mesozoic sequence	This new pool discovery has further established hydrocarbon potential of Mesozoic Sequence in Saurashtra Offshore and has also proved flow potential of the sequence in the block.

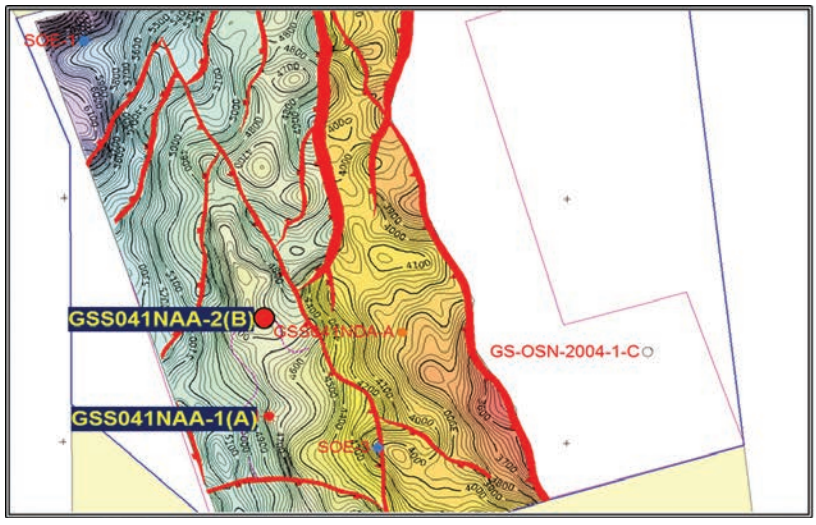


Fig. 4.54 : Structure map on Top of Object-I showing location of well, GSS041NAA-2

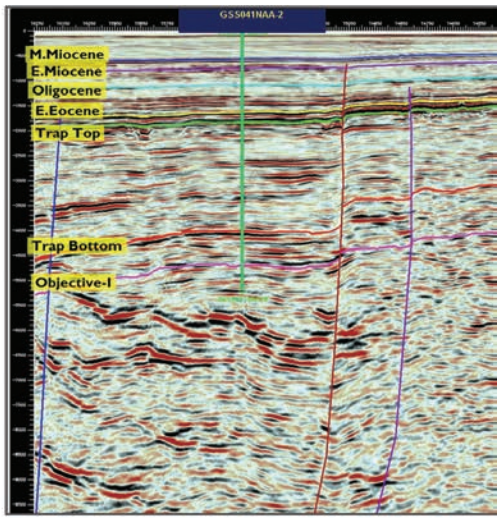


Fig. 4.55 : Inline 2130 passing through well, GSS041NAA-2

Table 4.26 : CBE-UPWEST-1 (CB-OSN-2004/1)

Operator : FOCUS

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
CBE-UPWEST-1 / CB-OSN-2004/1	Obj-I 694m-697m Flowed gas @4.11 mmscf/d through a 12mm choke. Obj-II 632m-635m Flowed gas @3.88 mmscf/d through a 12 mm choke. Obj-III 513m-519m Flowed gas @3.64 mmscf/d through a 12mm choke. All objects produced gas from Kand Formation of Miocene age	Gas discovery in new sand zones of Kand Formation has proven the occurrence and potential for hydrocarbons across multiple productive horizons. Hydrocarbon discovery in these new sand zones has further increased the prospectivity of the area.

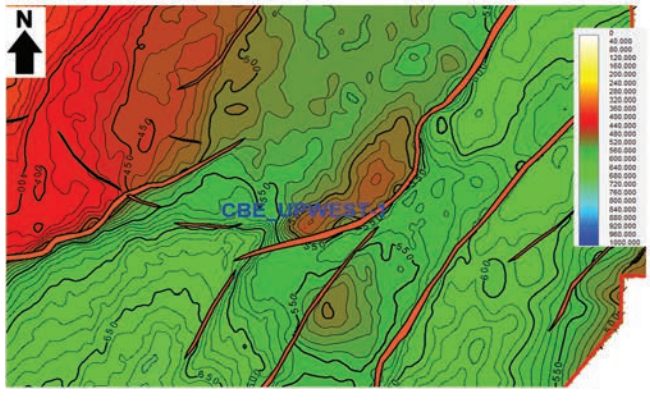


Fig. 4.56 : Structure map at Kand top

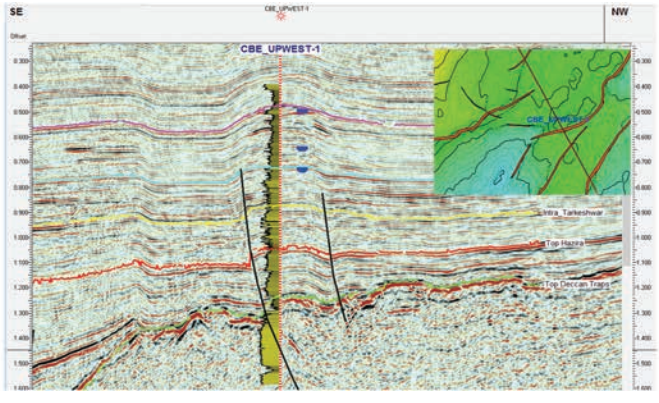


Fig. 4.57 : Seismic section through well CBE-UPWEST-1

Table 4.27 : CB-K-2 (CB-OSN-2004/1)

Operator : FOCUS

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
CB-K-2 / CB-OSN-2004/1	Obj-I 1006m-1009m Flowed oil @510.64 bbls/day through a 10mm choke. Obj-II 996.4m-1000.4m Flowed oil @ 505 bbls/day through a 10 mm choke. Obj-III 969m-975m and 977-982m Flowed gas @3.8 mmscf/d on a 10 mm choke All objects produced Oil/Gas from Intra-Tarkeshwar /Dadhar Formation of Oligocene-Miocene age.	New prospect discovery in Intra-Tarkeshwar/Dadhar formation in well CB-K-2 has imparted great impetus for future exploration and has opened up large area.

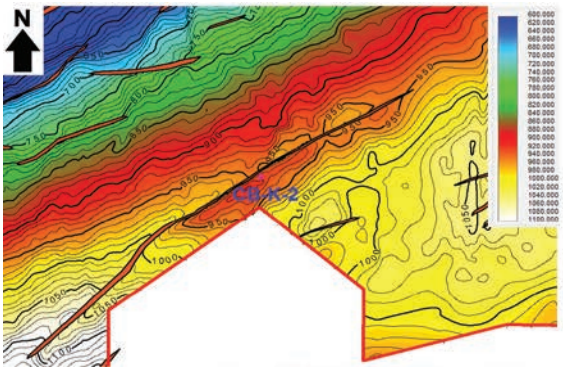


Fig. 4.58 : Structure map (Intra-Tarkeshwar/Dadhar)

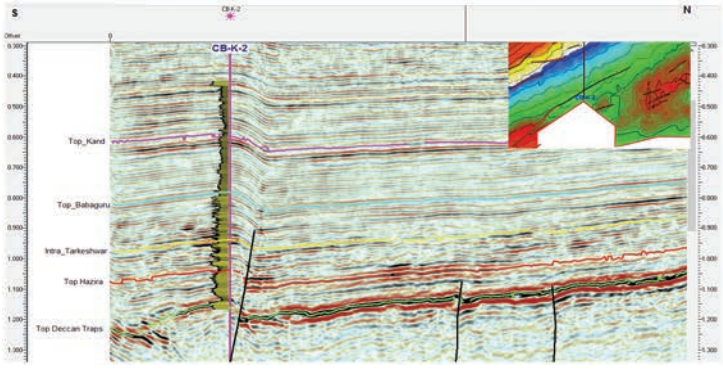


Fig. 4.59 : Seismic section through well CB-K-2

Table 4.28 : JYOTI -2 (CB-ONN-2005/9)

Operator : MERCATOR

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
JYOTI -2	Obj-II:- 2551-2556, 2558 – 2564 m Produced oil @2000 BOPD at 32/64" choke and 5000 BOPD at 64/64" choke from Ankleshwar formation of Eocene age.	The discovery of oil in this well has opened up new avenues for exploration and exploitation of Oil in Ankleshwar Formation in this structure. This has opened up the area for exploration in eastern part of Jambusar-Broach block.

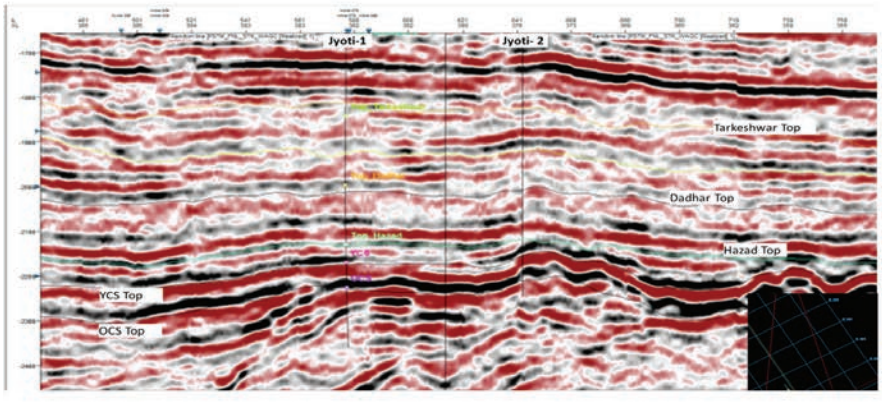


Fig. 4.60 : Seismic Section Along Well Jyoti-2

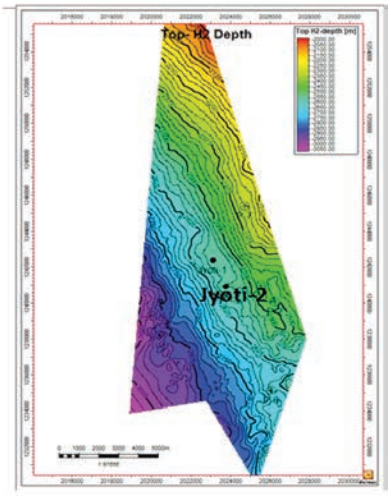


Fig. 4.61 : Depth Contour Map Close to Hazad Reservoir

RAJASTHAN BASIN

Table 4.29 : Saraswati-4 Basement (RJ-ON-90/1)

Operator : CAIRN

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
Saraswati-4/ Saraswati-4 Basement	Obj:-1403-1631 produced oil @165 BOPD through 10/64" Choke from Basement of Proterozoic age	Hydrocarbon discovery in Malani Basement of Proterozoic age. This discovery in Malani Basement has established hydrocarbon potential of basement reservoir in Barmer Basin.

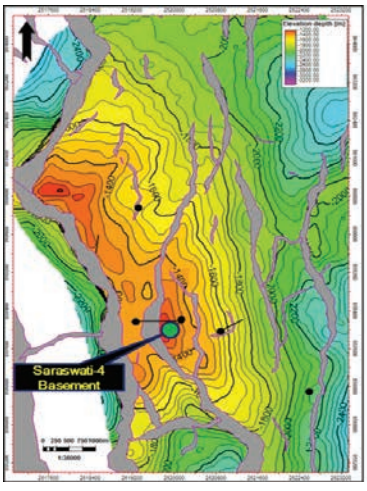


Fig. 4.62 : Depth Contour Map of Basement

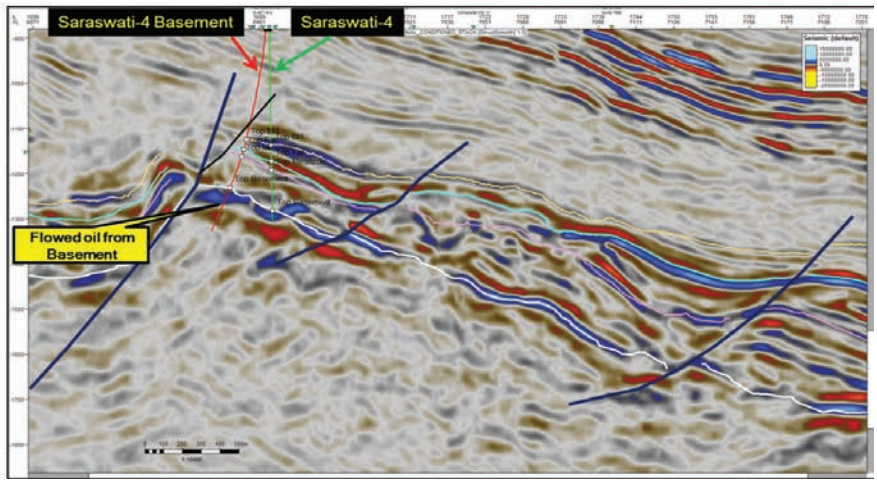


Fig. 4.63 : Seismic section near well Saraswati-4 Basement

Table 4.30 : Raageshwari North-1 (RJ-ON-90/1)

Operator : CAIRN

Structure/ Well No. & Location	Testing Results	Leads/ Expl. Efficacy
Raageshwari North-1	Obj-II: Interval 3635.66-3636.66 m, 3649.46-3650.46 m, 3672.91-3674.91 m, 3696.11-3698.11 m produced oil@ 50-90 bopd through 12/64" choke from Felsic 2 of Deccan age. Obj-III: On testing Interval 3459.5-3461.5 m, 3478-3480 m , 3499-3501 m oil surfaced from Felsic 3 of Deccan age. Obj-IV: Interval 3381.8-3382.8 m, 3394-3395 m, 3413.7-3414.7 m produced oil@ 30-79 bopd through 20/64" Choke from Basalt of Deccan age.	Hydrocarbon Discovery in Volcanics of Deccan age. This discovery in Volcanics of Deccan age has opened a new vista in volcanics of Barmer basin and will significantly increase the reserves of Barmer basin.

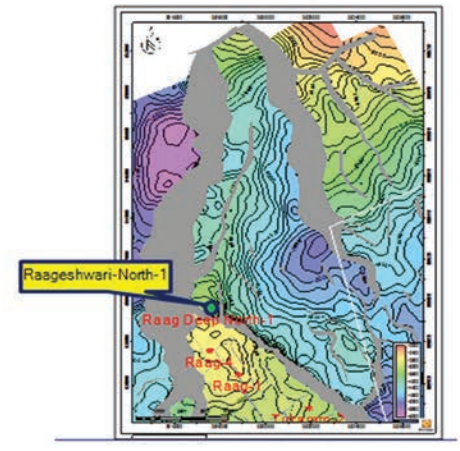


Fig. 4.64 : Depth Contour Map of Volcanics

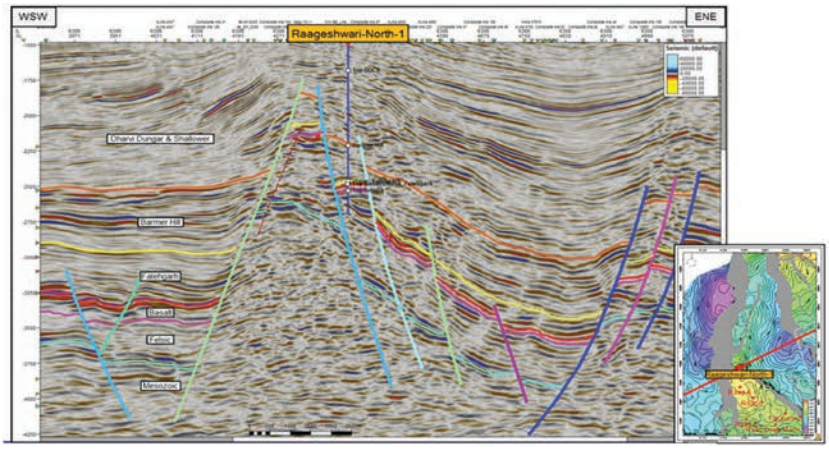


Fig. 4.65 : Seismic Section near well Raageshwari-North-1

4.4 OIL & GAS PRODUCTION

The targeted crude oil production for Oil and Natural Gas Corporation Limited (ONGC), Oil India Limited (OIL) and PSC-regime for the year 2015-16 was at 37.046 million metric tonnes (MMT) and the actual production achieved was 36.95 MMT. The crude oil production in 2015-16 was 99.74 % of the target production and showed a decrease of 1% when compared to production of 37.461 MMT during 2014-15. The production of natural gas during 2015-16, was targeted at 35.28 Billion Cubic Metres (BCM), whereas the actual production was 32.249 BCM. The natural gas production in 2015-16 was 91% of the target production and showed a decrease of 4% when compared to production of 33.658 BCM during 2014-15.

In the upstream sector, the two Upstream National Oil Companies (NOCs) viz., ONGC and OIL play a dominant role with a total share of about 72 % in Oil and Oil equivalent gas (O+OEG) production in the country. In 2015-16, ONGC produced nearly 60% of indigenous crude oil and 66 % of the country's gas production, while OIL's share was 9% of indigenous crude oil and also 9% of country's gas production. The share of Private/PSU / Joint Venture (JV) companies operating under PSC and CBM Contract regime in oil and gas production was about 31% and 25% (24% conventional & 1% CBM gas) respectively. Crude oil and natural gas production basin-wise by ONGC, OIL and Private/JV companies during 2015-16 is as given in Table below.

Oil Production of country in 2015-16 (MMT)

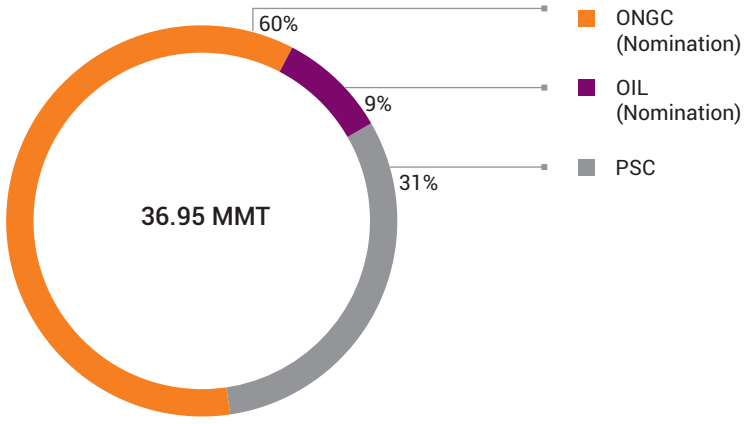


Fig. 4.66

Gas Production of country in 2015-16 (MMSCM)

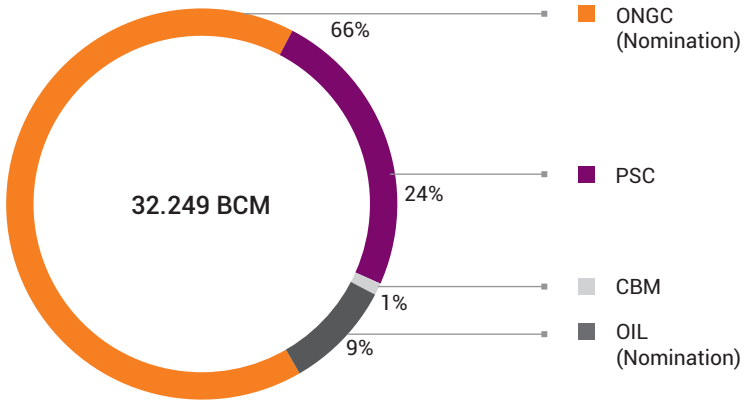


Fig. 4.67

Table 4.31 : Basin-wise and operator-wise production of country in FY 2015-16

Sl. No.	COMPANY/ OPERATOR	BASIN	PRODUCTION		
			OIL (MMT)*	GAS (MMSCM)	O+OEG (MMT)
		NATIONAL OIL COMPANIES (NOC)			
1	ONGC	Assam-Arakan	0.96	1736.47	2.70
2		Cambay	4.31	1399.28	5.71
3		Cauvery Onland	0.25	1010.25	1.26
4		KG (Onland & Offshore)	0.32	831.60	1.15
5		Mumbai Offshore	16.52	16194.08	32.71
6		Rajasthan	0.00	4.96	0.00
TOTAL ONGC			**22.37**	**21176.64**	**43.54**
7	OIL	Assam-Arakan	3.23	2631.75	5.86
8		Rajasthan	0.00	206.19	0.21
TOTAL OIL			**3.23**	**2837.94**	**6.06**
TOTAL NOCs			**25.59**	**24014.57**	**49.61**
		PVT/JV COMPANIES (PSC)			
9	CAIRN	Cambay	0.411	68.435	0.48
10		Krishna Godavari	1.019	260.077	1.28
11		Rajasthan	8.599	699.354	9.30
12	ESSAR	Cambay	0.001	0.000	0.00
13	FOCUS	Rajasthan	0.003	427.508	0.43
14	GEOENPRO	Assam-Arakan	0.052	18.083	0.07
15	GSPC	Cambay	0.053	10.569	0.06
16		Krishna Godavari	0.004	134.169	0.14
17	HERAMEC	Cambay	0.005	10.113	0.02
18	HOEC	Cambay	0.006	5.785	0.01
19		Cauvery	0.002	21.911	0.02
20	HRDCL - PPCL	Cambay	0.000	0.065	0.00
21	JTI	Cambay	0.051	11.996	0.06
22	NIKO	Cambay	0.005	42.294	0.05
23	OILEX	Cambay	0.001	1.387	0.00
24	ONGC	Cambay	0.003	0.000	0.00
25		Cauvery	0.007	0.621	0.01
26	ONGC+BG+RIL	Mumbai	0.903	2180.848	3.08
27	RIL	Krishna Godavari	0.208	3939.972	4.15
28	SELAN	Cambay	0.026	8.562	0.03
TOTAL PVT/JV			**11.356**	**7841.749**	**19.20**
		COAL BED METHANE (CBM)			
1	ESSAR	Raniganj East		236.499	0.24
2	GEECL	Raniganj South		152.924	0.15
3	ONGC	Jharia		2.040	0.00
4	RIL	Sohagpur East / West		1.410	0.00
TOTAL				**392.873**	**0.39**
INDIA GRAND TOTAL			**36.950**	**32249.194**	**69.20**

*Note : Figures Inclusive of Condensate (MMT); 1 MMT = 1 BCM

4.4.1 Oil and Gas Production in PSC Regime in 2015-16:

Under the PSC regime, in 2015-16, 37 oil and gas blocks; and 5 CBM blocks were under production. A total of 16 companies were operating in these producing fields/ blocks in 2015-16. Currently, crude oil and natural gas production is from seven sedimentary basins of the country which are - Rajasthan, Assam-Arakan, Assam Shelf Basin, Cambay, Cauvery, Krishna-Godavari and Mumbai.

Crude oil production during 2015-16 was 11,356 TMT as against the target of 10,719 TMT. Achievement with respect to target was 106% and w.r.t 2014-15 it was 96 %. Majority of the oil produced was from the Rajasthan basin (76 %), followed by Krishna Godavari Basin (11 %). In 2015-16, the share of offshore crude oil production was about 22 % and the remaining crude oil production was from 4 States viz., Rajasthan, Gujarat, Arunachal Pradesh and Tamil Nadu.

Gas production under PSC Regime during 2015-16 is 8235 MMSCM as against the target of 8362 MMSCM. Achievement w.r.t target is 98 % and that of w.r.t 2014-15 is 92 %. In CBM blocks, the gas production was 393 MMSCM. Majority of the gas is coming from Krishna Godavari basin (53 %), followed by Mumbai basin (26%). In 2015-16, the share of offshore natural gas production was about 80%. The remaining natural gas production including CBM was from 7 States viz., Rajasthan (14%), Gujarat (1.1%), West Bengal (4.7 %), Arunachal Pradesh (0.22 %), Jharkhand (0.02%), Madhya Pradesh (0.02%) and Tamil Nadu (0.01%).

Basin wise Oil Production in PSC Regime in 2015-16

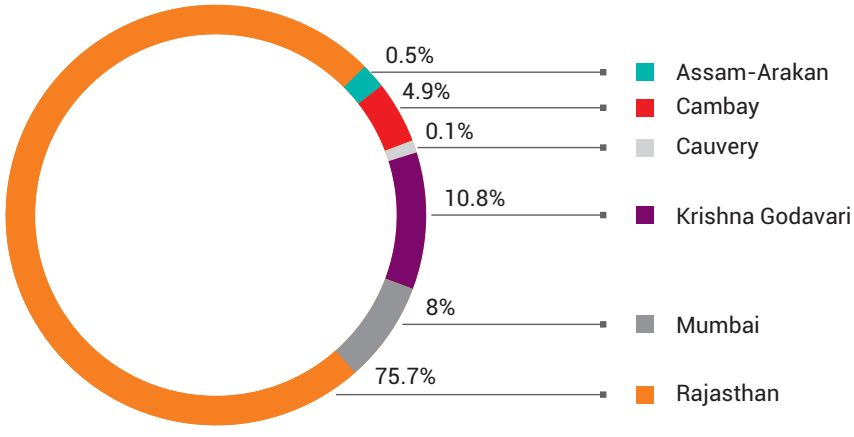


Fig. 4.68

Basin wise Gas Production in PSC + CBM Contract Regime in 2015-16

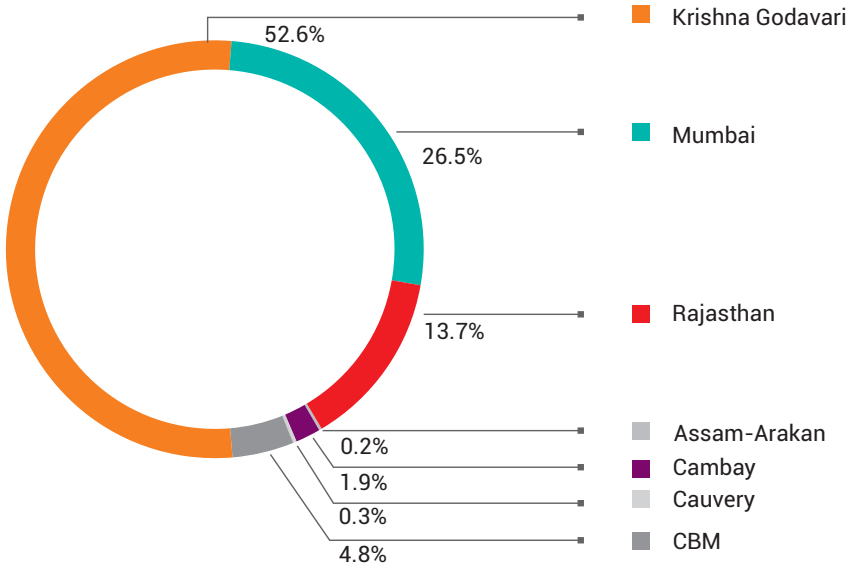


Fig. 4.69

Location wise Oil Production in PSC Regime in 2015-16

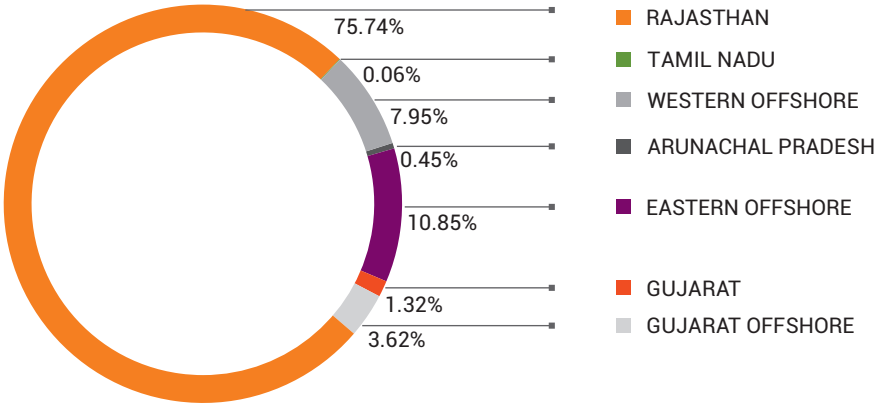


Fig. 4.70

Location wise Gas Production in PSC + CBM Contract Regime in 2015-16

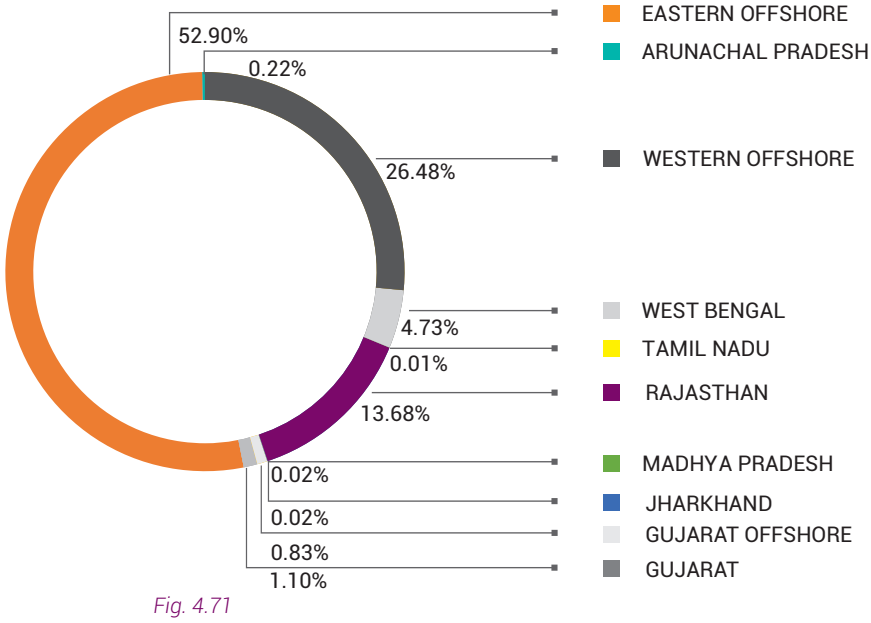


Fig. 4.71

4.4.2 Fields which commenced production in FY 2015-16

The major fields that have commenced production during FY 2015-16 are as under:

Table 4.32 : Fields that commenced production in FY 2015-16

Basin Name	Cambay	Block Name	CB-ONN-2001/1
Field	Nadiad-1	Location(State)	Gujarat
Round	NELP	Original Area (SKM)	215
Present PEL Area (SKM)	26	Present ML Area (SKM)	26
Consortium	ONGC	Operator	ONGC
Date of commencement of production	June 2015	Oil/Gas	Oil

Basin Name	Cauvery	Block Name	CY-ONN-2002/2
Field	Madanam-6	Location (State)	Tamil Nadu
Round	NELP	Original Area (SKM)	280
Present PEL Area (SKM)	26	Present ML Area (SKM)	-
Consortium	ONGC(60), BPCL(40)	Operator	ONGC
Date of commencement of production	-	Oil/Gas	Oil


OIL

Chapter 5

Synopsis

of E&P Activties till 2015-16

E&P Activities

Hydrocarbon Discoveries

Oil and Gas Production

5 Synopsis of E&P Activities till 2015-16

Implementation of NELP and CBM policy in 1997 introduced a new contractual and fiscal model for award of hydrocarbon acreages. The main objective was to attract significant risk capital from Indian and foreign companies, new geological concepts, state-of-the-art technologies and best management practices in Indian E&P sector. In March 2016, the policy regime has transitioned from NELP (Profit sharing) to HELP (Revenue sharing). The gamut of E&P activities carried out so far under various policy regimes over the years by PSUs, Indian private and Foreign companies have been encapsulated in this chapter. Also mentioned are the quantum of Oil and Gas discoveries made in India till date and geo-scientific studies carried out till date by DGH.

5.1 EXPLORATION ACTIVITIES

The company wise exploratory inputs since inception till 2015-16 are as under:

5.1.1 Exploratory efforts by PSUs

Oil PSUs have carried out 1161093.5 Line Kilometre (LKM) of 2D seismic survey, 286928 Sq. Km of 3D seismic survey and drilled 6501 Exploratory wells since inception as on 31.03.2016. The company-wise details of exploratory efforts in terms of 2D, 3D seismic and exploratory wells are as under:

Table 5.1 : Exploratory efforts by PSUs since inception (till 2015-16

Sl. No.	Company (Operator)	As on FY 2015-16		
		2D Seismic (LKM)	3D Seismic (SKM)	Exploratory Wells (Nos.)
1	ONGC-Nomination	882324.78	113007	5797
2	Oil India Ltd.-Nomination	73532.6	12480.3	362
3	ONGC- PSC regime	196442.92	141639	226
4	Oil India Ltd. - PSC regime	2022.2	7061	83
5	Bharat Petro Resources Ltd.	10	90.55	2
6	Gujarat State Petroleum Corporation Ltd.	6421	11371	16
7	Indian Oil Corporation Ltd.	0	277	7
8	Gail (India) Limited	0	577	0
9	National Thermal Power Corporation	340	425	8
	Grand Total	**1161093.5**	**286928**	**6501**

5.1.2 Exploratory efforts by Private E&P companies

Indian Private Companies have carried out 114105.7 Line Kilometre (LKM) of 2D seismic survey, 107509.16 Sq. Km. of 3D seismic survey and drilled 347 Exploratory wells since inception as on 31.03.2016. The company-wise details are as under:

Table 5.2 : Exploratory efforts by Private since inception (till 2015-16)

Sl. No.	Company (Operator)	As on FY 2015-16		
		2D Seismic (LKM)	3D Seismic (SKM)	Exploratory Wells (Nos.)
1	Adani Welspun Exploration Ltd.	0	3586	0
2	Essar Oil Ltd.	4425	1619	18
3	Cairn India	3709	2429.39	48
4	Esveegee Steel (Gujarat) Pvt. Ltd.	0	135	0
5	Focus Energy Ltd.	14787.56	5717.77	97
6	Geo Enpro	52	114	2
7	Hindusthan Oil Exploration Company Ltd.	626	1860	15
8	Interlink Petroleum Ltd.	0	64	2
9	Jay Polychem (India) Ltd.	0	268	2
10	Jubilant Oil & Gas Private Limited	692.14	638	14
11	Mercator Petroleum Private Limited	773	175	5
12	Prize Petroleum Company Ltd.	2050	304	2
13	Reliance Industries Ltd.	86475	90316	134
14	Selan Expl. Tech. Ltd.	166	132	5
15	Omkar Naturals Resources Pvt. Ltd.	350	83	1
16	Sintex Oil & Gas Pvt. Ltd.	0	68	2
	Grand Total	**114105.7**	**107509.16**	**347**

5.1.3 Exploratory efforts by Foreign companies

Foreign Companies have carried out 63,209 Line Kilometre (LKM) of 2D seismic survey, 21,709 Sq. Km of 3D seismic survey and drilled 249 exploratory wells since inception as on 31.03.2016. The company-wise exploratory efforts are provided in Table 5.3.

Table 5.3 : Exploratory efforts by Foreign since inception (till 2015-16)

Sl. No.	Company (Operator)	As on FY 2015-16		
		2D Seismic (LKM)	3D Seismic (SKM)	Exploratory Wells (Nos.)
1	BHP Billiton Pty. Ltd.	12806	0	0
2	British Gas Exploration and Production (India) Ltd.	2006	5187	15
3	Cairn Energy	19925	6684.39	180
4	Canoro Resources Ltd.	346	104	4
5	ENI (India) Ltd.	5141	3170	1
6	Geo-Global Resources Inc.	476	0	0
7	Geo-Petrol International Inc.	206	0	0
8	Hardy E&P India Inc.	518	718	4
9	Heramac Ltd.	0	9	2
10	Naftogaz	319	537	8
11	Niko Resources Limited.	161	1304	26
12	OAO Gazprom	4932	530	3
13	Oilex-NL Holdings Ltd	0	178	1
14	Okland Offshore Holdings Ltd.	0	0	1
15	Petrogas	440	1120	3
16	Premier Oil North East India.	261	0	1
17	Santos International Operations Pty. Ltd.	17253	2602	0
	Grand Total	**63209**	**21709**	**249**

5.2 OIL & GAS PRODUCTION

With the advent of NELP and CBM policy, Crude Oil and Natural Gas production under PSC regime has continually increased over the years until 2013-14 after which the oil production has become stagnant and gas production has gradually declined. To arrest this decline and provide impetus to the production levels, Govt. has launched DSF policy and HELP under a new fiscal and contractual regime. The oil and gas production trend of the country till 2015-16 is given below:

Table 5.4 : Year-Wise Production in PSC Regime

Year	Oil + Condensate (MMT)	Gas (BCM)
1994-95	0.25	0.09
1995-96	0.64	0.33
1996-97	1.34	0.51
1997-98	2.51	1.68
1998-99	3.04	2.87
1999-00	4.02	3.46
2000-01	4.08	3.60
2001-02	4.14	4.05
2002-03	4.09	5.41
2003-04	4.31	6.49
2004-05	4.30	6.78
2005-06	4.55	7.36
2006-07	4.83	7.04
2007-08	5.09	7.73
2008-09	4.67	8.09
2009-10	5.26	21.99
2010-11	9.68	26.77
2011-12	10.53	21.61
2012-13	11.64	14.49
2013-14	12.08	9.50
2014-15	11.79	8.91
2015-16	11.36	8.23

Oil and Gas Production in PSC + CBM Contract Regime Since Inception

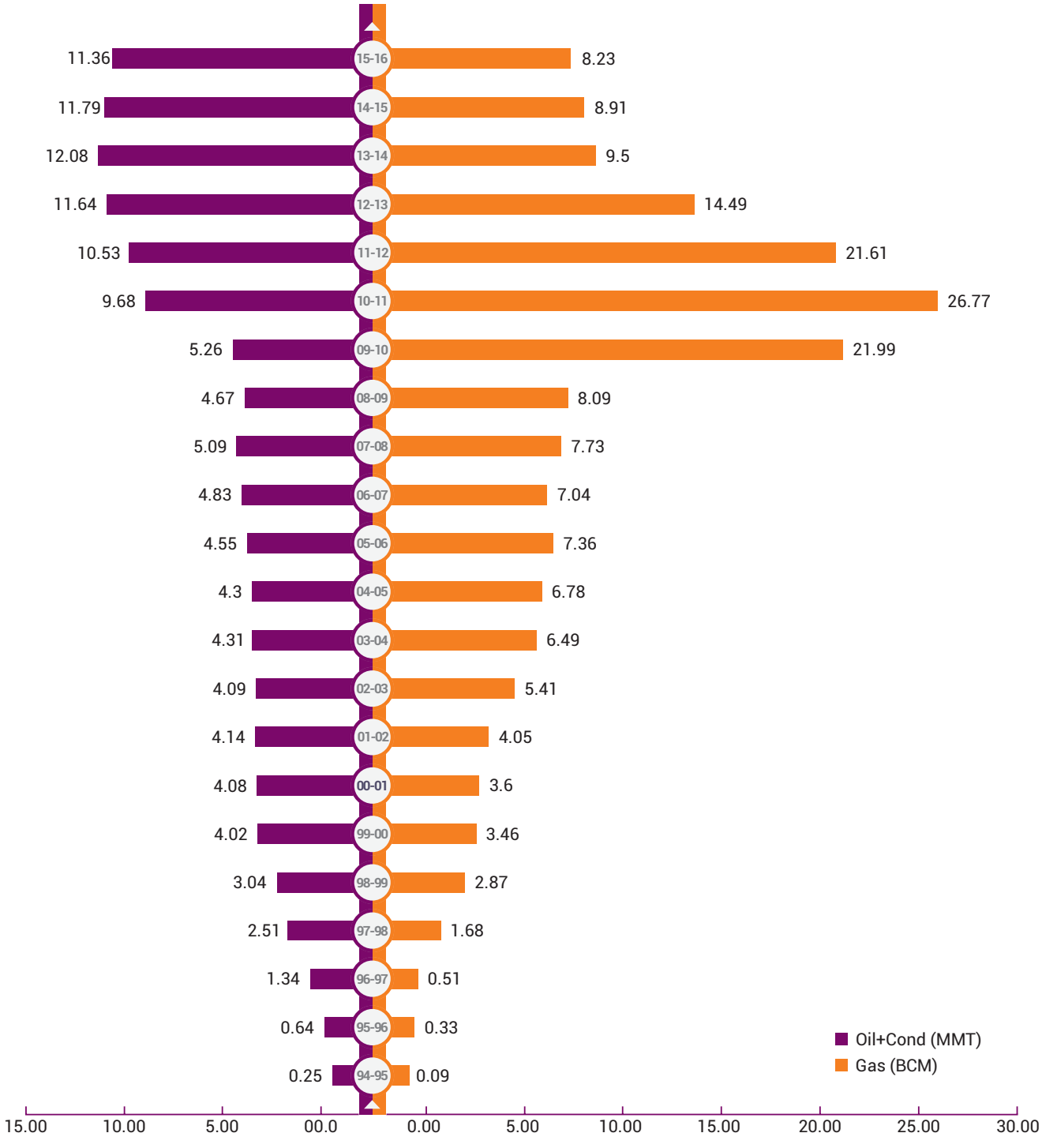


Fig. 5.1

The crude oil and natural gas production is from seven sedimentary basins of the country which are - Rajasthan, Assam-Arakan, Assam Shelf Basin, Cambay, Cauvery, Krishna-Godavari and Mumbai. The trend in production of crude oil during the period 2005-06 to 2015-16 along with the growth over the previous year is highlighted in the graph overleaf. The contribution of oil coming from onshore has increased from 101 TMT in 2005-06 to 8810 TMT in 2015-16 which is mainly attributed to production from Rajasthan Basin.

Oil Production in PSC Regime from 2005-06 to 2015-16

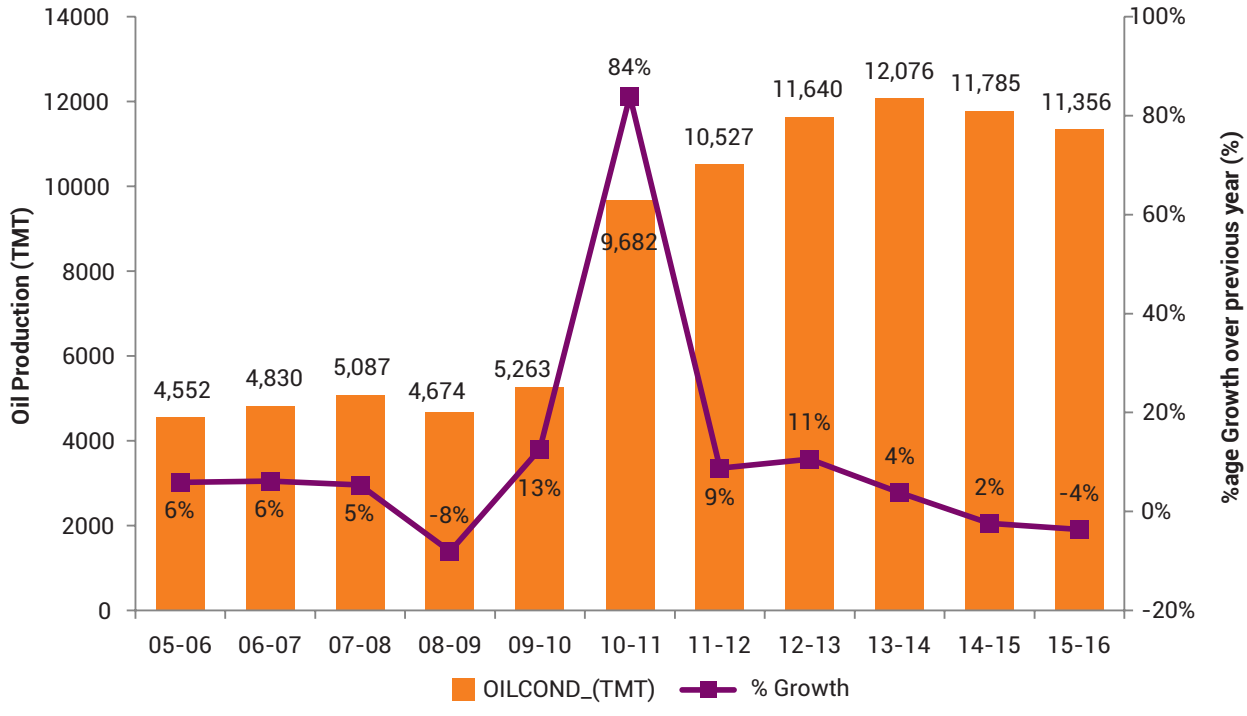


Fig. 5.2

The trend in production of natural gas during the period 2005-06 to 2015-16 along with the growth over the previous year is highlighted in the graph below. In 2005-06, gas production was 7,358 MMSCM which by 2015-16 reached to 8,235 MMSCM and major chunk of gas production is coming from offshore blocks. However, there was major growth in gas production (172%) in 2009-10 which is mainly attributed to the production coming from offshore block in Krishna Godavari Basin. Also, the incidental gas production from CBM blocks started in 2008-09.

Gas Production in PSC + CBM Contract Regime from 2005-06 to 2015-16

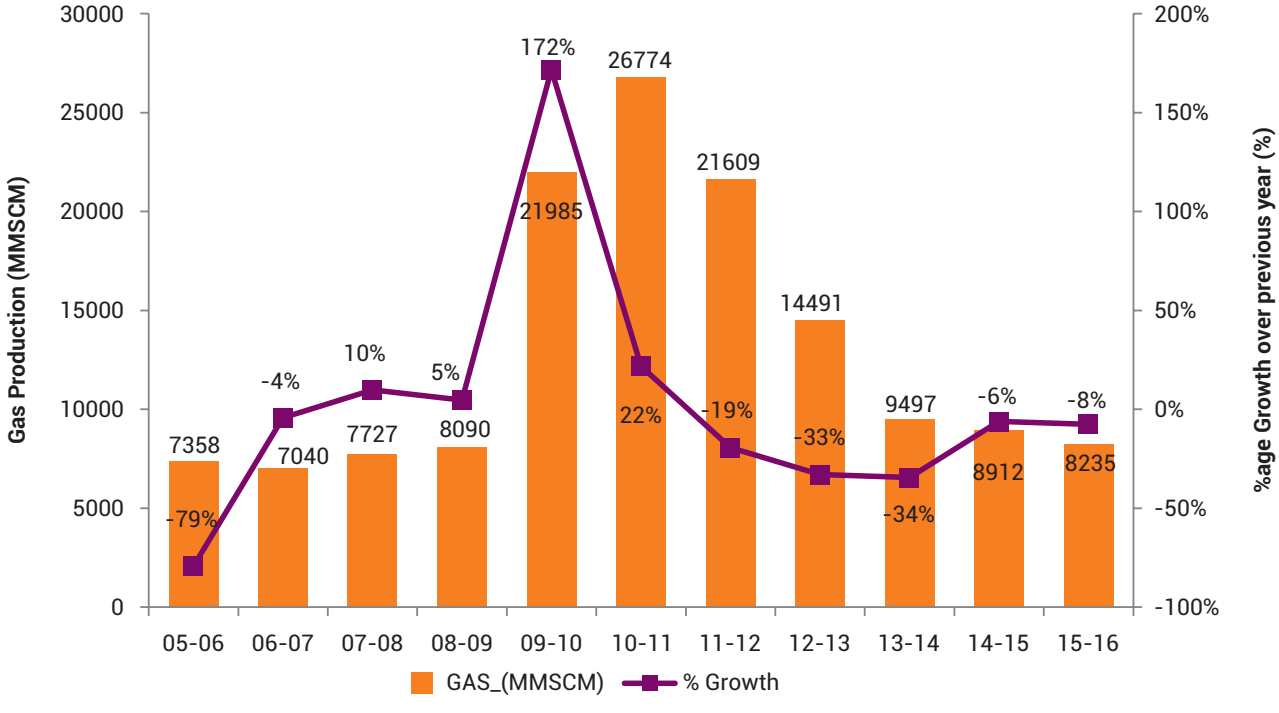


Fig. 5.3

Table 5.5 : Location wise Crude Oil and Natural Gas Production in PSC Regime from 2005-06 to 2015-16

CRUDE OIL (TMT)				NATURAL GAS (MMSCM)				
Year	Offshore	Onshore	Total	Year	CBM	Onshore	Offshore	Total
2005-06	4451.06	101.18	**4552.24**	2005-06	-	1556.71	5800.92	**7357.63**
2006-07	4669.26	160.64	**4829.91**	2006-07	-	1131.21	5908.49	**7039.70**
2007-08	4894.93	191.99	**5086.92**	2007-08	-	866.54	6860.85	**7727.39**
2008-09	4431.31	242.97	**4674.29**	2008-09	19.79	722.17	7348.09	**8090.04**
2009-10	4528.78	733.75	**5262.53**	2009-10	38.40	596.96	21349.76	**21985.12**
2010-11	4281.98	5400.01	**9681.99**	2010-11	41.36	678.67	26054.46	**26774.49**
2011-12	3733.16	6793.80	**10526.96**	2011-12	84.19	614.94	20909.84	**21608.96**
2012-13	2803.95	8836.10	**11640.05**	2012-13	107.24	683.72	13699.93	**14490.88**
2013-14	2662.57	9413.85	**12076.41**	2013-14	165.52	903.91	8427.66	**9497.09**
2014-15	2729.46	9055.76	**11785.22**	2014-15	228.24	1094.83	7588.88	**8911.95**
2015-16	2546.21	8809.79	**11356.01**	2015-16	392.87	1236.34	6605.41	**8234.62**

Location wise Oil Production in PSC Regime from 2005-06 to 2015-16 (TMT)

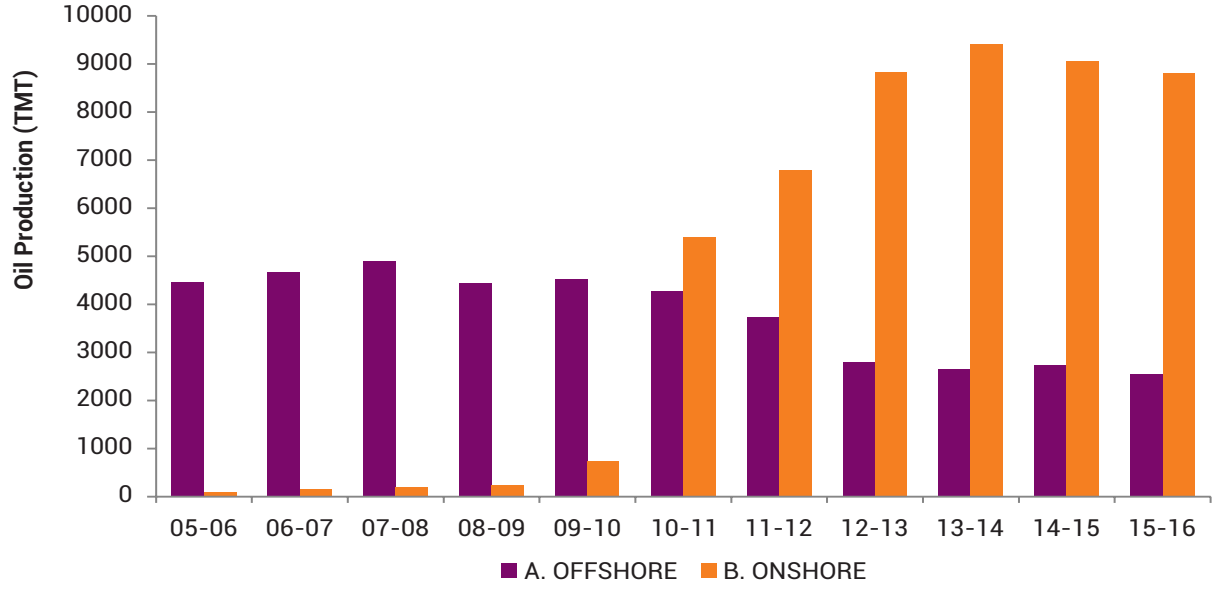


Fig. 5.4

Location wise Gas Production in PSC + CBM Contract Regime from 2005-06 to 2015-16 (MMSCM)

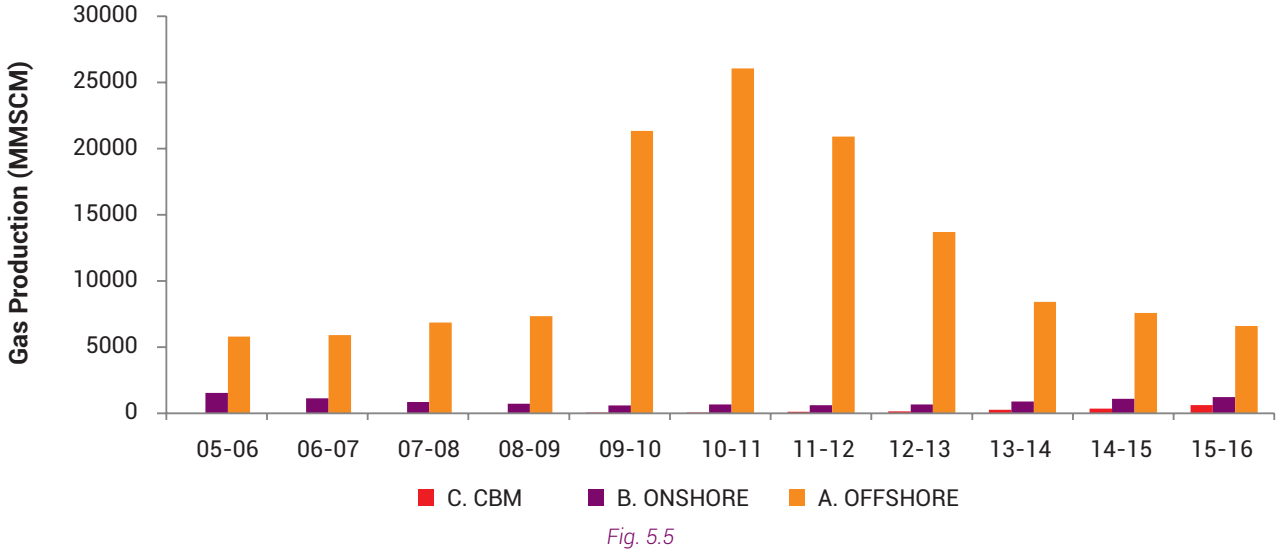


Fig. 5.5

Crude Oil Production in various regimes till 2015-16 (TMT)

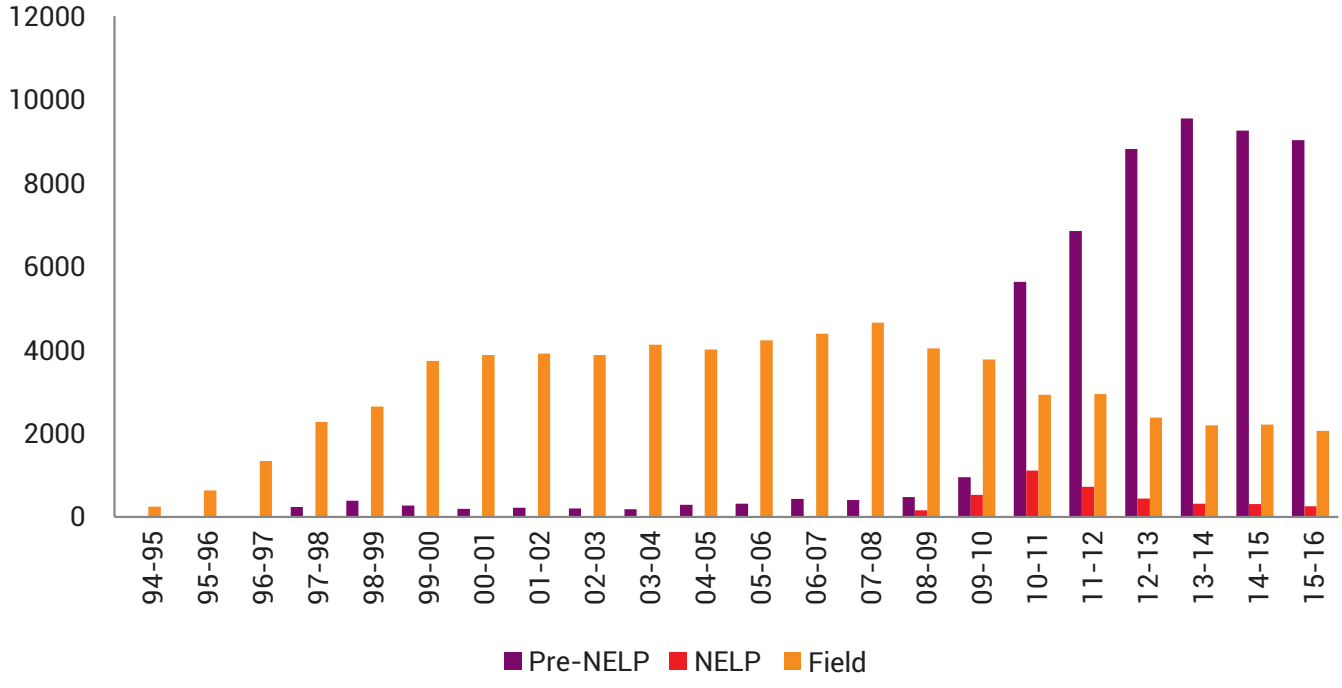


Fig. 5.6

Natural Gas Production in various regimes till 2015-16 (MMSCM]

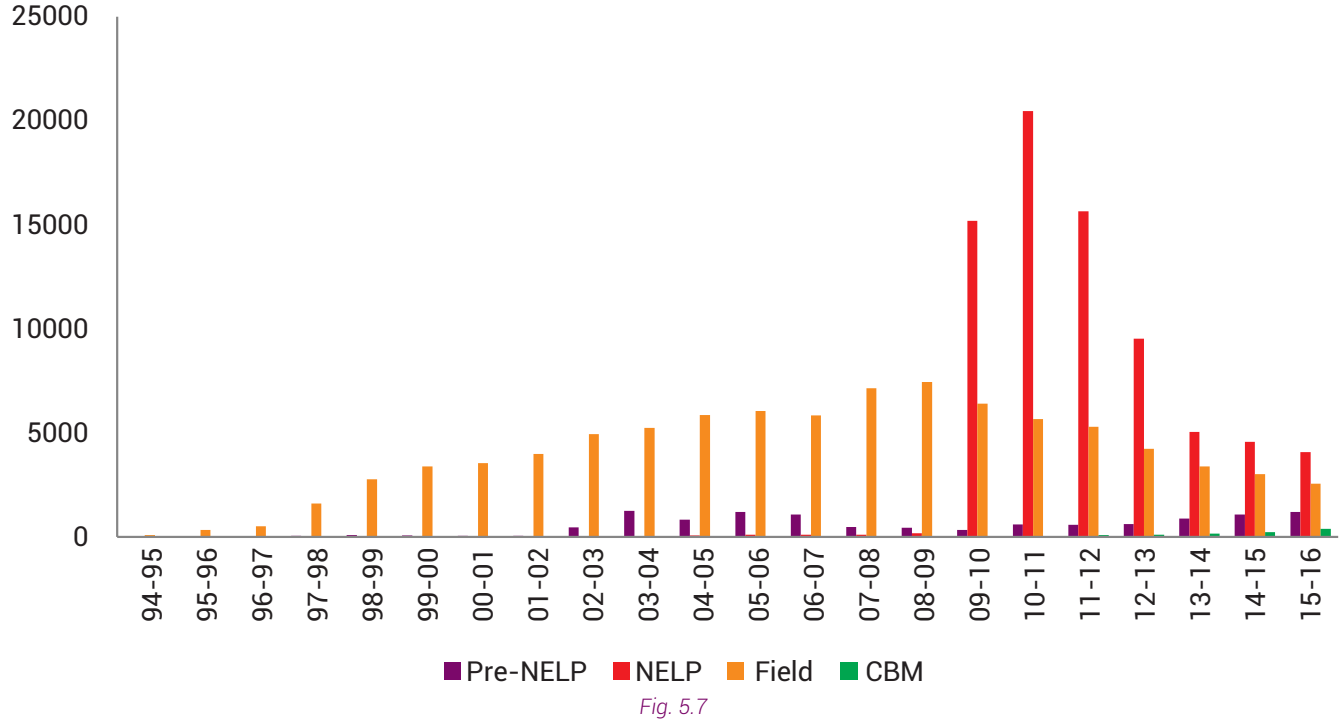


Fig. 5.7

Cumulative Oil & Gas Production in PSC + CBM Contract Regime (Oil in TMT, Gas in MMSCM)

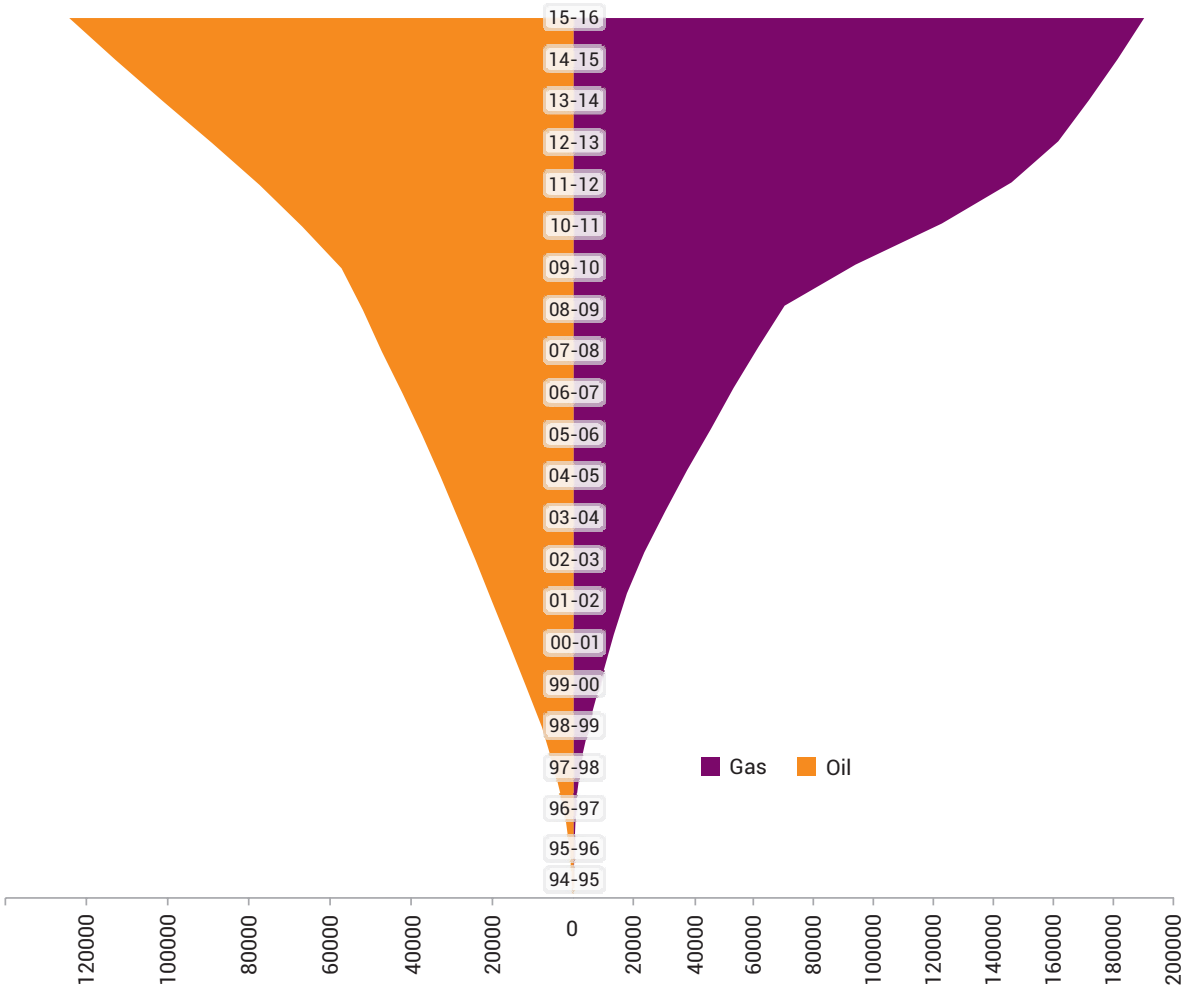
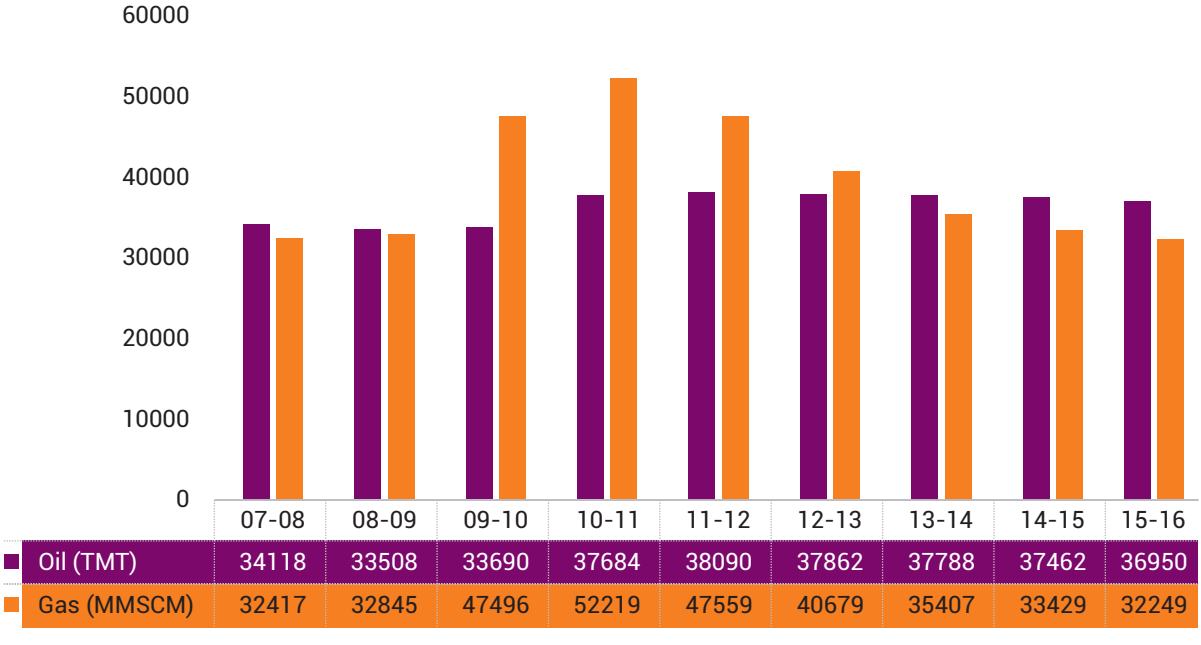


Fig. 5.8

Oil & Gas Production in the country from 2007-08 to 2015-16



	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16
Oil (TMT)	34118	33508	33690	37684	38090	37862	37788	37462	36950
Gas (MMSCM)	32417	32845	47496	52219	47559	40679	35407	33429	32249

Fig. 5.9

Table 5.6 : Contrubution by ONGC, OIL & Pvt./ JVs in Oil & Gas production

Year	Oil Production (MMT)				Gas Production (BCM)			
	ONGC (Nomination)	OIL (Nomination)	Pvt/JVs (PSC)	Total	ONGC (Nomination)	OIL (Nomination)	Pvt/JVs (PSC)	Total
2011-12	23.71	3.85	10.53	38.09	23.316	2.633	21.609	47.558
2012-13	22.56	3.66	11.64	37.86	23.548	2.642	14.49	40.68
2013-14	22.24	3.466	12.08	37.79	23.284	2.626	9.497	35.41
2014-15	22.26	3.41	11.78	37.46	22.02	2.72	8.91	33.66
2015-16	22.37	3.23	11.36	36.96	21.18	2.84	8.23	32.25

Oil Production Contribution (MMT)

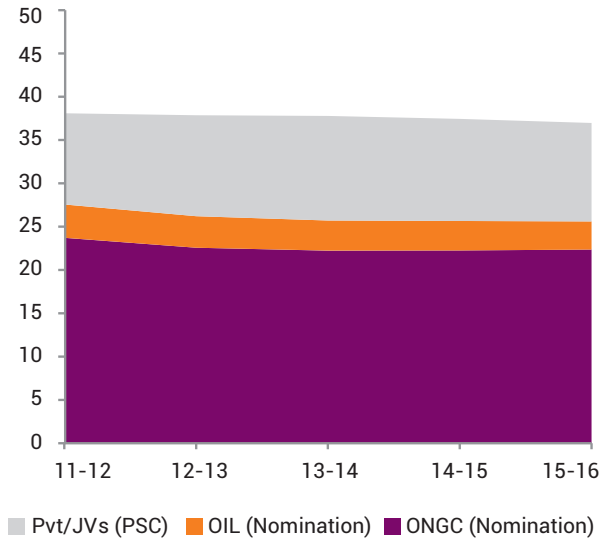


Fig. 5.10

Oil Production Contribution (%)

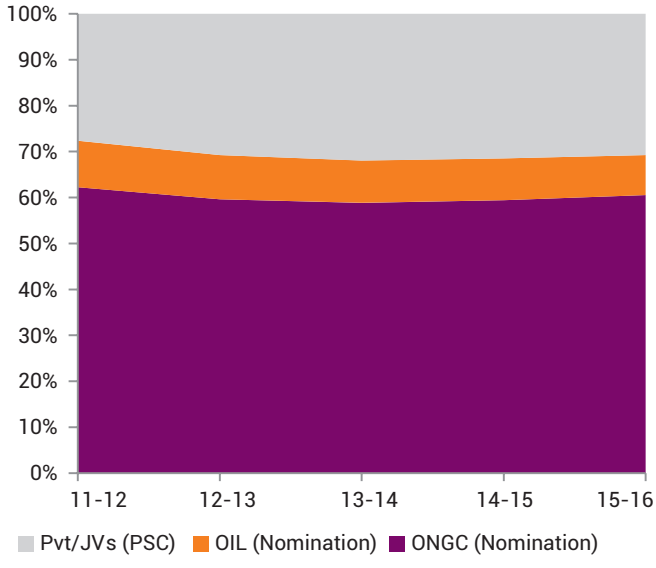


Fig. 5.12

Gas Production Contribution (BCM)

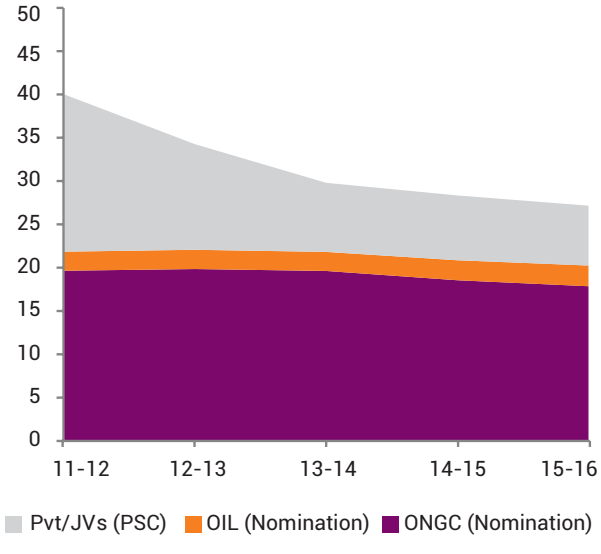


Fig. 5.11

Gas Production Contribution (%)

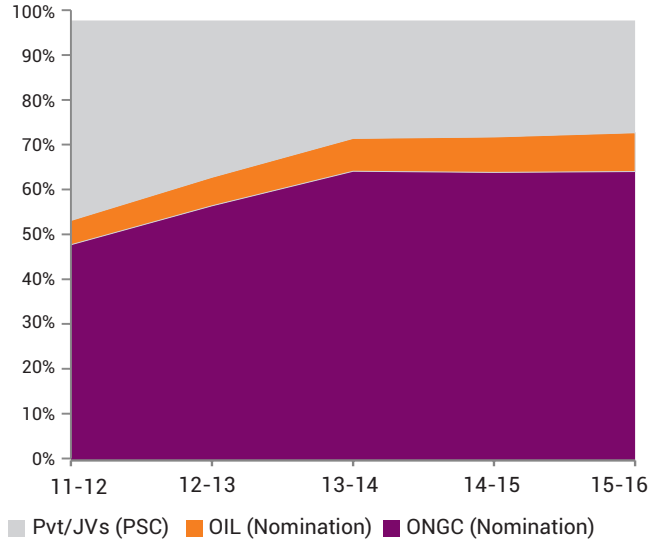


Fig. 5.13

5.3 HYDROCARBON DISCOVERIES

Table 5.7 : Basin wise discoveries under various regimes as on 31.03.2016

Basin	Oil	Gas	Total
Andaman-Nicobar	-	1	1
Assam-Arakan	-	7	7
Cambay	62	14	76
Cauvery	3	6	9
Gujarat Kutch	-	4	4
Gujarat Saurashtra	-	3	3
Krishna Godavari	17	54	71
Mahanadi	-	4	4
Mumbai Offshore	1	3	4
North East Coast	-	9	9
Rajasthan	36	7	43
Satpura-S.Rewa-Damodar	-	1	1
Total	**119**	**113**	**232**

Table 5.8 : Region wise discoveries under various regimes as on 31.03.2016

Region	Oil			Gas			Total
	NELP	Pre-NELP	Pre-NELP field	NELP	Pre-NELP	Pre-NELP field	
Deep Water	8	-	-	40	-	-	48
On Land	43	53	2	13	10	-	121
Shallow water	4	3	6	44	5	1	63
Grand Total	**55**	**56**	**8**	**97**	**15**	**1**	**232**

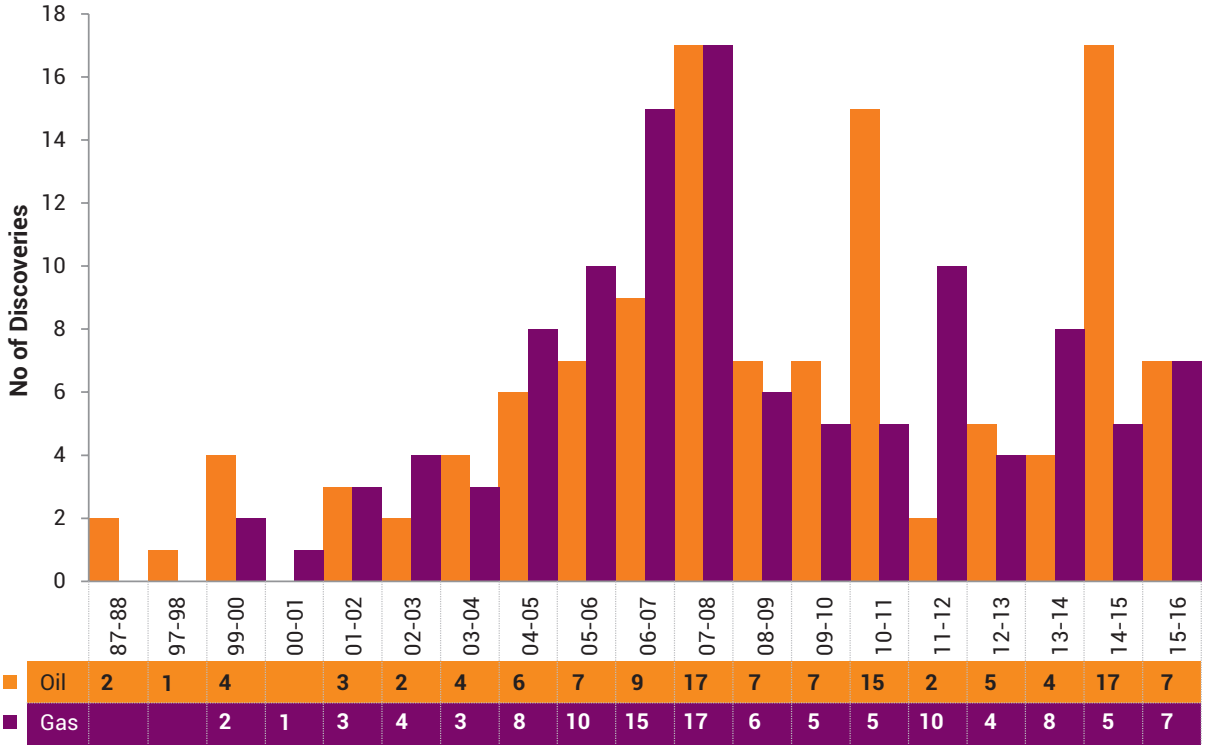
Table 5.9 : Details of oil and gas discoveries under Pre-NELP regime as on 31.03.2016

Operator	Block	PSC Round	Oil	Gas	Total
BGEPIL	Panna-Mukhta	PSC-Field Round	1	-	1
Cairn	CB-OS/2	Pre-NELP	2	3	5
	Ravva	PSC-Field Round	5	1	6
	RJ-ON-90/1	Pre-NELP	35	4	39
ESSAR	CB-ON/3	Pre-NELP	5	-	5
Focus	GK-ON/4	Pre-NELP	-	1	1
	RJ-ON/6	Pre-NELP	-	3	3
GSPC	CB-ON/2	Pre-NELP	11	1	12
HARDY	CY-OS-2	Pre-NELP	-	1	1
HOEC	AAP-ON-94/1	Pre-NELP	-	1	1
	CB-ON/7	Pre-NELP	2	-	2
Interlink Petroleum	Baola	PSC-Field Round	1	-	1
ONGC	CB-OS/1	Pre-NELP	1	-	1
RIL	SR-OS-94/1	Pre-NELP	-	1	1
Selan Exploration Technology Limited	Karjisan	PSC-Field Round	1	-	1
Pre-NELP Total			**64**	**16**	**80**

Table 5.10 : Details of oil and gas discoveries under NELP regime as on 31.03.2016

Operator	Block	PSC Round	Oil	Gas	Total
Focus	CB-OSN-2004/1	NELP-VI	2	3	5
GSPC	CB-ONN-2000/1	NELP-II	4	-	4
	CB-ONN-2002/3	NELP-IV	8	-	8
	CB-ONN-2003/2	NELP-V	2	1	3
	KG-OSN-2001/3	NELP-III	-	9	9
Jay polychem(India) Pvt. Ltd.	CB-ONN-2009/8	NELP-VIII	1	-	1
JOGPL	AA-ONN-2002/1	NELP-IV	-	3	3
	CB-ONN-2002/2	NELP-IV	2	-	2
	CY-ONN-2002/1	NELP-IV	-	1	1
MPL	CB-ONN-2005/9	NELP-VII	2		2
NAFTOGAS	CB-ONN-2004/5	NELP-VI	1	-	1
NIKO	CB-ONN-2000/2	NELP-II	-	2	2
OIL	KG-ONN-2004/1	NELP-VI	-	1	1
	RJ-ONN-2004/2	NELP-VI	1		1
ONGC	AA-ONN-2001/1	NELP-III	-	2	2
	AA-ONN-2001/2	NELP-III	-	1	1
	AN-DWN-2002/1	NELP-IV	-	1	1
	CB-ONN-2001/1	NELP-III	1	-	1
	CB-ONN-2002/1	NELP-IV	1	-	1
	CB-ONN-2004/1	NELP-VI	1	-	1
	CB-ONN-2004/2	NELP-VI	5	-	5
	CB-ONN-2004/3	NELP-VI		1	1
	CB-ONN-2005/4	NELP-VII	1		1
	CB-OSN-2003/1	NELP-V	-	3	3
	CY-ONN-2002/2	NELP-IV	2	1	3
	CY-ONN-2004/2	NELP-VI	1	-	1
	GK-OSN-2009/1	NELP-VIII	-	1	1
	GK-OSN-2009/2	NELP-VIII	-	1	1
	GK-OSN-2010/1	NELP-IX	-	1	1
	GS-OSN-2004/1	NELP-VI	-	2	2
	KG-DWN-2005/1	NELP-VII	-	1	1
	KG-DWN-98/2	NELP-I	6	8	14
	KG-ONN-2003/1	NELP-V	2	-	2
	KG-OSN-2004/1	NELP-VI	-	7	7
	MB-OSN-2005/1	NELP-VII	-	2	2
	MB-OSN-2005/3	NELP-VII	-	1	1
	MN-DWN-98/3	NELP-I	-	2	2
	MN-OSN-2000/2	NELP-II	-	2	2
	NEC-DWN-2002/2	NELP-IV	-	1	1
RIL	CB-ONN-2003/1	NELP-V	8	-	8
	CY-DWN-2001/2	NELP-III	-	2	2
	CY-PR-DWN-2001/3	NELP-III	-	1	1
	GS-OSN-2000/1	NELP-II	-	1	1
	KG-DWN-2001/1	NELP-III	-	1	1
	KG-DWN-2003/1	NELP-V	-	4	4
	KG-DWN-98/1	NELP-I	1	-	1
	KG-DWN-98/3	NELP-I	1	19	20
	KG-OSN-2001/1	NELP-III	-	3	3
	KG-OSN-2001/2	NELP-III	2	-	2
	NEC-OSN-97/2	NELP-I	-	8	8
Grand Total			**55**	**97**	**152**

Year wise Oil and Gas Discoveries under PSC regime



	87-88	97-98	99-00	00-01	01-02	02-03	03-04	04-05	05-06	06-07	07-08	08-09	09-10	10-11	11-12	12-13	13-14	14-15	15-16
Oil	2	1	4		3	2	4	6	7	9	17	7	7	15	2	5	4	17	7
Gas			2	1	3	4	3	8	10	15	17	6	5	5	10	4	8	5	7

Fig. 5.14

5.4 GEOSCIENTIFIC STUDIES CARRIED OUT BY DGH

Table 5.11 : Geoscientific Surveys/ Studies till date by DGH :

Sl. No.	Area/Block	Survey Type	Area	Achievement (API)	Year	Agreement/ MoU signed with
			I. RECONNAISSANCE SURVEY			
1	Western & Eastern Offshore	Satellite Gravity	Offshore	1.642 Million Sq. Km.	1995-98	Petroscan, Sweden
2	Kutch Offshore & Onland	Aero-Magnetic	Onland	23,730 LKM	1995-96	NRSA, Hyderabad
3	Nagpur-Wardha-Belgaum	MT	Onland	352 Stations	1996-98	NGRI, Hyderabad
4	Himalayan Foreland	Aero-Magnetic	Onland	11,958 LKM	2003-05	NRSA, Hyderabad
5	Punjab and Foot Hills of Himalayas	Aero-Magnetic	Onland	12,765 LKM	2005-06	NRSA, Hyderabad
			II. JOINT VENTURE SPECULATIVE SURVEYS			
			OFFSHORE			
6	East Coast	2D seismic & GM	Offshore	7428.685 LKM & RI of 4625 LKM of old data	1996-97	Western Geophysical, USA
7	Andaman-Nicobar	2D seismic & GM	Offshore	3606.375 LKM & RI of 695 LKM of old data	1996-97	Western Geophysical, USA
			ONLAND			
8	Ganga Valley (GV-ON-90/5)	2D seismic	Onland	634 GLK	1997-98	Alpha Geo, Hyderabad
9	Vindhyan (VN-ON-90/5)	2D seismic	Onland	566 GLK	1997-98	Alpha Geo, Hyderabad
			III. SPECULATIVE SURVEYS			
10	Western & Eastern Offshore	2D seismic	Offshore	16,174 LKM	2005-07	GXT, USA
11	Western Offshore	2D seismic (Re-processing)	Offshore	Re-processing (12,000 LKM)	2007-08	GGS Spectrum, Norway
12	Andaman Offshore	2D seismic	Offshore	7240.725 LKM	2007-09	PGS, Singapore
13	Eastern Offshore	CSEM	Offshore	2146.5 sq. km.	2007-08	EMGS, Norway
14	Western Offshore	2D seismic	Offshore	1498.35 LKM	2009-10	Fugro Data Services, Switzerland
15	Western Offshore	2D seismic	Offshore	2109.113 LKM	2009-10	Fugro Multiclient Services Pty Ltd, Australia
16	West and East coast	2D seismic	Offshore	9632.5 LKM	2008-10	GXT, USA
17	Andaman Islands of India	2D seismic (Re-processing)	Offshore	Re-processing (10,638 LKM)	2009-10	Spectrum Geo Ltd, U.K.
18	Kutch	Airborne HRAM	Onland	55,668.3 LKM	2007-09	Mcphar, Canada
		Airborne GM	Onland	13,994.64 LKM	2009-10	Mcphar, Canada
19	Kutch-Saurastra	2D CSEM & MMT	Offshore	310.5 LKM	2015-16	EMGS ASA, Norway
			IV. SEISMIC SURVEYS			
			OFFSHORE			
20	Andaman Infill	2D Seismic	Offshore	1484.75 LKM	1999	Western Geophysical, USA
21	Southern Tip (ST)	2D Seismic	Offshore	2835.925 LKM	2001-02	Large, Russia
22	East Coast (EC)	2D Seismic	Offshore	4319.45 LKM	2001-02	Large, Russia
23	Andaman-Nicobar (AN)	2D Seismic	Offshore	4307.275 LKM	2001-02	Large, Russia
24	West Coast (WC)	2D Seismic	Offshore	12,000.65 LKM	2002-03	Large, Russia
			ONLAND			
25	Ganga Valley (GV)	2D Seismic	Onland	1135.05 LKM	2002-03	Alpha Geo, Hyderabad
26	Chambal Valley (CV)	2D Seismic	Onland	805.00 GLK	2003-04	Alpha Geo, Hyderabad
27	Kutch	2D Seismic (Acq.)	Onland	690.6 GLK	2006-09	NGRI, Hyderabad
28	Kutch	2D Seismic (P&I)	Onland	690.6 GLK	2010-12	GEOPIC, ONGC, Dehradun
			V. INTEGRATED GEOPHYSICAL SURVEYS			
29	Deccan Syneclise (DS)	Gravity, MT, DRS,	Onland	6000 Stations,	2003-04	NGRI, Hyderabad
	Narmada-Tapti Area	2D seismic		600 & 50 stations, 700 LKM		
			VI. GRAVITY -MAGNETIC SURVEYS & OTHER GEOPHYSICAL SURVEYS			
			OFFSHORE			
30	Gulf of Kutch	MS & MMT	Offshore	133.984 LKM &13Stn.	2006-08	NGRI, Hyderabad
			ONLAND			
31	Vindhyan (Amriti)	GM	Onland	303 Stations (80 sq.km)	2003-04	NGRI, Hyderabad
32	Central India	Land MT	Onland	102 Stations	2006-09	NGRI, Hyderabad
33	Narmada-Cambay/ Deccan Syneclise	Analysis of Aerial Images/ Remote sensing data	Onland	302,500 sq. km	2006-08	NGRI, Hyderabad

Geophysical Surveys Carried Out by DGH

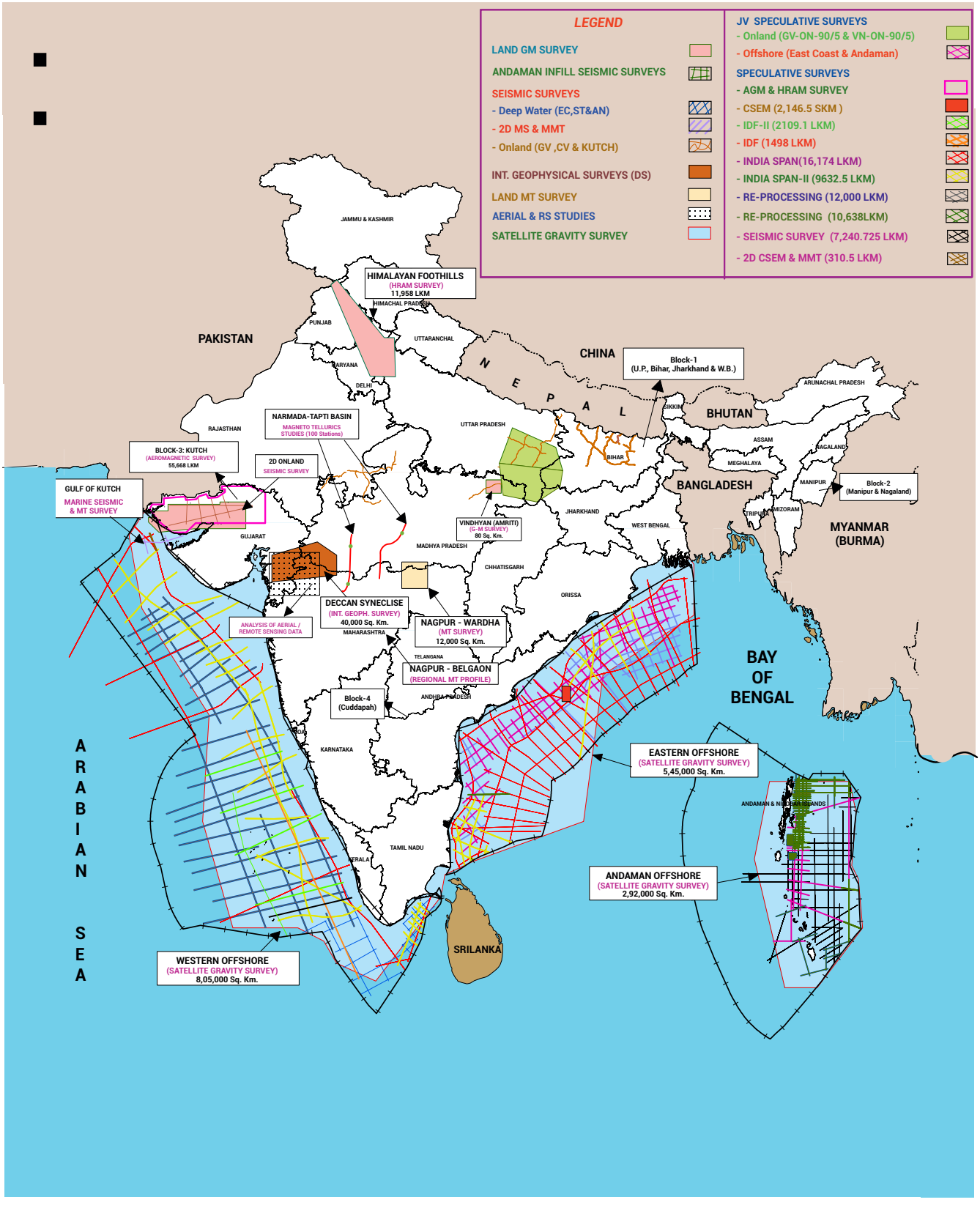
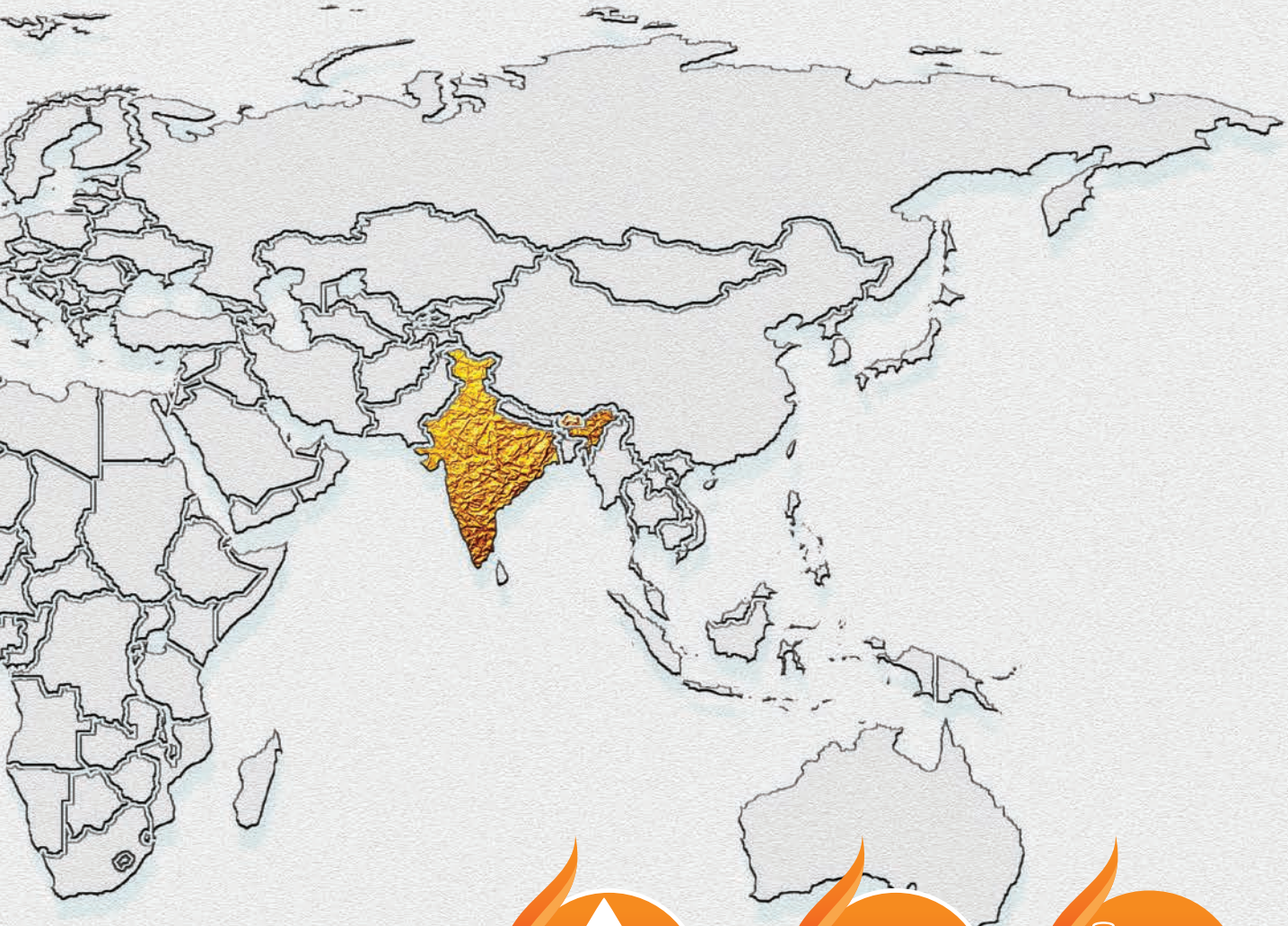


Fig. 5.15

Chapter 6

Petroleum

Resource and Reserves in INDIA



Hydrocarbon Reserves Status

Basin-wise in-place Volume & Reserves

Reserve Replacement Ratio

6 Petroleum Resource and Reserves in INDIA

6.1 CONVENTIONAL HYDROCARBON RESOURCES

The resource assessment of Indian Sedimentary Basins was carried out during the year 1990 by Indo-Soviet Resource Appraisal Group (ISRAG) in ONGC under Indo-Soviet protocol and in 1996 by ONGC. Based on this assessment, the conventional hydrocarbon prognosticated resources in 15 sedimentary basins along with the deep water areas of the country are of the order of 28.1 Billion Tonnes of Oil and Oil Equivalent of Gas (O+OEG). The resources in the offshore are 18.82 Billion Tonnes of O+OEG out of which deepwater areas account for 7 Billion Tonnes. The contribution of onshore part of basins is 9.27 Billion Tonnes of O+OEG. Basin-wise details of prognosticated hydrocarbon resources in the country are given in the table below:

Table 6.1 : Basin-wise prognosticated hydrocarbon resources

Basin	Oil and Oil Equivalent Gas O+OEG (MMT)		
	Offshore Part of Basin	Onland Part of Basin	Total Basin
Mumbai	9190	-	9190
Assam-Arakan Fold Belt	-	1860	1860
Cambay	-	2050	2050
Upper Assam	-	3180	3180
Krishna-Godavari	555	575	1130
Cauvery	270	430	700
Rajasthan	-	380	380
Kutch	550	210	760
Andaman-Nicobar	180	-	180
Kerala-Konkan	660	-	660
Saurashtra Offshore	280	-	280
Ganga Valley	-	230	230
Bengal	30	160	190
Himalayan Foreland	-	150	150
Mahanadi	100	45	145
Total	**11,815**	**9,270**	**21,085**
Deep Water	**7,000**	**-**	**7,000**
Grand Total	**18,815**	**9,270**	**28,085**

Ministry of Petroleum & Natural Gas (MoP&NG) has issued an office order in January, 2014 to carry out re-assessment of Hydrocarbon Resources for Sedimentary Basins of India including Deep Water Areas. The work of hydrocarbon resource assessment is to be carried out under the leadership of ONGC's Institute KDMIPE (Keshava Deva Malaviya Institute of Petroleum Exploration) at Dehradun and Multi Organization Teams were formed to carry out this exercise.

National Steering Committee in its second meeting held on 16.7.2015 concluded that the mandated exercise of 'Re-assessment of hydrocarbon resources for sedimentary basins and deep water areas of India' will be taken up in-house by ONGC in association with OIL and DGH. The project work will be carried out in a de-centralised manner at designated work centres of ONGC and be completed in 27 months' time (01.09.2015 to 30.11.2017). The project was kicked off by CMD, ONGC in presence of Board Members on 14.8.2015 at KDMIPE, Dehradun. As on date, study for Satpura-South Rewa-Damodar and Bastar basins has been completed and draft report prepared. Report will be reviewed by international experts for suggestions and the same will be incorporated in the final report. Presently, the study of 13 sedimentary basins is in progress at eight work centers.

Table 6.2 : Details of ONGC work centers for study of sedimentary basin

Basin	ONGC Work Center
Mumbai Offshore, Assam-Arakan Fold Belt (AAFB), Chhattisgarh	KDMIPE
Kerala-Konkan,Kutch	Mumbai
Krishna-Godavari, Cauvery	Chennai
Mahanadi, Bengal	Kolkata
Cambay	Vadodara
Rajasthan	New Delhi
Vindhyan	GEOPIC
Assam Shelf	Jorhat

6.2 HYDROCARBON RESERVES OF INDIA

As on 01.04.2016, In-place hydrocarbon volume of 11233.6 Million Metric Tonnes (MMT) of oil and oil equivalent gas could be established through exploration by ONGC, OIL and Private/JV companies. Out of 11233.6 MMT of O+OEG of in-place volumes, the ultimate reserves are about 4257.55 MMT of O+OEG. The break-up of hydrocarbon reserves established by ONGC, OIL and Companies under the PSC regime in the country as on 01.04.2016 are as under:

Table 6.3 : Reserves Status During the year 2015-16 (as on 01.04.2016)

Sl. No.	Subject	Parameter	ONGC (Nomination)*	OIL (Nomination)*	PSC regime	Total
1	**Initial In-place volume**	Gas (BCM)	2473.51	366.57	1361.80	4201.87
		Oil (MMT)	5286.12	797.89	995.45	7079.46
		O+OEG (MMT)	**7759.63**	**1116.73**	**2357.25**	**11233.60**
2	**Accretion of In-place volume**	Gas (BCM)	58.46	9.7259	-98.40	-30.21
		Oil (MMT)	56.81	-2.8620	20.10	74.05
		O+OEG (MMT)	**115.27**	**5.7484**	**-78.30**	**42.72**
3	**Ultimate Reserves**	Gas (BCM)	1313.79	205.38	785.95	2305.13
		Oil (MMT)	1507.36	247.64	225.20	1980.20
		O+OEG (MMT)	**2821.15**	**425.2506**	**1011.15**	**4257.55**
4	**Accretion of Ultimate Reserves**	Gas (BCM)	16.63	7.7787	18.67	43.08
		Oil (MMT)	14.38	0.3199	9.82	24.52
		O+OEG (MMT)	**31.01**	**7.2121**	**28.49**	**66.71**
5	**Balance Recoverable Reserves**	Gas (BCM)	669.60	119.4539	589.71	1378.77
		Oil (MMT)	548.18	80.5845	95.90	724.67
		O+OEG (MMT)	**1217.78**	**183.8595**	**685.62**	**2087.25**

Note : Conversion factor 1 MMT = 1 BCM

O+OEG- Oil and Oil Equivalent of Gas.

** Data as Provided by ONGC & OIL*

For estimation of O+OEG, Conversion factor considered by OIL : 1 BCM = 0.8828 MTOE

6.3 RESERVES ESTABLISHED UNDER PSC REGIME

Hydrocarbon exploration in Indian Basins has picked up pace after the implementation of NELP and eventually more reserves have been established. Award of acreages under DSF policy and HELP will further accentuate the Oil & Gas reserve base of India. The trend of In-place volume and Ultimate reserves of crude oil and natural gas under the PSC regime during the period 2008-09 to 2015-16 along with the growth with base year as 2008-09 is provided. Over the years, the In-place volume has increased by 46 % and Ultimate reserves have increased by 40 % when compared to figures as on 01.04.2008.

In-Place Volume Trend over under the PSC regime

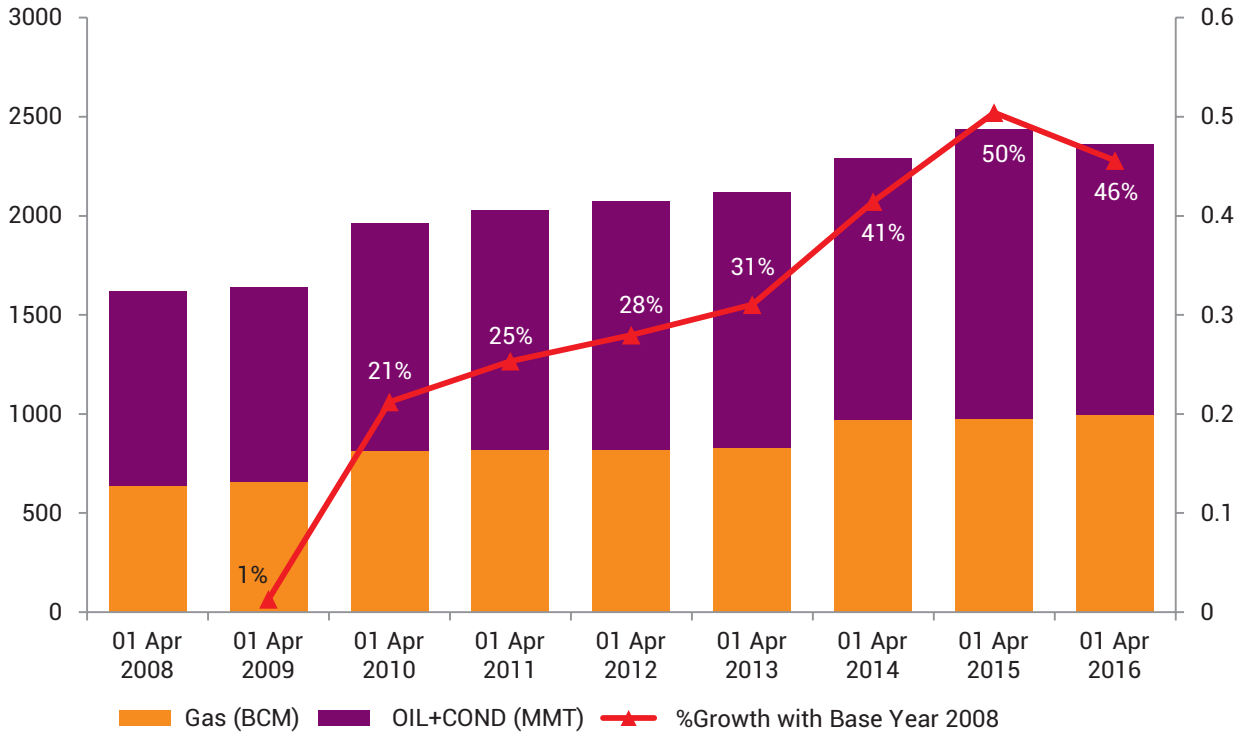


Fig. 6.1

Table 6.4 : In-place volume trend under PSC regime

In-Place as on 01.04.2016				
As on	OIL+COND (MMT)	Gas (BCM)	O + OEG (MMT)	%Growth with Base Year 2008
01.04.2008	639	980	1619	-
01.04.2009	658	982	1640	1%
01.04.2010	814	1148	1963	21%
01.04.2011	821	1209	2029	25%
01.04.2012	817	1255	2072	28%
01.04.2013	830	1292	2122	31%
01.04.2014	972	1318	2290	41%
01.04.2015	975	1460	2436	50%
01.04.2016	995	1362	2357	46%

The trend of Ultimate Reserves of crude oil and natural gas (O+OEG) under the PSC regime in major basins from 01.04.2008 to 01.04.2016 is highlighted in the graphs below.

Ultimate Reserves Trend under PSC regime

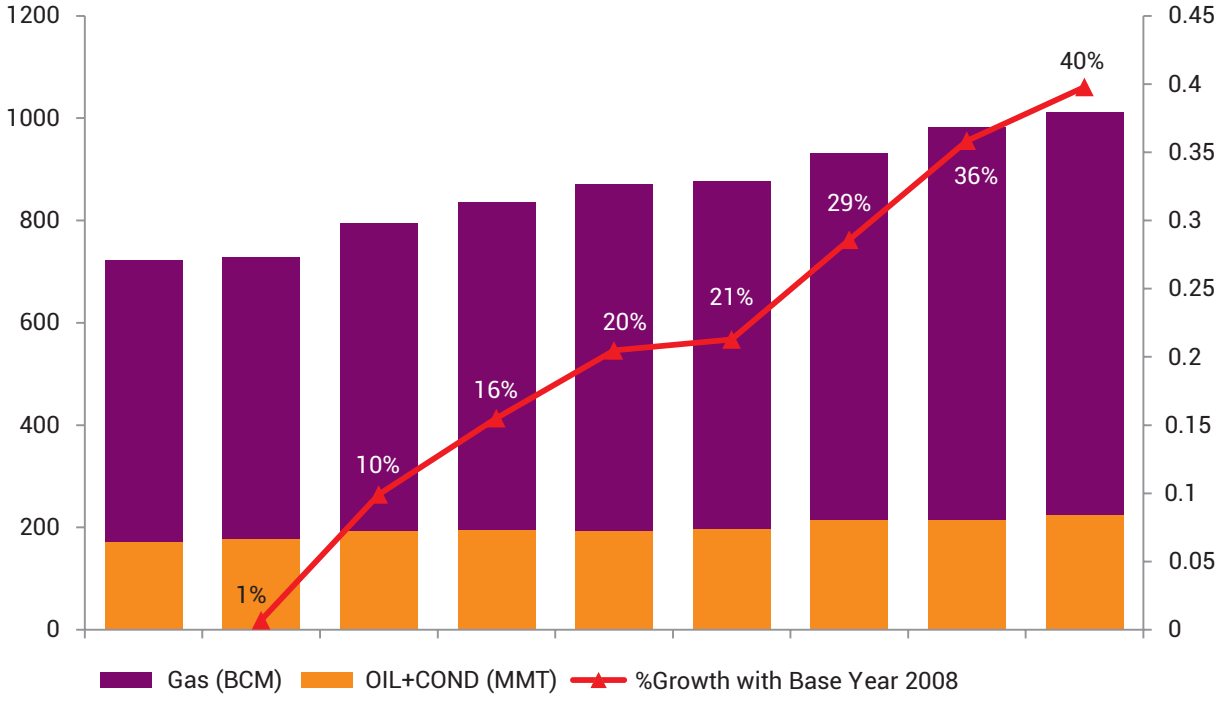


Fig. 6.2

Table 6.5 : Ultimate Reserves trend under PSC regime

Ultimate as on 01.04.2016				
As on	OIL+COND (MMT)	Gas (BCM)	O + OEG (MMT)	% Growth with Base Year 2008
01.04.2008	172	551	723	-
01.04.2009	178	550	728	1%
01.04.2010	194	601	795	10%
01.04.2011	195	641	836	16%
01.04.2012	195	677	871	20%
01.04.2013	197	680	877	21%
01.04.2014	215	716	930	29%
01.04.2015	215	767	983	36%
01.04.2016	225	786	1011	40%

6.4 BASIN-WISE IN-PLACE VOLUME AND ULTIMATE RESERVE TREND (O+OEG IN MMT) UNDER PSC REGIME

India has 26 sedimentary basins covering an area of 3.14 million square kilometres. The sedimentary basins of India, onland and offshore up to the 200 m isobath, have an areal extent of about 1.79 million sq. km. In the deepwater beyond the 200 m isobath, the sedimentary area has been estimated to be about 1.35 million sq. km. Thus, the total works out to 3.14 million sq. km. Major basins where hydrocarbon potential has been established under the PSC regime are Assam-Arakan, Cambay, Cauvery, Krishna Godavari, Mahanadi, Mumbai and Rajasthan.

Table 6.6 : Basin-wise In-place volume (O + OEG (MMT)) Distribution under PSC Regime (as on 01.04.2016)

Basin	In-Place
CBM	284.043
Assam-Arakan Shelf	61.735
Cambay	147.086
Cauvery	78.958
Krishna Godavari	867.771
Mahanadi	27.052
Mumbai	504.889
Rajasthan	385.711
Grand Total	**2357.245**

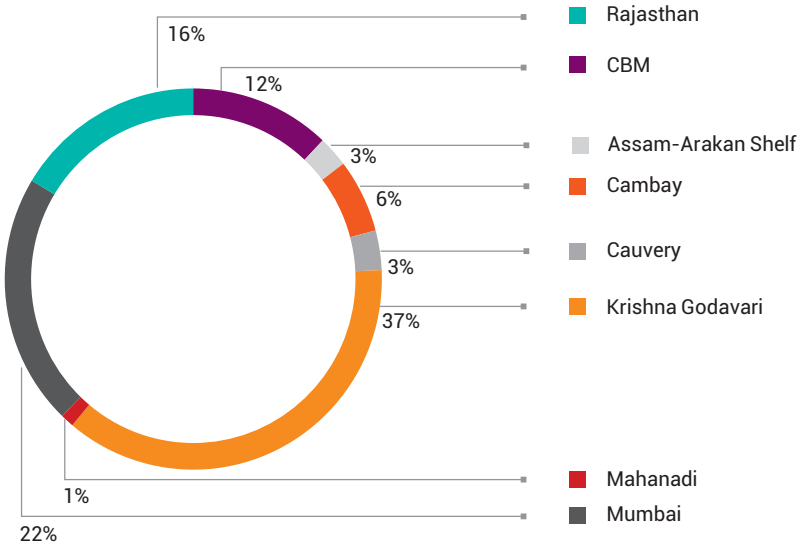


Fig. 6.3

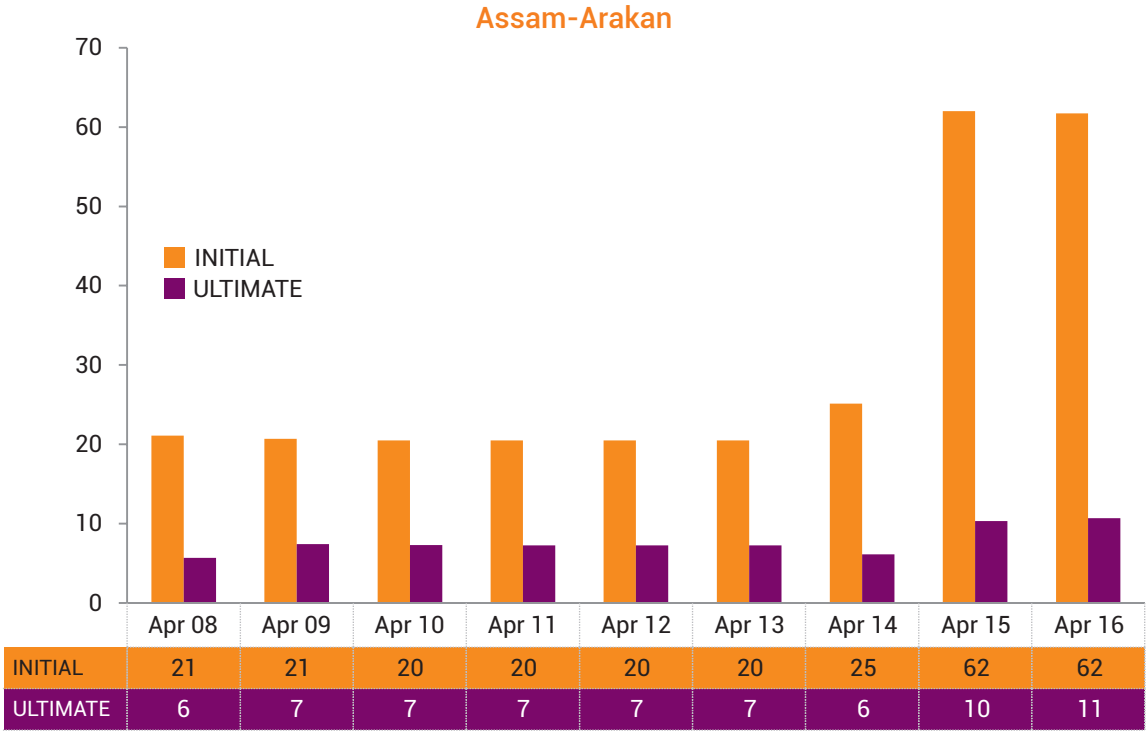
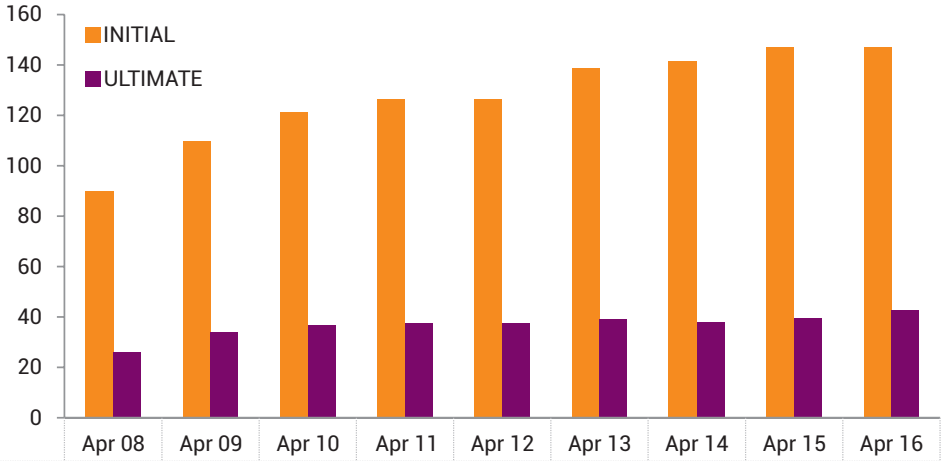


Fig. 6.4

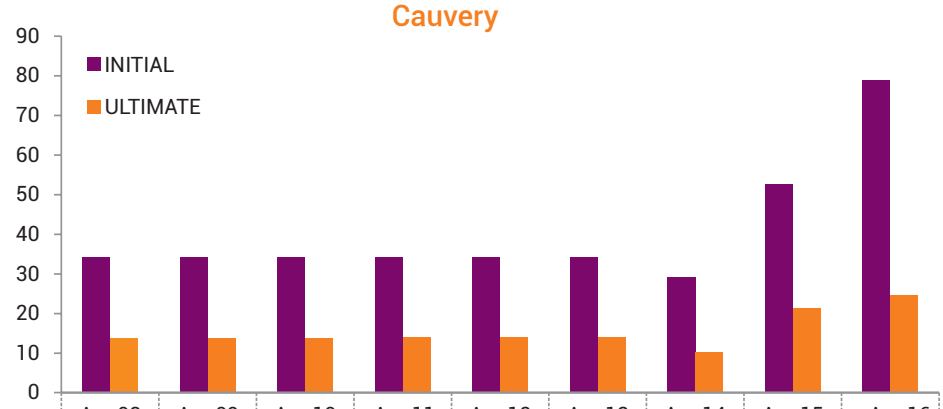
Cambay



	Apr 08	Apr 09	Apr 10	Apr 11	Apr 12	Apr 13	Apr 14	Apr 15	Apr 16
INITIAL	90	110	121	126	127	139	141	147	147
ULTIMATE	26	34	37	38	38	39	38	40	43

Fig. 6.5

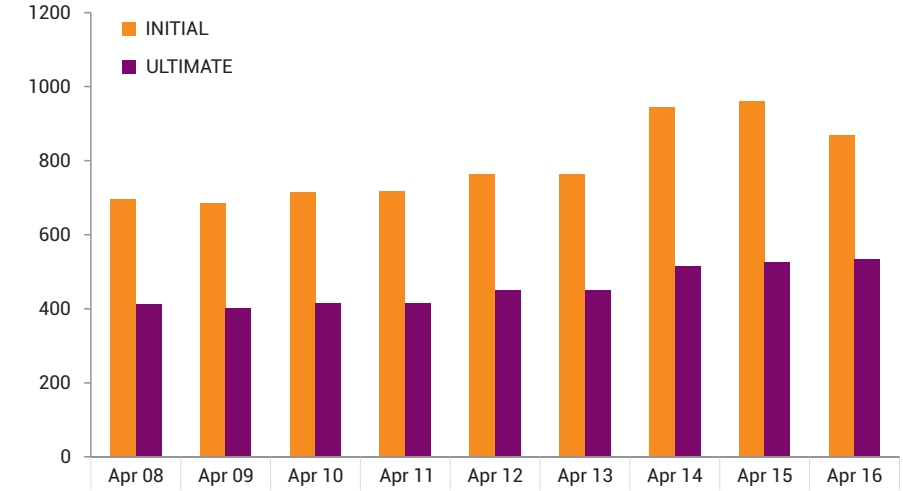
Cauvery



	Apr 08	Apr 09	Apr 10	Apr 11	Apr 12	Apr 13	Apr 14	Apr 15	Apr 16
INITIAL	34	34	34	34	34	34	29	53	79
ULTIMATE	14	14	14	14	14	14	10	21	25

Fig. 6.6

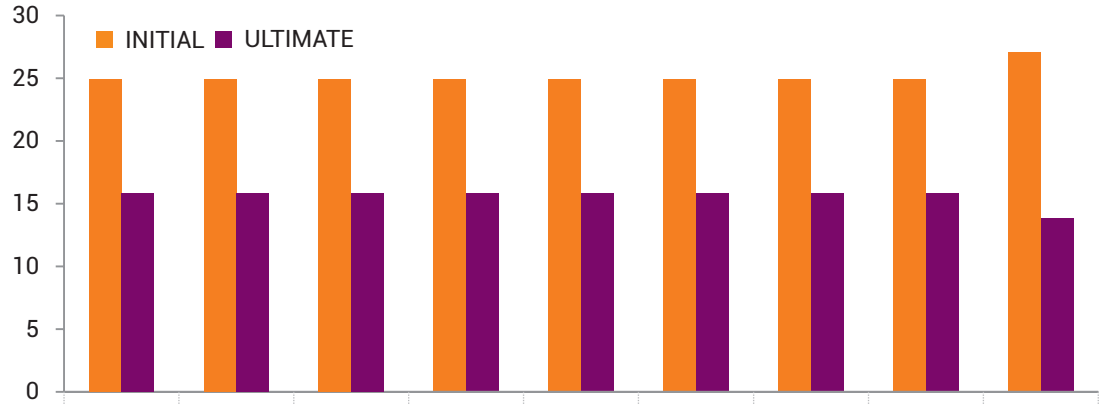
Krishna Godavari



	Apr 08	Apr 09	Apr 10	Apr 11	Apr 12	Apr 13	Apr 14	Apr 15	Apr 16
INITIAL	696	686	714	717	763	764	944	960	868
ULTIMATE	411	402	414	414	450	450	514	525	533

Fig. 6.7

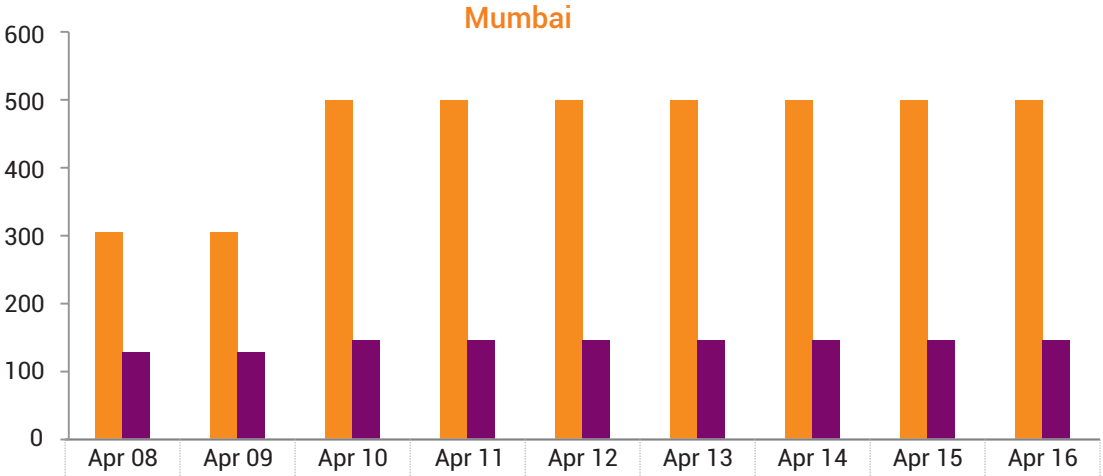
Mahanadi



	Apr 08	Apr 09	Apr 10	Apr 11	Apr 12	Apr 13	Apr 14	Apr 15	Apr 16
INITIAL	27	27	27	27	27	27	27	27	27
ULTIMATE	14	14	14	14	14	14	14	14	14

Fig. 6.8

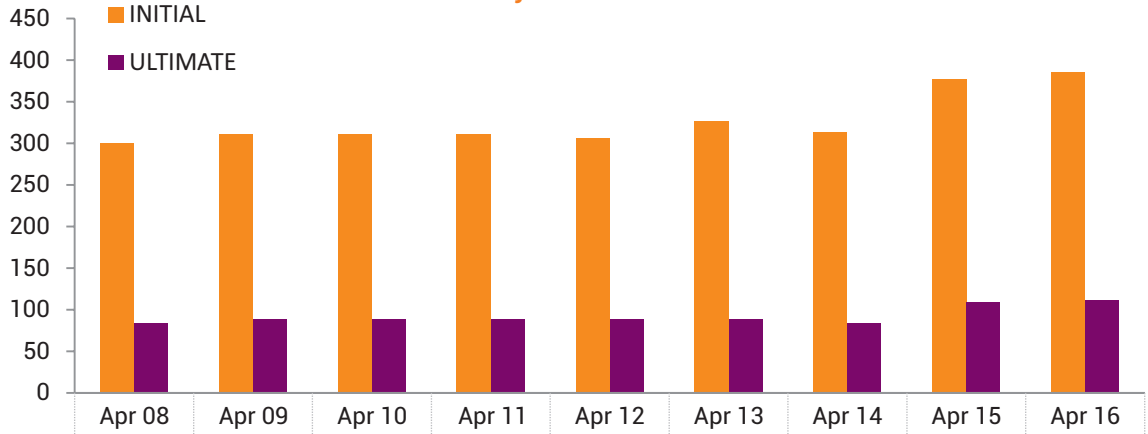
Mumbai



	Apr 08	Apr 09	Apr 10	Apr 11	Apr 12	Apr 13	Apr 14	Apr 15	Apr 16
INITIAL	309	309	505	505	505	505	505	505	505
ULTIMATE	130	130	148	148	148	148	148	148	148

Fig. 6.9

Rajasthan



	Apr 08	Apr 09	Apr 10	Apr 11	Apr 12	Apr 13	Apr 14	Apr 15	Apr 16
INITIAL	300	310	310	310	306	326	313	376	386
ULTIMATE	83	88	88	88	88	88	83	108	111

Fig. 6.10

Table 6.7: State-wise In-place volume (O + OEG in MMT) Distribution under PSC Regime (as on 01.04.2016)

Location/ Area	In-Place
Andhra Pradesh	32.237
Arunanchal Pradesh	15.274
Assam	12.141
Eastern Offshore	906.525
Gujarat	108.412
Jharkhand	58.119
Madhya Pradesh	103.356
Rajasthan	385.711
Tamil Nadu	35.019
Tripura	34.321
West Bengal	122.568
Western Offshore	543.563
Grand Total	**2357.245**

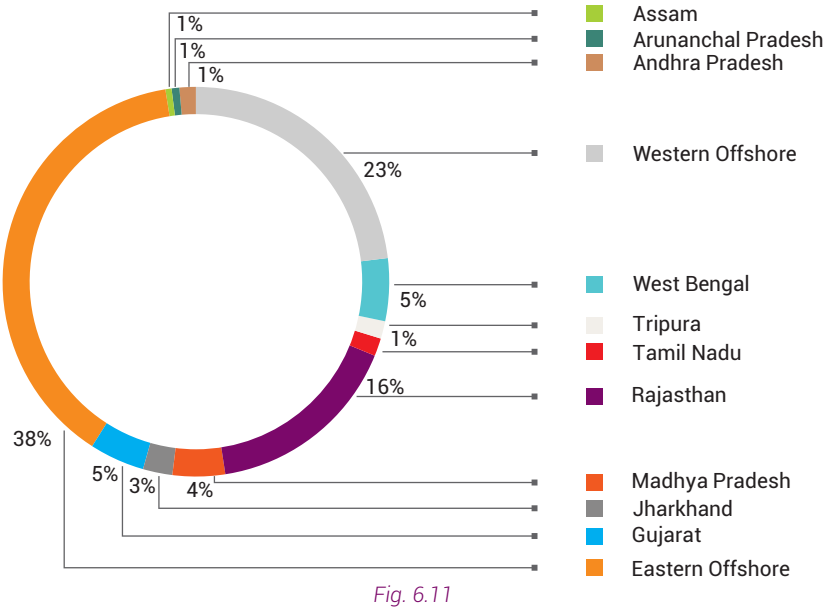


Fig. 6.11

Table 6.8: Bidding Round-wise In-place volume (O + OEG in MMT) Distribution under PSC Regime (as on 01.04.2016)

Bidding Round	In-Place
CBM	284.043
Field	698.798
NELP I	692.716
NELP II	8.914
NELP III	75.747
NELP IV	69.794
NELP V	38.295
NELP VI	30.459
Pre-NELP	458.479
Grand Total	**2357.245**

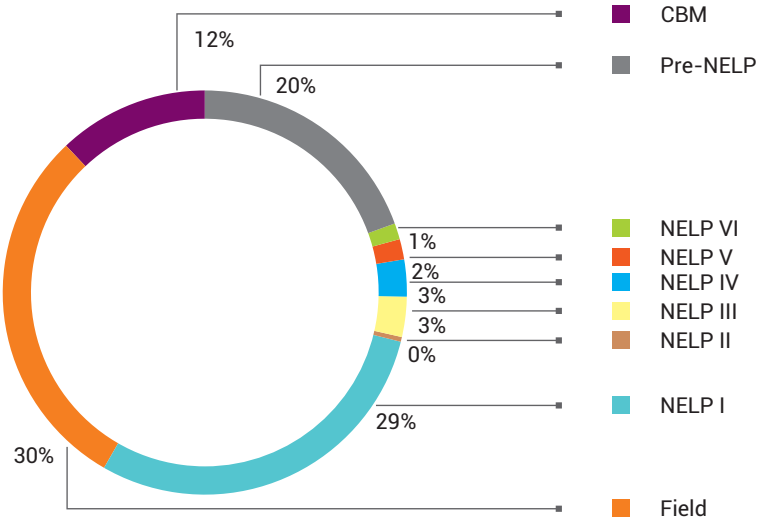


Fig. 6.12

Table 6.9 : Major contribution to accretion of in-place reserves was from following blocks (FY 2015-16):

Block Name	Accretion of in-place reserves	Details
CB-OS/2	1.356	2P data as provided by Operator considered for Lakshmi and Gauri fields.
KG-DWN-98/2	20.461	FDP of Cluster-II discoveries (A2,P1,M3,M1,M4,G2-2,R1,U3,U1,A1)
RAVVA	8.596	2P data as provided by Operator considered.
DHOLKA	1.909	Revised by MC
RJ-ON-90/1	9.478	Aishwariya RFDP (2015), KW#2, 3, 6 -FDP (2015)
CY-ONN-2002/2	30.415	FDP of MADNAM#3, 5, 6
CY-ONN-2004/2	1.624	DoC of PN#8 discovery
JHARIA	3.041	Revised as per approved FDP

6.5 RESERVE REPLACEMENT RATIO (RRR)

RRR is a parameter to judge the operating performance of an oil and gas exploration and production company. The Reserve Replacement Ratio provides an estimate of the amount of reserves added to a company's reserve base during the year relative to the amount of oil and gas produced. A reserve replacement ratio if greater than 1 indicates stable demand condition environments and suggest that reserves are added up along with simultaneous draining out of reserves through continued production. The trend of Reserve Replacement Ratio (RRR) of crude oil and natural gas under the PSC regime during the period as on 01.04.2008 to 01.04.2016 is shown in the graph below.

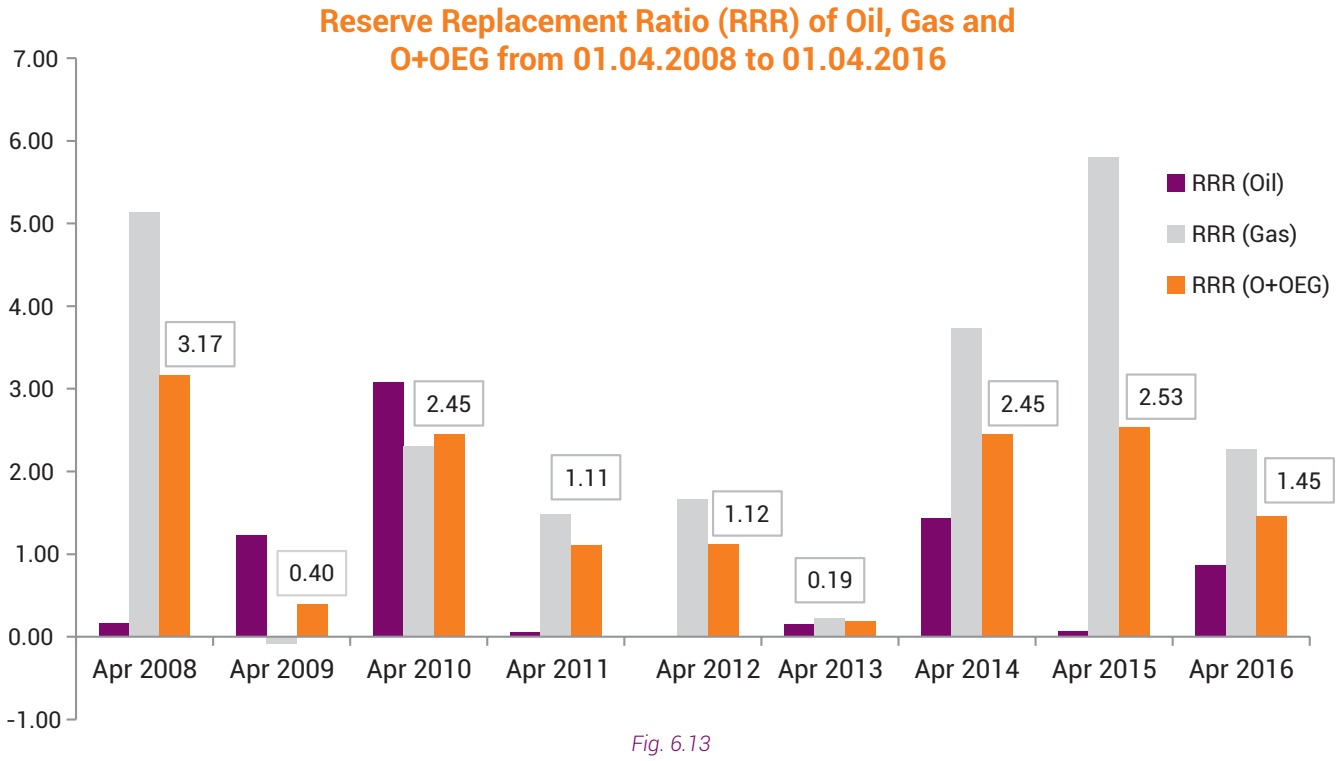
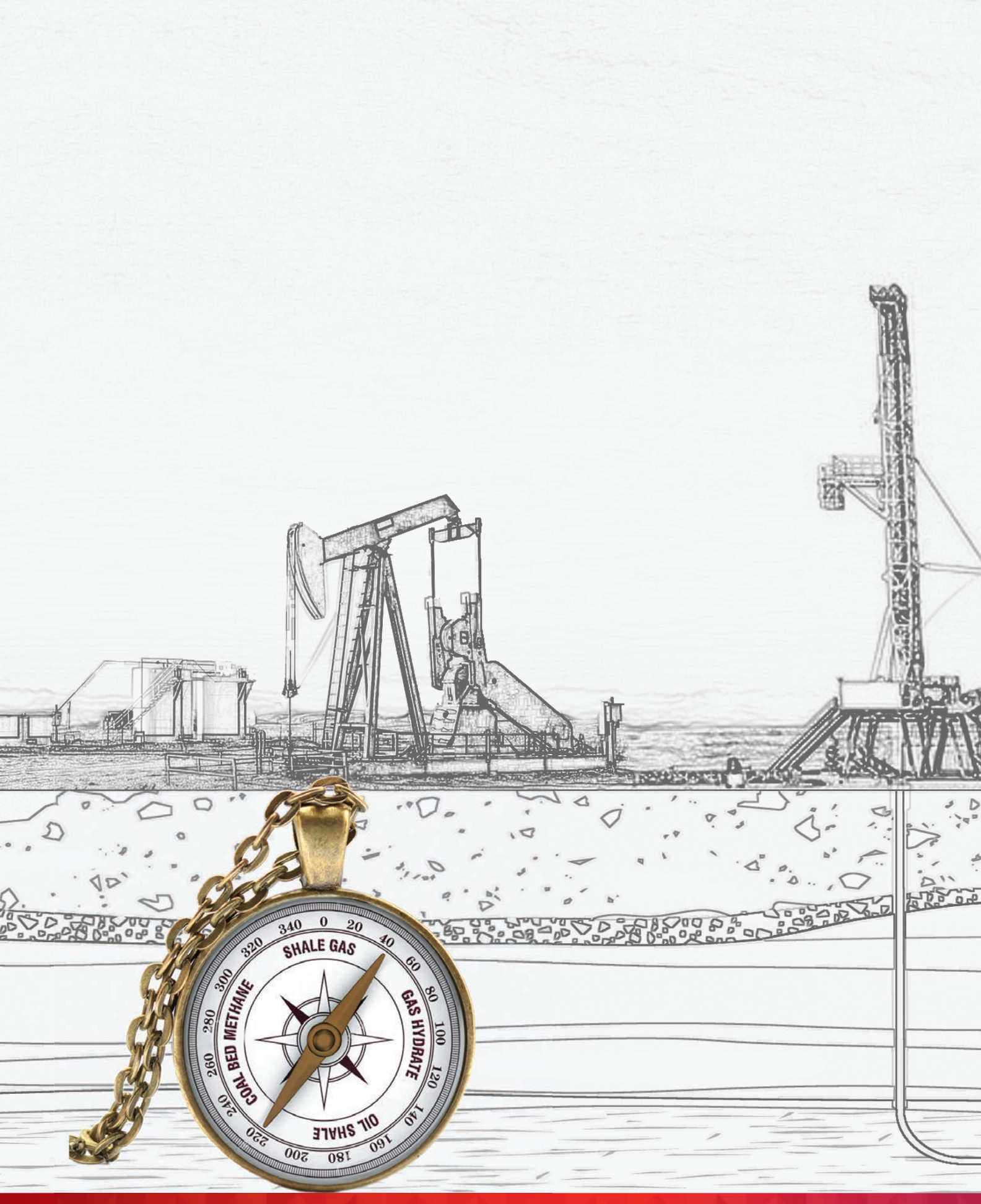


Fig. 6.13

Table 6.10: Trend of Reserve Accretion Production & RRR under PSC regime.

	Reserve accretion			Production			RRR		
As on	OIL+COND (MMT)	Gas (BCM)	O + OEG (MMT)	OIL+COND (MMT)	Gas (BCM)	O + OEG (MMT)	Oil	Gas	O+OEG
01.04.2008	0.85	39.73	40.58	5.09	7.73	12.81	0.17	5.14	3.17
01.04.2009	5.76	-0.71	5.05	4.67	8.09	12.76	1.23	-0.09	0.40
01.04.2010	16.20	50.56	66.76	5.26	21.99	27.25	3.08	2.30	2.45
01.04.2011	0.57	39.83	40.40	9.68	26.77	36.46	0.06	1.49	1.11
01.04.2012	0.00	35.92	35.92	10.53	21.61	32.14	0.00	1.66	1.12
01.04.2013	1.71	3.24	4.96	11.64	14.49	26.13	0.15	0.22	0.19
01.04.2014	17.37	35.50	52.88	12.08	9.50	21.57	1.44	3.74	2.45
01.04.2015	0.80	51.71	52.51	11.82	8.92	20.74	0.07	5.80	2.53
01.04.2016	9.822	18.669	28.491	11.36	8.23	19.59	0.86	2.27	1.45

NGHP-2 Research Drilling Vessel CHIKYU


SHALE GAS
GAS HYDRATE
OIL SHALE
COAL BED METHANE
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340

Chapter 7

Unconventional

Hydrocarbons

Coal Bed Methane

Shale Gas/Oil

Gas Hydrates

7 Unconventional Hydrocarbons

7.1 COAL BED METHANE (CBM)

In order to harness CBM potential in the country, the Government of India formulated CBM Policy in 1997, wherein CBM being Natural Gas is explored and exploited under the provisions of Oil Fields (Regulation and 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). The CBM development in India gained momentum with the announcement of Coal Bed Methane (CBM) policy in 1997 which laid the foundation of commercial exploitation of CBM in India. As per the policy, Ministry of Petroleum & Natural Gas (MoP&NG) became the administrative body and Directorate General of Hydrocarbons (DGH) was made the nodal agency for development of CBM in the country. To facilitate implementation of CBM policy, a MoU has been signed between Ministry of Petroleum & Natural Gas (MoP&NG) and Ministry of Coal (MoC).

India has the fifth largest proven coal reserves in the world and thus holds significant prospects for exploration and exploitation of CBM. The prognosticated CBM resources in the country are about 92 TCF (2600 BCM) in 12 states of India. CBM blocks were carved out by DGH in close interaction with Ministry of Coal (MoC), GSI & Central Mine Planning and Design Institute (CMPDI), Ranchi. Under the CBM policy, till date, four bidding rounds of CBM 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] which covers 16,613 sq. km out of the total available coal bearing areas for CBM exploration of 26,000 sq. km. While identifying the blocks for CBM development, such areas where coal mining was not envisaged for the next 15-20 years have been considered. To date, most CBM exploration and production activities in India is pursued by domestic Indian companies. Total prognosticated CBM resource for awarded 33 CBM blocks, is about 62.4 TCF (1767 BCM), of which, so far, 9.9 TCF (280.34 BCM) has been established as Gas in Place (GIP).

The Gondwana sediments of Eastern India host the bulk of India's coal reserves and all the current CBM producing blocks. The vast majority of the best prospective areas for CBM development are in Eastern India, situated in Damodar Koel valley and Son valley. CBM projects exist in Raniganj South, Raniganj East and Raniganj North areas in the Raniganj coalfield, the Parbatpur block in Jharia coalfield and the East and West Bokaro coalfields. Son valley includes the Sonhat North and Sohagpur East and West blocks. Currently, commercial production has commenced from Raniganj South CBM block operated by M/s. GEECL since July 2007.

As on March 2016, CBM production is around 1.168 MMSCMD from 4 CBM blocks which includes test gas production from 3 CBM blocks and commercial production from one CBM block. Eight more CBM blocks are expected to start commercial production in near future. The total CBM production is expected to be around 5.7 MMSCMD by 2018.

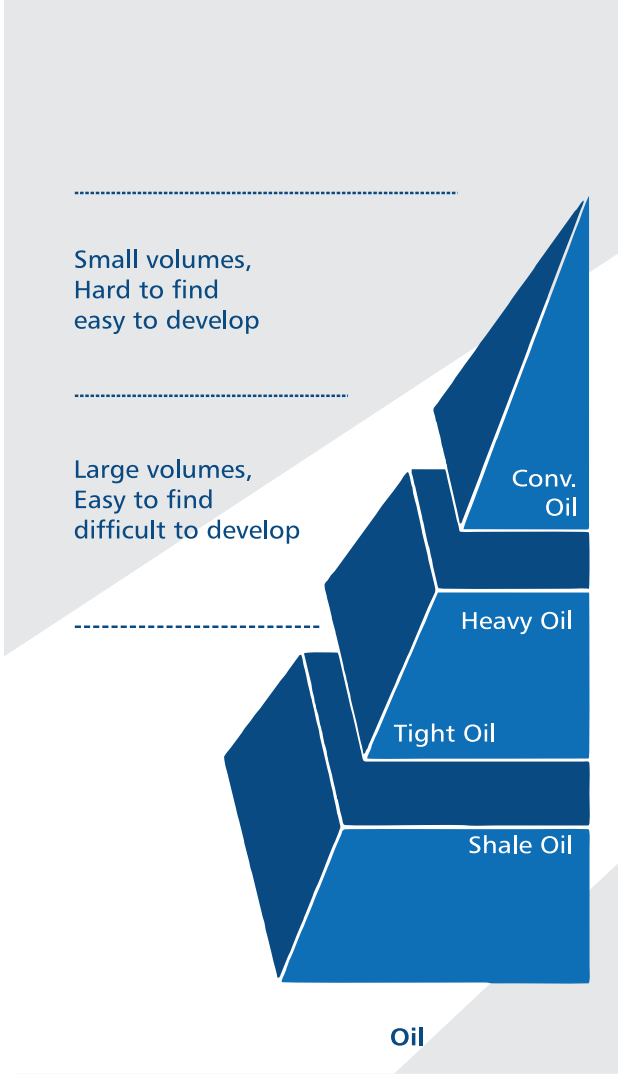
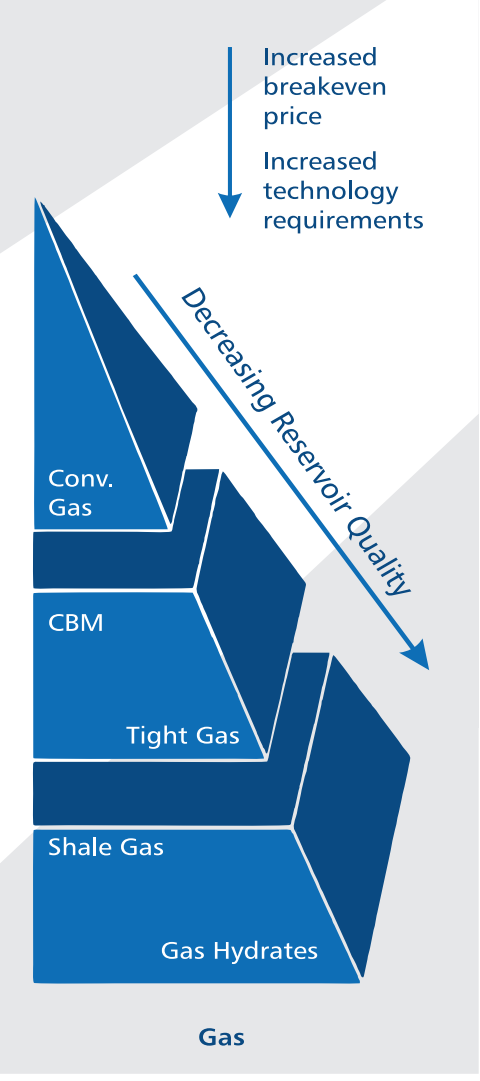


Table 7.1 : State-wise Distribution of CBM Resources in India

Sl. No.	State	Prognosticated CBM Resources (in BCM)	Prognosticated CBM Resources (in TCF)	Established CBM Reserves
1	JHARKHAND	722.08	25.5	1.916
2	RAJASTHAN	359.62	12.7	0
3	GUJARAT	351.13	12.4	0
4	ODISHA	243.52	8.6	0
5	CHHATTISGARH	240.69	8.5	0
6	MADHYA PRADESH	218.04	7.7	3.65
7	WEST BENGAL	218.04	7.7	4.33
8	TAMIL NADU	104.77	3.7	0
9 &10	TELANGANA & ANDHRA PRADESH	99.11	3.5	0
11	MAHARASHTRA	33.98	1.2	0
12	NORTH EAST	8.50	0.3	0
TOTAL		**2599.48**	**91.8**	**9.9**

Conversion factor: 1 cubic metre = 35.3147 cubic feet



GGS Installed in CBM block SP (West)-CBM-2001/I in Madhya Pradesh

Table 7.2 : In-Place CBM Reserves

Sl. No.	State	Block name	Operator	Approx area (sq. km.)	GIIP (BCM)	GIIP (TCF)	Recoverable Reserves (BCM)	Recoverable Reserves (TCF)
1	West Bengal	RG(E)-CBM-2001/1	EOL	500	60.881	2.15	28.12	0.993
2	Jharkhand	BK-CBM-2001/1	ONGC	95	30.182	1.06	3.68	0.130
3	Jharkhand	NK-CBM-2001/1	ONGC	340	9.529	0.34	1.46	0.052
4	Madhya Pradesh	SP(E)-CBM-2001/1	RIL	495	47.855	1.69	17.56	0.620
5	Madhya Pradesh	SP(W)-CBM-2001/1	RIL	500	55.501	1.96	18.97	0.670
6	West Bengal	RANIGANJ NORTH	ONGC	350	7.430	0.26	1.86	0.066
7	Jharkhand	JHARIA	ONGC	85	14.610	0.52	3.04	0.107
8	West Bengal	RANIGANJ SOUTH	GEECL	210	54.368	1.92	37.94	1.340
			Total	**2575**	**280.357**	**9.9**	**112.63**	**3.978**

Table 7.3 : Snapshot of CBM in India

CBM Policy formulated in:	**1997**
MoU signed between MoP&NG & MoC	**09.09.1997**
Total CBM rounds conducted	**4**
No. of CBM Blocks awarded	**33**
Coal bearing Area identified for CBM	**26,000 Sq. Km.**
Area covered under 33 CBM Blocks	**16, 613 Sq. Km.**
CBM Resources identified in the area made available (26,000 sq. km.)	**2600 BCM (91.8 TCF)**
CBM Resources (in 33 Blocks)	**1767 BCM (62.4 TCF)**
Established CBM Reserves (Gas in Place-GIP)	**280.34 BCM (9.9TCF)**
Commercial Production commenced	**July 2007**
Total No. of CBM Wells drilled	**725**
Investment made so far	**USD 1.4 Billion**
Present Gas Production (as on March 2016)	**1.168 MMSCMD from 4 CBM blocks**
No. of CBM Blocks in Production Phase	**2**
No. of CBM Blocks in Development Phase	**6**
No. of CBM Blocks in Exploration Phase	**4**
No. of CBM Blocks relinquished	**4**
No. of CBM Blocks awaiting PEL	**2**
No. of CBM Blocks under relinquishment	**14**
Annual CBM production in FY 2015-16	**392.87 MMSCM**

Table 7.4 : Status of CBM Blocks (as on 31.03.2016)

Sl. No.	Block	Coalfield	State	Contractor (PI%)	Date of signing contract	Present area (sq. km.)	Present Status
				CBM BLOCKS OFFERED ON NOMINATION/FIPB ROUTE			
1	Raniganj (South)	Raniganj	West Bengal	**GEECL** (100)	31.05.2001	210	Production Phase
2	Raniganj (North)	Raniganj	West Bengal	**ONGC** (74)-CIL (26)	06.02.2003	311.8	Development
3	Jharia	Jharia	Jharkhand	**ONGC** (90)-CIL (10)	06.02.2003	65.1	Development
				CBM ROUND-I			
4	RG(East)-CBM-2001/I	Raniganj	West Bengal	**EOL** (100)	26.07.2002	500	Development
5	SP(East)-CBM-2001/I	Sohagpur	Madhya Pradesh	**RIL** (100)	26.07.2002	495	Development
6	SP(West)-CBM-2001/I	Sohagpur	Madhya Pradesh	**RIL** (100)	26.07.2002	500	Development
7	BK-CBM-2001/I	Bokaro	Jharkhand	**ONGC** (80)-IOC (20)	26.07.2002	74.1	Development
8	NK-CBM-2001/I	North Karanpura	Jharkhand	**ONGC** (55)-IOC (20)-PEPL (25)	26.07.2002	271.5	Development
				CBM ROUND-II			
9	SH(N)-CBM-2003/II	Sonhat	Chhattisgarh	**RIL** (100)	06.02.2004	825	Under relinquishment
10	BS(1)-CBM-2003/II	Barmer Sanchor	Rajasthan	**RIL** (100)	06.02.2004	1045	Under relinquishment
11	BS(2)-CBM-2003/II	Barmer Sanchor	Rajasthan	**RIL** (100)	06.02.2004	1020	Under relinquishment
12	SK-CBM-2003/II	South Karanpura	Jharkhand	**ONGC** (100)	06.02.2004	70	Under relinquishment
13	NK(W)-CBM-2003/II	North Karanpura	Jharkhand	**ONGC** (100)	06.02.2004	267	Under relinquishment
14	ST-CBM-2003/II*	Satpura	Madhya Pradesh	**ONGC** (100)	06.02.2004	714	Relinquished
15	WD-CBM-2003/II*	Wardha	Maharashtra	**ONGC** (100)	06.02.2004	503	Relinquished
16	BS(3)-CBM-2003/II*	Barmer Sanchor	Rajasthan	**ONGC** (70)-GSPC (30)	06.02.2004	790	Relinquished
				CBM ROUND-III			
17	SP(N)-CBM-2005/III	Sohagpur	Madhya Pradesh	**R-Infra** (55)-RNRL (45)	07.11.2006	609	Exploration
18	SR-CBM-2005/III	Singrauli	Madhya Pradesh	**DIL** (90)-Coal Gas Mart (10)	07.11.2006	330	Exploration
19	RM-CBM-2005/III	Rajmahal	Jharkhand	**Dart Energy** (35)-GAIL (35)-EIG (15)-TATA Power (15)	07.11.2006	469	Under relinquishment
20	GV(N)-CBM-2005/III	Godavari	Telangana	Coal Gas (10)-**DIL** (40)-Adinath (50)	07.11.2006	386	Under relinquishment
21	BB-CBM-2005/III	Birbhum	West Bengal	**British Petroleum** (100)	16.11.2006	248	Under relinquishment
22	MR-CBM-2005/III	Mand Raigarh	Chhattisgarh	**Dart Energy** (35)-GAIL (35)-EIG (15)-TATA Power (15)	07.11.2006	634	Under relinquishment
23	TR-CBM-2005/III	Tatapani Ramkola	Chhattisgarh	**Dart Energy** (35)-GAIL (35)-EIG (15)-TATA Power (15)	07.11.2006	458	Under relinquishment
24	BS(4)-CBM-2005/III	Barmer Sanchor	Rajasthan	REL (45)-RNRL (45)-**Geopetrol** (10)	07.11.2006	1168	Under relinquishment
25	BS(5)-CBM-2005/III	Barmer Sanchor	Rajasthan	REL (45)-RNRL (45)-**Geopetrol** (10)	07.11.2006	739	Under relinquishment
26	KG(E)-CBM-2005/III	Kothagudem	Andhra Pradesh	REL (45) – RNRL(45) - **Geopetrol** (10)	07.11.2006	750	Under relinquishment
				CBM ROUND-IV			
27	AS-CBM-2008/IV	Assam	Assam	**Dart Energy** (10)-OIL (90)	29.07.2010	113	Under relinquishment
28	MG-CBM-2008/IV	Mannargudi	Tamil Nadu	**GEECL** (100)	29.07.2010	667	Under Arbitration
29	RM(E)-CBM-2008/IV	Rajmahal	Jharkhand	**EOL** (100)	29.07.2010	1128	Exploration
30	TL-CBM-2008/IV	Talcher	Odisha	**EOL** (100)	29.07.2010	557	PEL awaited
31	IB-CBM-2008/IV	Ib Valley	Odisha	**EOL** (100)	29.07.2010	209	PEL awaited
32	SP(NE)-CBM-2008/IV	Sohagpur	Madhya Pradesh & Chhattisgarh	**EOL** (100)	29.07.2010	339	Exploration
33	ST-CBM-2008/IV*	Satpura	Madhya Pradesh	**Dart Energy** (80)-Tata Power (20)	29.07.2010	714	Relinquished

Operator has been marked Bold

*Exit option exercised by Contractor & approved by GoI

7.2 SHALE GAS AND OIL

Shale Gas and Oil exploration policy was announced on 14th October, 2013 by the Govt. of India for National Oil Companies to explore and exploit shale oil and gas resources in nomination areas. As per policy guidelines, ONGC and OIL are required to carry out exploration in 50 and 6 blocks respectively.

7.2.1 Oil India Ltd. (OIL): Activities during 2015-16

OIL is presently carrying out shale gas and oil exploration in two onland basins namely Assam & Arakan and Jaisalmer basin. OIL has initially identified five Blocks, viz. Dibrugarh, Chabua, Dumduma, Jaisalmer and Jairampur from its Nomination acreages and later on identified one more block (Deomali PEL) and started G&G evaluation. OIL has completed G&G evaluation of four Blocks i.e, Dibrugarh PML, Chabua PML, Dumduma PML and Jaisalmer PML. The reports have been submitted to OIL's Management for peer review before finalisation. Jairampur Extension PEL and Deomali PEL are situated in thrust best area of Upper Assam basin which have paucity of G&G data. In this regard, OIL has planned to drill three core holes up to a maximum depth of 2000 m in these two areas to acquire additional G&G information.

7.2.2 Oil And Natural Gas Corporation (ONGC): Activities during 2015-16

ONGC is presently carrying out shale gas and oil exploration in four onland basins namely, Cambay, KG, Cauvery, Assam and Assam-Arakan. As on date, a total of twelve (Cambay: NGSGA, NJSGA, PJSGA, NDSGA, WRSGA, LJSGA, PLSGA; KG: MGSGA, WGSGA, MDSGA; Cauvery: KUSGA, TKDSGA) exploratory locations for shale gas and oil are available for drilling in 2016-17 and subsequent year. In addition, coring and other data collection are planned in suitable exploratory wells in identified blocks. ONGC has drilled 18 wells so far and one well is under drilling. So far 69 crores have been collected in 17 wells.

During the current year 2015-16, ONGC has completed coring and other data collection programme in six wells (four in Cambay and one each in KG and Cauvery basins) in different blocks. These data will help in assessment of the shale gas and oil potential of respective blocks.

Three of these wells GNSGB, GNSGC and GNSGD were drilled in Cambay basin exclusively for shale gas and oil. Besides the drilling of above mentioned shale gas and oil wells, ONGC has also carried out hydro-fracturing in one well JMSGA which was drilled in 2013-14.

7.2.3 Other Activities – International Shale Gas and Oil Workshop - 2016

In order to accelerate shale gas and oil development in the country at the most appropriate time, a two-day "International Shale Gas and Oil Workshop" was organized by DGH on 28th to 29th January 2016 in New Delhi. The broad objectives of the workshop were two-fold:

- Devise policy framework for facilitating and regulating shale development in India
- Establish favorable regulatory and fiscal environment for stakeholders to promote investment and infrastructure development

It was attended by industry personnel involved in shale gas and oil operations from India and various other countries besides officials from regulatory authorities, the Ministry of Petroleum and Natural Gas (MoP&NG), consultancy companies and academicians.

A total of 26 presentations, spread over 9 sessions, were made and their brief details are as below:

- The composition of participating speakers was 60% international and 40% Indian
- Speakers included representatives from operating companies (national oil companies and private), service providers, consultancy companies, academic and research institutes.
- Topics covered encompassed technological improvements, below and above ground issues, Indian experience, International experiences/ case studies, socio-environmental aspects, policies regulations and fiscal terms.

A poster competition was also held with participation of 39 representatives from 11 universities. The students interacted with the Hon'ble minister and highlighted the salient points of their posters.


International
SHALE GAS & OIL
WORKSHOP 2016, India
28th & 29th January, 2016 at The Taj Mahal Hotel, New Delhi
Under the aegis of


Right time to go for Shale Play
International
SHALE GAS & OIL
GSPC

7.3 GAS HYDRATES

7.3.1 Activities in India

Gas Hydrates can be an unconventional future energy source world over. World over the production of gas from gas hydrates are at R&D stage. USA, Japan, Russia, China, Germany and Korea are deeply involved in developing a technology to exploit these proved Gas hydrates reserves.

In India, Gas hydrate research and exploratory activities are being steered by the Ministry of Petroleum & Natural Gas under National Gas Hydrate Program (NGHP). The presence of Gas Hydrate is established in Krishna-Godavari, Mahanadi, Gulf of Mannar and Andaman Basin.

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

NGHP-Expedition-02 was approved in 15th Steering Committee held in (Oct '2013) and the 17th Steering Committee (in Jan'2015) approved the expenditure of USD 101.12 Million (Rs 616.95 crores) for the NGHP-Expedition-02. The cost of NGHP Expedition-02 is shared by OIDB (50%), ONGC (20%), OIL (10%), GAIL (10%) and IOCL (10%). ONGC was mandated to execute NGHP-02 by hiring suitable vessel and integrated services.

NGHP-02 was commenced on 3rd March 2015 and has been completed on 28th July 2015. Total 42 wells drilled at 25 sites in Krishna-Godavari and Mahanadi area in sand reservoirs for gas hydrates. LWD was completed in 25 wells in 4 areas A, B C & E. Coring and wire line logging was carried out in 17 wells in areas 'B' 'C' & 'E'.

NGHP-02 has discovered significant gas-hydrate-bearing sand reservoir system in the Krishna-Godavari B, C and E area. Area A, which is in the Mahanadi deep water basin, has several sand zones devoid of gas hydrates. Identified two distinct gas hydrate accumulations in Krishna-Godavari Basin, one is approximately 20 to 100 m thick, layer-type, depths 400 m and other accumulation is a fracture-type unit of variable thickness at shallow levels.

To chalk out a way forward plan for NGHP Exp-03, a meeting was held with reputed international scientists/experts on 1st Feb & 2nd Feb 2016 at DGH & on 3rd Feb 2016 in New Delhi. The Gas Hydrate experts from Japan and USA had attended the meeting. The deliberations on the first two days, i.e 1st Feb & 2nd Feb 2016 were held at Workstations/conference room of DGH and were technically intensive. These deliberations concluded on the 3rd Feb 2016 in Hotel Claridges, New Delhi.

The brief outcome of the deliberations during the 3-day meet concluded that NGHP Expedition-02 results are encouraging and further extensive studies to be carried out to assess the gas hydrate resource potential, reservoir characterization, reservoir de-lineation

and geo-mechanical modelling for seafloor and wellbore stability and identification of sites for pilot production for testing. KG deep offshore Area 'B' & 'C' contain gas hydrate accumulations which can be suitable sites for future gas hydrate production testing under NGHP Exp-03.

7.3.2 Research Projects Under NGHP

Two NGHP R & D projects under direct funding by OIDB were approved in 15th steering committee and 1st installment of funds to the executing organizations has been released.

The first NGHP R & D project of KDMIPE, ONGC with IIT-Kanpur entitled "Modelling and Simulation of Methane Extraction from Gas Hydrates via Simultaneous Depressurization and CO_2 injection", was taken up with an aim to design a simulator with all dynamic variables and estimate methane release per unit time.

The second project of NGRI entitled, "Carbon Dioxide & Methane Hydrate phase stability in sandy and clay environment: Laboratory studies" approved under NGHP

funding was formulated to carry out the CO_2 phase stability experiments using synthetic sand & clay particles and to find out the rate of methane yield due to depressurization.

7.3.3 Future Plan for NGHP-Exp-03

The Expedition-03 aims at carrying out pilot production testing after a thorough study of the data collected in the two earlier expeditions, planning and designing a suitable production testing method, understanding of environmental impacts of attempting a pilot production testing.

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 under way 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.

7.4 OIL SHALE

7.4.1 Oil Shale activities during 2015-16:

In order to obtain good Oil Shale samples, a team comprising of representatives from DGH along with a geologist and a scientist from IOCL's R&D Centre-Faridabad visited Tikaka colliery, Margherita coalfield, Assam from 10th to 11th December 2015. The team collected Oil Shale samples to study the hydrocarbon potential of these samples at IOCL, R&D centre, Faridabad. Presently, the studies on the collected Oil Shale samples are being carried out at the centre.

DGH had entered into an MoU with IOCL, R&D Centre-Faridabad on 3rd January 2013 for tenure of 3 years with an aim to develop Oil Shale as alternate source of Energy leading to energy security of the nation. The validity of the MoU was over on 2nd January 2016. In view of the positive outcome of the ongoing studies carried out by IOCL-R&D centre, it was strongly felt that this MoU should be extended for another three years i.e; from 3rd January 2016 to 2nd January 2019 on same terms and conditions with an aim to:

- Finish the extensive studies on the samples in hand which may shed light on the potential of shale available in the Assam colliery.
- Study the Oil shale samples available in other parts of the country.

7.5 UNDERGROUND COAL GASIFICATION (UCG)

Underground Coal Gasification (UCG) is a method of converting unworked coal - coal still in the ground - into a combustible gas which can be used for industrial heating, power generation or the manufacture of hydrogen, synthetic natural gas or diesel fuel. With a vast proven reserve of coal, India has the potential to use Underground Coal Gasification (UCG) technology to effectively utilize coal. UCG is a new well proven technology of coal extraction that is being investigated and implemented around the world and that avoids most of the challenges of coal mining. Development of UCG is envisaged to provide for energy security.

Government has approved a policy framework on 16.12.2015 for development of Underground Coal Gasification (UCG) in coal and lignite bearing areas in the country. A policy on the lines broadly similar to the existing policy for Coal Bed Methane (CBM) development on revenue sharing basis will be adopted for offering the blocks through competitive bidding. An Inter-Ministerial Committee (IMC) under the Ministry of Coal with members from concerned Ministries will be responsible for identification of the areas, deciding about blocks to be put to bidding or awarding them to PSUs on nomination basis. Representative of DGH is a member of the IMC to provide necessary support so as to frame the Model Contract. In addition, Ministry of Coal may engage a consultant for development of the contract document and development of bid documents, work programme, conducting the bidding process, evaluation of bids, monitoring and process protocols, etc., Central Mine Planning and Design Institute Limited (CMPDIL) will be the nodal agency. In the perspective of next two years some explored blocks will be identified for offer. Subsequently, additional blocks will be identified for offer in the long term.

ONGC* has also taken an initiative to test the UCG technology in India for which R&D Pilot Projects are being carried out as per the recommendations of the consultant from the SIM of Russia to establish UCG technology.

ONGC has signed an Agreement of Collaboration (AoC) with M/s National Mining Research Center-Skochinsky Institute of Mining (NMRC-SIM), Russia on 25th November 2004 to co-operate in the Services, Operations, Development and Research related to Under Ground Coal Gasification (UCG) in India which has been further renewed up to March 4, 2020. The project is envisaged to be completed in phases comprising of various stages right from site selection to construction of UCG Enterprise.

ONGC has taken up Vastan Mine block site belonging to GIPCL in Naninaroli, Surat district, Gujarat as an R&D Pilot Project to establish UCG technology in collaboration with M/s Skochinsky Institute of Mining (SIM), Russia. All the ground work and inputs for construction and implementation of UCG Pilot Project at Vastan, has been completed since 2009. Further, development and project execution will be carried out by a joint venture between GIPCL & ONGC for Underground Coal Gasification purposes.

Further, a number of sites have been jointly identified by ONGC & Neyveli Lignite Corporation Limited (NLC) for studying their suitability to UCG. These are Tadkeshwar in Gujarat and Hodu-Sindhari & East Kurla in Rajasthan. One more site was jointly identified by ONGC & GMDC viz. Surkha in Bhavnagar district, Gujarat. The data of all the fields have already been analysed for evaluating the suitability of these sites for UCG. All the sites have been found suitable for UCG exploration. Once the technology is established in India, UCG will emerge as a major clean coal utilization technology capable of providing significant impact in our country in the near future.

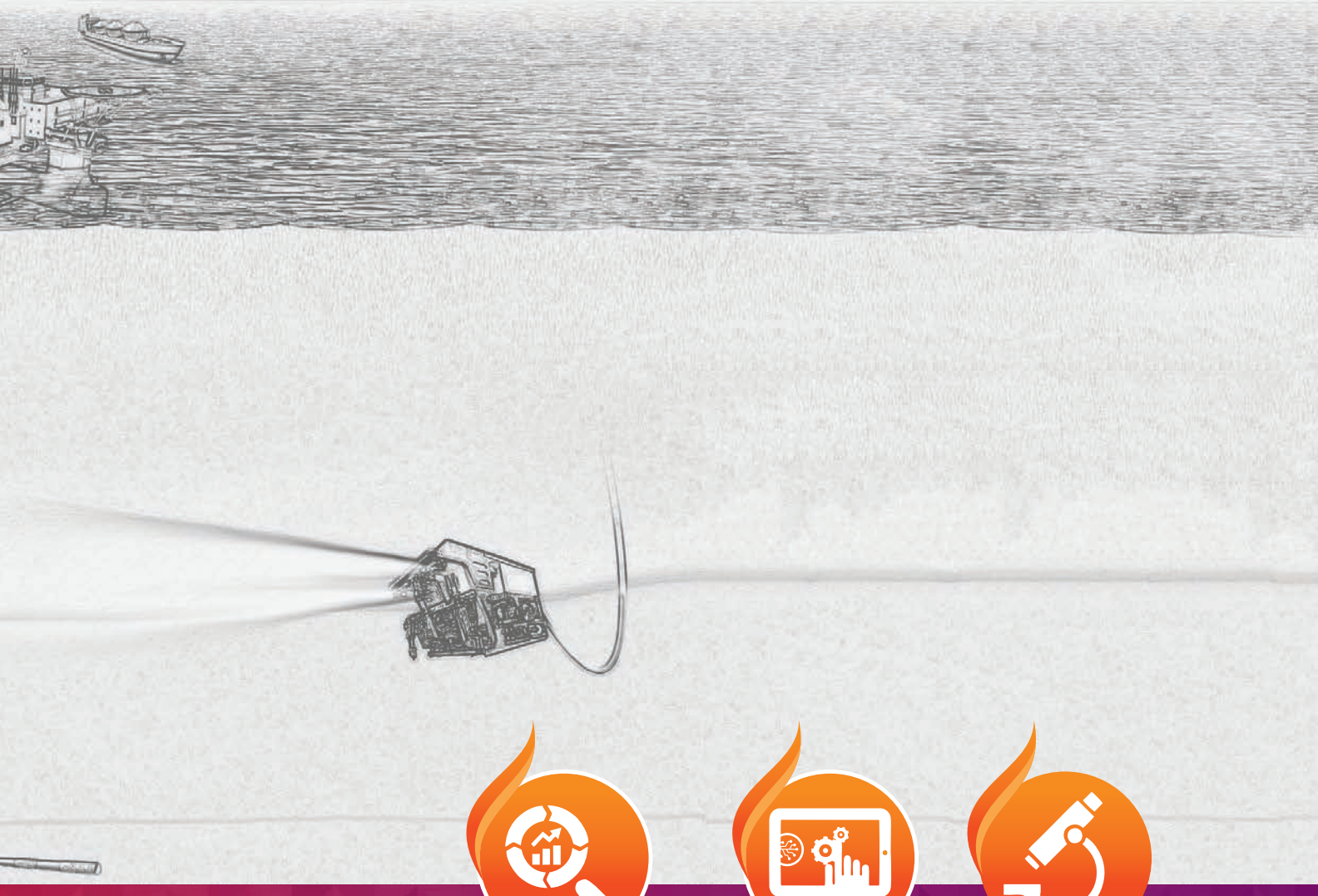
**Information as provided by ONGC*

NGHP-I Research drilling vessel
-Joides Resolution

Chapter 8

Technology

Initiatives



Improved Oil Recovery/ Enhanced Oil Recovery

New Technology

Special Studies

8 Technology Initiatives

8.1 ONGC

8.1.1 Exploration: New Technology Adopted during the Year and Benefits

(Table 8.1)

Sl. No.	New Technology Adopted/Used	Benefits
1	Digital multi-array tools for VSP data Acquisition	Enables Multi-level VSP acquisition with better fidelity.
2	Anisotropic Migration in seismic data processing	Reliable imaging by analysis of the Spatial and temporal variation of anisotropic parameters.
3	Litho Scanner-High Definition Spectroscopy in Shale gas wells	Better evaluation in terms of TOC of shale gas prospects.
4	Post Perforation dynamic under balance Production Enhancement (Rigless P3 perforation)	Excellent dynamic drawdown of around 1200 and 1000 PSI was achieved resulting in production enhancement of 1000 bopd.
5	Magnetic Resonance (MR) while Drilling through LWD (Mag Traklog)	Fluid type was identified with the help of Mag Trak log.
6	Induction of Surface Tension Analysis Technology	Selection of better microbial culture for surface tension and interfacial tension reduction.
7	New suite of Petroleum System Modelling solution consisting of Petrel and PetroMod software.	Enables to perform the Risk Assessment workflow with better accuracy by integrating seismic, well and geological information.
8	Tomo Facilitator from M/s.Paradigm	Velocity modelling and refinement.
9	Network Attached Storage (NAS) environment upgraded to 25 TB from Storage Area Network (SAN) environment.	Workload distribution for optimum resource utilization with higher efficiency.
10	Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)	To carry out heavy metal analysis in Sea water, Sediment samples, Fish samples, Benthos, Drill cuttings, Oil samples, etc. thereby enabling in taking corrective measures and increasing efficiency of effluent treatment plant so as to safeguard and protect the marine environment.
11.	Microwave Digestion System	Protecting the complete decomposition/loss and contamination of the matrix, reduction of handling and process time, etc. during pre-treatment of samples obtained from field prior to analysis.

8.1.2 Other methodology/technologies used during FY 2015-16

- New methodology using NMR-ECS-Density log combination using Noble Gas Mass Spectrometre (NGMS) for evaluation of Shale Gas prospects.
- Facies modelling based on hi-tech image logs includes identification and characterization of facies from Image logs and calibrate other conventional logs with image log with respect to facies and propagation of these facies in the entire Charada-Mansa area. Generation of maps, Fence diagram, Phi*He*So Maps, Relief Maps of Olpad-1 and Olpad-2 Facies, based on these processed log data and facies has been carried out. This study has helped in identification of prospective areas in Olpad-1 and Olpad-2 facies.
- Use of Low KCl Mud for drilling in A&AA Basin lead to increased stability of the wellbore even after long exposure of open hole.
- Clear testing fluid, calcium bromide in B-34-2, Mumbai Offshore Basin: HP-HT well requires higher specific gravity brine for testing HPHT wells. Clear testing fluid makes production testing job less complicated and safer than testing HC bearing zone in mud. Clear testing fluid will be used in future HP-HT wells. In well B-34-2, the object tested flowed Qo-1166bpd, Qg @ 117673 m3/d, with FTHP 700 psi through 5/8" choke.

8.1.3 Technology developed/tested in house and absorbed during the year for IOR / EOR processes:

- Cyclic Steam Stimulation (CSS) followed by Insitu combustion in Lanwa Field, Mehsana Asset.
- High Pressure Air injection in light oil fields, Gamij and Malleshwaram field.
- Polymer & ASP flooding in Bechraji, a heavy oil field (Avg. Viscosity of 270 cp) of Mehsana Asset
- Water Shut Off (WSO) and Profile Modification (PM) jobs in fields of ONGC
- Mitigation of Paraffin deposition in well tubular through Microbial treatment (PDB job using PDS-10).
- Sodium Nitrate Treatment for mitigation of H_2S in injectors of MHN and producers of MHS fields.
- MEOR jobs in extra heavy oil reservoirs like Charada and Lanwa.

8.1.4 Production: Some of the major technologies recently inducted in Onshore are as under :

1. Multi stage hydro-fracturing technology has been inducted in Onshore for the first time in Ahmedabad Asset for productivity improvements in tight sands of Chhatral reservoir of Gamij field. A total of 4 horizontal wells have been taken up for multi-stage hydro-fracturing. 3 wells have been successfully hydro-fractured out of which one has been put on production and the other wells are under activation/ completion.
2. Rajahmundry Asset has taken a major step forward for testing of HP-HT wells with clear fluid instead of earlier practice of using mud based fluid which had given limited success in a couple of wells out of 9 such wells tested. HPHT well WPGAA in Penugonda field was successfully tested with clear fluid, Calcium Bromide of 1.70 SG (14.2 ppg). All the tankages and the allied interconnecting piping to handle the clear fluid brine were designed and fabricated in-house.
3. In Assam Asset (Geleki field) well GKHB was facing multiple complications during drilling due to severe wellbore stability issues because of planned 'S' profile. These issues, like, stuck pipe, held ups, mud cut had led to side tracking the well three times. To overcome these challenges, 1D Mechanical Earth Models (MEM) were constructed for different well sections using Sonic scanner & Open hole logs. Based on Models, recommended mud weights were used for different sections leading to considerable reductions in wellbore issues and reduction in drilling time for 8.5" section.
4. For the first time in ONGC, Rajahmundry Asset executed High Rate Water Pack (HRWP) job for Gravel pack completion in well KV#29 of Kesavadaspalem field for containing production of sand from the reservoir. The GP job was completed using Weatherford–WFX style BlackCat GP Packer system.
5. Pad drilling is being adopted in Onshore for Additional Development of Gamij field. This has substantially reduced land required for development wells and saving of time in rig movements.
6. Sandface chemical dozing is being done for improved flow assurance in Lanwaheavy oil field of Mehsana Asset. 13 wells have been completed on Progressive Cavity Pump (PCP) systems with control line for chemical dozing.

8.1.5 Major new technologies introduced/being adopted in Offshore in the last few years:

a. **Segmented completion with Swell Packer & Sliding Sleeve:** Used in wells of Western Offshore to isolate water bearing zones/zones not to be comingled using open-hole swell packers and allowing flow through sliding sleeves / inflow control valves.

b. **Multi Finger Imaging (MIT) Tool:** A corrosion survey tool deployed in tubing. It helps in implementing mitigation measures at the early stages to avoid well down time.

c. **Proppant Hydro-fracturing of Basal Clastics and Basement** has been successfully implemented in Western Offshore wells and similar jobs are planned for other wells in Basal Clastics layer.

d. **Encapsulated Acid Emulsion Dispersant System (EAEDS)** has been successfully implemented in offshore for deep penetration in the reservoir and subsequently releasing the encapsulated acid in pores resulting in improved well productivity.

e. **StethoScope 825,** a new generation Formation Pressure While Drilling (FPWD) tool introduced in Mumbai offshore, allows optimising mud weight to ensure safe and efficient drilling and in turn the well bore stability.

f. **CO_2 tracer survey:** New technologies for Gas lift surveillance "CO_2 tracer survey" from M/s. Weatherford has been introduced in Western Offshore. This technology provides a simple, more efficient, non-intervening method for trouble shooting a gas lift well system.

g. **Surface Controlled Auto Gas Lift System (SCAGLS):** The system provided variation of Gas Lift Valve (GLV) opening from surface control for activating the wells initially with required gas quantity. This system helps in early activation of wells and also enables to sustain production through optimization of required gas injection quantity.

h. **Directional Drilling Technologies:** Technologies like MWD, LWD and periscope related to directional drilling, are being employed to target the right zone. In addition to this Rotary Steerable System (RSS) is being deployed for controlled drilling and placement of well.

i. **Multi-lateral Completions:** To enhance productivity of multi-layered reservoir, Multilateral completion with surface controlled/wireline controlled sliding sleeves is being used. Technology allows selective flow of layers without rig based interventions.

j. **Electrical Submersible Pump (ESP)**: Installation of ESP has been very useful in reviving sub-optimal wells where reservoir pressure as well as GOR is low and gas lift not feasible, but wells have good inflow potential. Use of ESP has been successful in NBP field and resulted in substantial oil gain.

k. **Y–tool completion:** Stimulation in ESP wells is a challenge. Y-tools is a useful technology for safe and effective stimulation job/coil tubing job, flow back after acid job, well intervention like PLT job, MPBT job, etc. in ESP wells. This has recently been used in NBP field in Western Offshore.

l. **Float over method of platform installation:** ONGC has adopted state-of-the-art "Float-Over Technology" for Offshore platform installation, resulting in saving of offshore construction time. B-193-AP & HRD process platforms have been installed in Dec'12 and Jan'15 respectively using Float-over method.

m. **Solvent along with wettability alteration:** A specific solvent formulation for treatment of reservoirs having asphaltene propensity has been developed and successfully applied in wells of B-193 cluster.

n. **Stimulation of long drain-holes:** Effective Stimulation of long-drain holes in heterogeneous carbonate reservoirs is being done by designing acid treatment jobs with diversion ability.

8.1.6 Drilling - Details of technologies inducted in past 5 year in Drilling Services are:

a. **6 New Generation AC-VFD rigs in Onshore** have been commissioned to drill ERD/deeper exploratory wells with improved drilling performance.

b. **PBL tool:** This large bore bypass tool is used for placing large size LCM pills through directional string without pulling out the string. This helps in safer, quicker and economical drilling of wells. The tool has been successfully used in wells of Western Offshore. Usage of PBL tool has resulted in downward trend in time lost due to Mud loss.

c. **Conductor Slot Recovery (CSR)** is a low risk technique to reutilize slots of offshore platforms for drilling new wells to increase production by replacing old conductor with new.

d. **Air Hammer Drilling and Turbo Drilling with Impreg Bits** have been successfully introduced in the Frontier basin, resulting in improvement in drilling performance by facilitating drilling very hard formations.

8.1.7 Drilling Fluid:

a. **Loss Control Material:** Mud loss is one of the major factors contributing to the NPT in offshore operation. In view of controlling losses in highly pressure depleted formations, **Stoploss** (For Non-reservoir formation) and **Frac-seal** (For reservoir formation) have been introduced. The success rate obtained during field operations was higher at about 85-95% and resulting in considerable reduction in NPT due to Mud loss System.

b. **Hollow Glass Sphere Mud System (HGS Mud System):** The re-development of Mumbai High field requires induction of new technologies in order to attain the objective of reaching the targeted 40% recovery factor from the field. The use of HGS based Sub-Hydrostatic Drilling Fluid in Mumbai Offshore is aimed to formulate sub-hydrostatic fluid to conduct balanced drilling and work-over in pay zones to minimize formation damage and prevent fluid loss due to depletion.

c. **Micro bubble based Drilling Fluid:** Most of the ONGC fields are depleted and reservoir pressures are less than hydrostatic. Drilling through these reservoirs without any complication is the most challenging task being faced today. This unique stabilized micro bubble system designed is expected to be a perfect fluid for drilling depleted reservoirs and simultaneously curing mud loss problem. The field trial of this drilling fluid has been done in the well HSD # 8H (Rig- Trident-II) of South Heera field for drilling 8 ½" section during the period 24th to 27th March, 2015.

d. **Choline Chloride as a substitute of KCl in drilling Fluids:** KCl-PHPA-Glycol non dispersed drilling fluid system is widely used in ONGC to drill clay section. Although KCl in concentration of 5 to 15 % provides effective inhibition of shales along with PHPA and Glycols yet discharge of saline drilling wastes poses environmental problems due to contamination of ground water and soil Choline Chloride – PHPA –Glycol system provides an effective substitute of KCl-PHPA-Glycol system. Choline Chloride works on one third the dose of KCl and it has been field implemented in wells of Ankleshwar, Ahmedabad and Mehsana Asset successfully.

e. **High Density Clean Brine for testing and completion in HTHP wells in Western & Eastern Offshore areas:** Formate brine reduces deep gas field development cost by cutting the time taken to drill, completes & evaluates

the reservoir section. It helps efficient delivery of recoverable reserves by improving the reservoir connectivity, providing precise reservoir definition & visualization, providing ideal fluid medium for supporting acoustics and electrical image log. Present status: implemented in the well YF#8. Cesium Formate has been successfully used in two wells YS#8-1 and C-39#P1.

f. **Advanced Mud Systems:** In addition to hollow glass sphere mud system & environment friendly SOBM (Synthetic Oil Base Mud Systems), Proprietary mud systems like KCl-PHPA-Glycol Mud system, Non-damaging Drilling Fluids, are being used to minimize the down hole complications in wells, especially in Mumbai Offshore, KG & Assam Asset wells. (SOBM) has been trial tested in Rajahmundry (Onshore) for better hole stability and minimize down-hole complications.

g. **Non-Invasive Fluid (NIF)** has been used for bore-hole stability in Deep-water wells and in Assam, where there is low margin between Fracture Gradient and Pore Pressure.

h. **Loss control solution during drilling and cementation:** Rapid Setting Fluid (RSF pill)/ Acid soluble loss control material used in well N_12#3Z & HG# 6H of Mumbai offshore with encouraging results. Fiber-cement used in Well# TISUA (Frontier Basin). Chemically activated polymer gel formulations used in Cauvery asset. Micro-bubble based light weight cement slurry used in severe seepage loss at shallow depth at Cauvery asset.

8.1.8 Cementation:

a. **Development of Light / Ultra-light weight slurries:** Wells having low fracture gradient and depleted reservoirs demands Light / Ultra-light weight slurries for desired cement rise. Being used regularly for cementation of CBM wells and many onshore & offshore wells.

b. **In-house development of weighted spacer:** Weighted spacer for cementation of high pressure wells has been developed In-house wherein density achieved upto 2.15 SG & applicable upto 165 Deg. C.

c. **Slurry formulation for HPHT wells:** Being regularly used in Rajahmundry Asset & Mumbai Region (140^0-200^{0}C)

8.1.9 Well Services:

a. **Joint Collaborative Project with M/s Schlumberger** for 2 years (from 10.09.2012 to 09.09.2014) for fracturing 30 wells. Under this Project, 19 wells have been fractured. With the aim to introduce new stimulation technologies and understanding its implications in ONGC's fields, out of the 19 wells, new technologies have been implemented in four wells.

b. **Adoption of new technologies by WS, Mumbai in Western Offshore for augmentation /maintenance of production in the last 5 years:**

(Table 8.2)

Description	Wells implemented	Brief Description
Swell packer	10	Hydrocarbon swell able packer in open hole for zonal isolation
ICD (inflow control device) completion	2	ICD technology used in horizontal open hole well to exploit thin oil rim present in the formation
Level-III completion(3 wells each in MH & N&H)	6	L-III completion that provides accessibility to the multilaterals
Segmentation through CT & ICV operated S/sleeve in horizontal wells	17	Segmentation of Horizontal open hole well using CT operated sliding sleeve / surface controlled ICV to arrest water & gas production. Water bearing zones are isolated using open hole swell packers in segments and selectively operating and allowing flow through sliding sleeve/in-flow control valves
Supply & installation of Manometer gauge	33	Monitoring of downhole temperature & pressure of reservoir
Roller Bogie / kick over tools	20	Slick line intervention in the well > 65 deg angle
Auto gas lift completion	3	Surface controlled auto gas lift valve completion for using reservoir gas for lifting purpose
MERAS x linked diverter (multistage emulsified retarded acid system)	13	A new dimension of acid stimulation formulation- 'Diversion of acid to the less conductive path' in horizontal wells, designed & developed In-house, for improvement of production
Multi Finger Imaging (MIT) Tool	120	Corrosion survey tool; Provides information on corroded tubing position, holes in tubing, thickness reduction, etc. Reduces rig time & fishing operation when proactively done in wells
Hollow Glass Sphere workover fluid	12	Use of HGS workover fluid which is lighter than sea water, is being utilized effectively for sub hydrostatic wells. Its use resulted in better operational efficiency, less complications and better post workover result.
Electrical Submersible Pump (ESP):	23	Candidates with low Pr and GOR but good inflow potential wells.
Water shut off – GEL job (Rigless)	3	Rigless water shut off job, which is innovative in nature is carried out in collaboration with KDMIPE (ONGC R&D institute)
Frac-seal	29	In case of total fluid loss in formation Frac-seal is used in form of pill. Since it is acid soluble, it may be used in reservoir also. It is found effective in sub-hydrostatic wells in arresting the total loss, thereby reducing workover time and better post workover result.

c. **Adoption of new technologies by WS and WSS, Ahmedabad:**

- Radial drilling technology is a cost effective technology to address problems of marginal and brown fields and providing the production enhancement. This technology is being implemented in Ahmedabad and action is in progress to implement in other work centres including Assam.
- Designed and implemented mechanism for Recovery of trapped Oil from Brine tank as a step towards environmental protection
- ONGC has entered into an MoU with **Super Wave Technology Pvt. Ltd.** (SWTPL), Bengaluru for indigenous development of technology for fracturing using shock waves as medium as an alternative to the conventional fracking techniques.

d. **Adoption of new technologies by WS and WSS, Ahmedabad:**

- Provisional patent has been applied for development of formulation of Frac. Slurry using sea water
- Provisional patent has been applied for design of 9-5/8" Over the Top assembly
- Agency is being finalized for roping in new tools, techniques and chemicals such as Ultra Low Temperature Breaker for hydro-fracturing, Universal X-Over tool for GP and alternate GP packer

e. **Special studies for productivity improvement:** Undertaken special study for developing Fast Hydrating Guar Gum (FHGG) for use in hydraulic fracturing jobs in ONGC fields.

f. **Initiatives and development in the field of Information Technology:** Acquired CTU software (Cerberus) and up-graded Field Pro software for Hydro fracturing.

g. **Specific areas where R&D was carried out/ Innovations:**

- Design & development of 9-5/8" Over The Top assembly for Gravel pack jobs.
- Design & development of Universal X-over tool for GP jobs.
- Alternate GP packer with improved design for better efficiency

Gravel Packing is a proven sand control technique and this operation prevents incursion of Sand inside wellbore in loosely Consolidated Sandstone formations. Normally GP packer is being used to carry out sand control operations. "Over the top packer system" was introduced by WSS in the western onshore fields in early 90's. This was suitable considering nature of reservoir, convenience of operations and cost effectiveness. The same method is still predominant for sand control operations in Western region. However the existing system cannot be used in High Pressure Oil/gas Wells for want of effective Casing isolation and reliability issue of annulus sealing, because of limitations of lead seal.

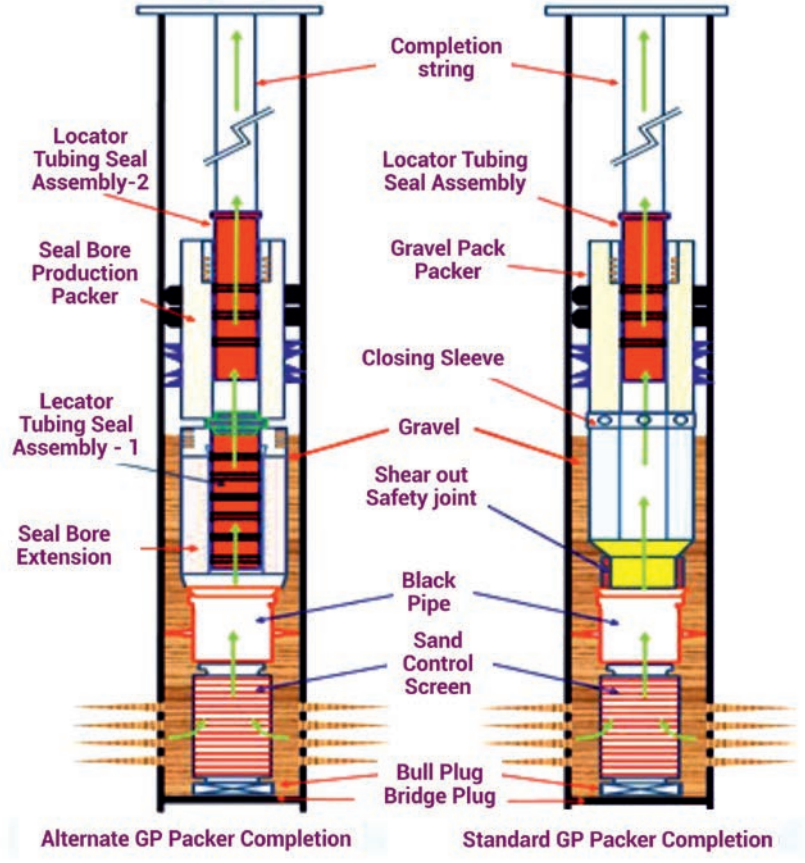
WSS Ahmedabad, ONGC has successfully completed Gravel pack job at well SNL # 117 of Mehsana Asset with in-house conceived and developed Alternate Gravel pack completion system for High-pressure Oil/ Gas wells. The standard Gravel Pack packer system, being used world over comprises of the retrievable Seal bore packer, Gravel pack upper extension having closing sleeve and lower extension, Shear out safety joint and seal assembly while its service tool is a combination of setting tool and X-over tool.

The innovative approach adopted, using in-house resources with modifications in seal bore packer and its accessories has resulted into development of alternative GP packer system, which is a unique blend of over the top packer system as well as standard GP packer system. The newly developed system is highly cost effective and very simple in operation, having all the completion functionalities of standard GP packer.

Standard 4" Seal bore extension was modified to have LH square thread at top for connection with indigenously designed and developed X-over tool. As during later stage, locator tubing seal assembly has to pass through these LH threads, the nominal diameter of thread was designed in such a way to avoid damage to locator tubing seal assembly. LTSA which usually runs inside the packer was attached to the bottom of packer with suitable modification. The connection between seal bore extension and LTSA -1 is as reliable as closing-sleeves of GP packer and does away the need of shear out safety joint of GP packer. The sealing of annulus is provided by packing element of seal bore packer which has same rating and reliability as that of GP packer.

Comparison of Standard & Alternate GP Packer System: *(Table 8.3)*

Sl. No.	Aspect	Standard GP Packer	Alternate GP Packer
01	Operational Simplicity	Complicated	Comparatively simpler
02	Cost (including service tool)	40 - 60 lakhs	05 - 06 lakhs
03	Ease of Procurement	Higher lead time	Easily available
04	Applicability	All types of well	All types of well
05	Ease of assembling	Difficult	Easy
06	Works as production packer	Yes	Yes
07	Requirement of Shear out safety joint	Yes	Doesn't require (inherent feature)
08	Possibility of Casing isolation from well fluids / pressure	Yes	Yes



The conservative estimate of cost reduction, using Alternate GP Packer system over GP Packer assembly works out to Rs. 40 Lakhs to Rs. 50 Lakhs per well. WSS Ahmedabad is in the process of obtaining Patent for this innovative and highly cost effective technology.

- Frac. Fluid Formulation using sea water.
- Development of Fast Hydrating Guar Gum for fracturing jobs.
- Development of ultra low temperature Frac. fluid upto 25 Deg C.
- Development of High temperature Frac. fluid upto 165 Deg C.

These have brought down cost drastically, as acquisition cost of these technologies from International service provide is very high. Apart from technological advancement, these also have resulted into ease in operations.

h. **Hydraulic Fracturing in HPHT wells (BHT >1500 C):** Successfully implemented Hydraulic fracturing technology in 3 wells in Rajahmundry and Cauvery fields.

i. **Oil Emulsified Acid Treatment:** Successfully implemented in wells of Ahmedabad fields which are suitable for water sensitive formations and deep penetration of live acid for removal of damage.

j. **Enhancement of Productivity by increasing hole size (under reaming) and Gravel packing:** Well Stimulation team for the first time completed 3 wells with Gravel Pack, having 9-5/8" casing and 12-1/4" under-reamed holes, using 9-5/8" Over The Top assembly. This technology has been developed in-house and will be suitable for exploiting sub-hydrostatic wells having heavy oils.

k. **Expandable Sand Screen Technology for sand control:** Gas wells with potential sand production due to unconsolidated sand reservoir have been successfully completed with Expandable Sand Screen technology (ESS) and have yielded very good results. This technology is an alternative to hitherto practiced gravel packing technology and has potential to be used in high producers.

l. **New technology implementation in Eastern offshore Kakinada: Testing & HF of deepest and hottest offshore reservoir- well no. YS-8-1**

New Technology induction with stimulation driven exploratory well testing through successful hydrofracturing in globally the deepest & hottest tight HP-HT Golapalli gas reservoir at Yanam Offshore block in Eastern Offshore at a depth of 5231-5250 m at a temperature of approx. 400 deg F. Anticipating very high pressure and temperatures, tools were rated for 15000 psi & 450 deg F for which Well Services, ONGC made meticulous plans along with best in class service providers Schlumberger and Halliburton. The fracturing executions in two objects were pumped through DP-II Modular Stimulation Vessel, utilizing 1100 bbl of specialized high temperature frac fluid SAPPHIRE XF with 98 tons of high strength proppant at maximum pressure of 12400 psi and pumping rate of 16 bpm. The job execution was performed commensurate with the design plan to create the fracture geometry and successfully place the proppant. The Bottom Hole temperature encountered during frac job was 388 deg F. The effort has provided valuable BHP & BHT data to understand reservoir characteristics, pre-frac and post-frac behaviour and its potential.

m. **Multi-cycle DST Tool of 15K Rating for safe HPHT well testing -onland**

A new technology "Multicycle DST Tool of 15K Rating" was used for the first time during testing of deepest onshore HPHT well KL#2A, Rajahmundry Well Services. The well was drilled upto

5450 metres with maximum mud weight of 2.05 g.cc and reservoir temperature was more than 450 deg F. Due care was taken to ensure safe operations and safety of the well. Clear fluid comprising Calcium Bromide and Zinc Bromide was used during testing for desired pressure transmission for DST operation of different downhole valves. This technology enabled us to give stage wise cycling of the recirculation valves in the DST string, thus different predetermined drawdown could be given for activation. This also eliminated the use of CTU in 15 K well for repeated activation.

n. **Some of the new technologies for HPHT fields**: Ceramic Sand Screens having exceptional resistance to erosion/ corrosion and outstanding hardness. It is touted to be useful in offshore wells and HPHT wells. **Corrosion resistant alloys** for casing liners and tubings. **HPHT FB-3 Retainer Production Packer**-Used in more than 5 wells in ONGC Mumbai High and Rajahmundry Assets.

8.1.10 IOR/EOR EFFORTS IN ONGC:

ONGC puts efforts on continual basis for performance analysis of fields and suitable technology & corrective measures are taken for improvement in crude oil production. **Improved Oil Recovery (IOR)/Enhanced Oil Recovery (EOR) schemes** were formulated by ONGC for improvement in production in its 15 major fields viz. Mumbai High, Heera, Neelam, Gandhar, Kalal, North KadiSanand, Santhal, Balol, Sobhasan, Jotana, Lanwa in Gujarat; Lakwa-Lakhmani, Geleki Rudrasagar in Assam. These IOR/EOR schemes helped in arresting the decline trend of oil production.

The status of current IOR/EOR projects is tabulated as under: *(Table 8.4)*

Sl. No.	Field	Scheme	Status of IOR/EOR Project
1	Mumbai High-North	IOR-Redevelopment Phase-III	Under implementation
2	Mumbai High-South	IOR-Redevelopment Phase-III	Under implementation
3	Heera	IOR-Redevelopment Phase-II	Under implementation
4	Neelam	Neelam Redevelopment Plan	Under implementation
5	Sanand	EOR-(Polymer Flood)	On stream
6	Balol	EOR-(Insitu Combustion)	On stream
7	Santhal	EOR-(Insitu Combustion)	The closure report of present ongoing scheme submitted for approval. New FR prepared and is under review.
8	Gandhar (GS-11)	EOR-(WAG)	Under implementation
9	Jhalora	EOR-ASP (Field expansion)	Under approval
10	Viraj	EOR-ASP (Field expansion)	Under approval

Enhanced Oil Recovery (EOR) Polymer Flooding/WAG/PM/WSO:

» Simulation of Polymer Flood study was carried out in Bechraji Field. Polymer flooding recommended for normal five spot pattern. The study envisages 8% incremental oil recovery by 2019 over water-flood.

» Simulation of Gandhar Field Water Alternate Gas injection (GS-9) full field expansion study was carried out. The study also identified two additional closed pilot areas before the finalization of FR for full field expansion.

» Profile Modification (PM) jobs were carried out successfully in Neelam & Heera fields. Water shut Off (WSO) jobs were carried out in Ankleshwar & Jambusar fields of Ankleshwar Asset. The incremental oil gain of 94772 m^3 was achieved by application of PM and WSO jobs during FY 2015-16.

Microbial EOR (MEOR): ONGC has also applied its indigenously developed technology of Microbial EOR process to increase production from sub-optimally flowing wells in different fields of ONGC. By application of microbial paraffin control technology, another MEOR process, field jobs have been carried out for improving well productivity by reducing frequency of scrapping to avoid wax deposition in wells of Mehsana and Ankleshwar fields. Indigenously developed MEOR formulations have been successfully applied for improving flow efficiency of surface flow

lines. It has been observed that >80 % wells are scrapping free after the job application.

Thermal EOR: ONGC has approved implementation of Cyclic Steam Stimulation (CSS) as a pilot project in Lanwa field. The study envisaged incremental oil gain of 0.32 MMT in 8 years.

Chemical EOR: Way forward laboratory study for Sanand Field polymer flood project was carried out with increased concentration of Polymer and ASP Flooding to enhance Linear Core Displacement Efficiency (LCDE) over existing Polymer flood. The study envisages 15 % additional LCDE over polymer flood. Simulation Study of Alkali-Surfactant in K-VA was carried out after successful encouraging results in laboratory. Laboratory chemical EOR studies in Northern part of North Kadi field was carried out. Laboratory results are encouraging with 12% additional LCDE with Polymer Flood and 22% additional LCDE with Alkali-Surfactant-Polymer (ASP) flood.

Preparation of Integrated Geo-cellular Models (GCM): As an important initiative to move from conventional map-based Geological model to fine scale Geo-cellular Model (GCM), IRS has taken lead in preparing GCMs of major fields in recent past in order to address issues of brownfield development by capturing reservoir heterogeneity, improved water flooding efficiency, optimizing infill drilling, etc. During FY 2015-16, GCM of Gandhar (GS-3A, 3B, 5C, 8 and 11), Limbodra, NBP (Revisit), B-192 and G-1 were taken up.

8.2 CAIRN

8.2.1 IOR/EOR

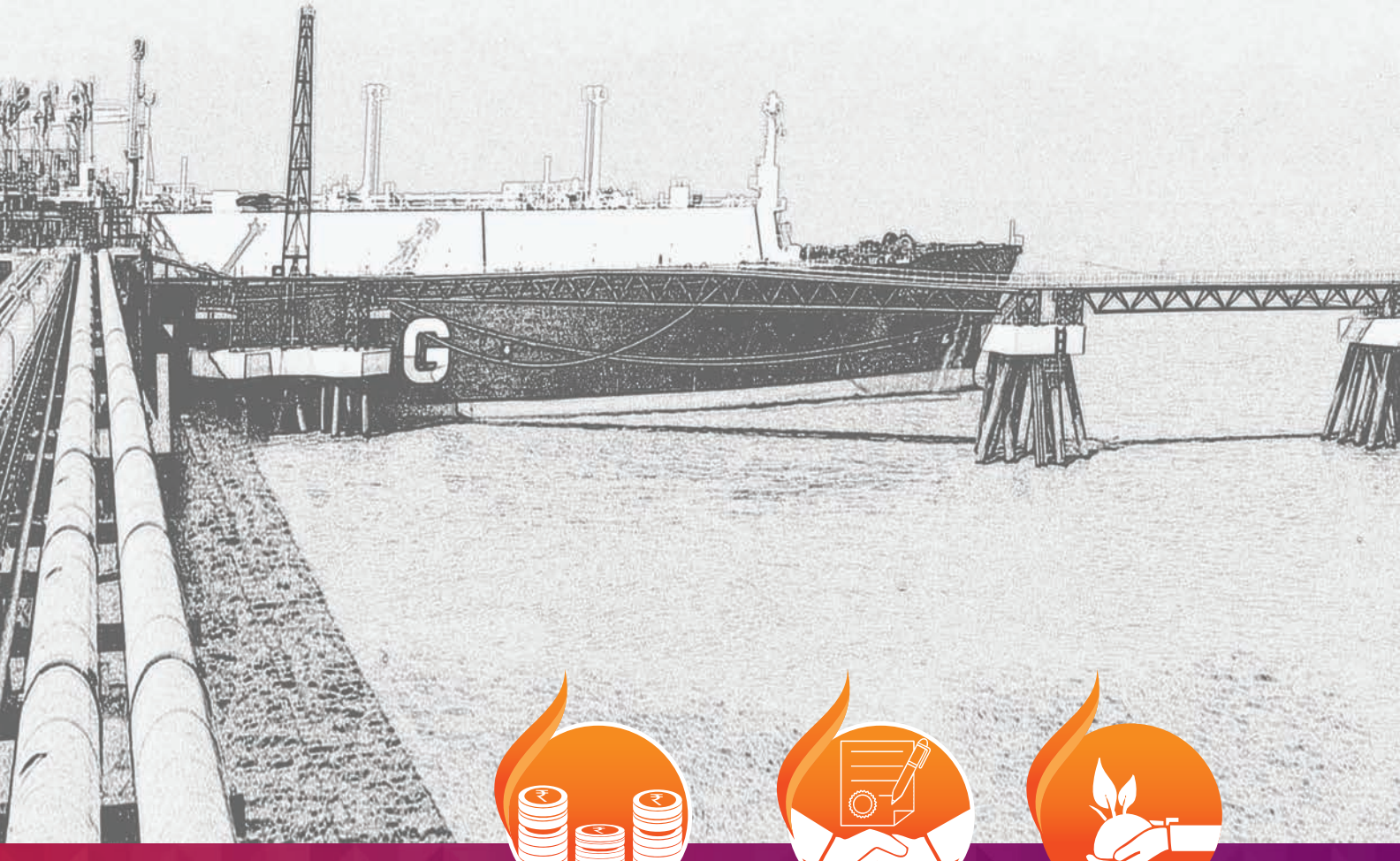
Mangla EOR: One of the largest polymer flood implementation execution was completed in Mangla Oil field (block RJ-ON-90/1). The surface facilities and drilling activities were completed and polymer injection was ramped up to the target 400,000 Barrels of polymerized injection water per day during the 4th quarter of the FY 2016. This is a significant achievement for the block which will enhance the production from this field. Incremental oil production in the range of ~20, 000 BOPD is being produced from EOR which is as per expectations of the FDP. Drilling of the FDP wells have been completed and few wells surface facilities hookup is ongoing.

The Rajasthan block have similar field in the blocks such as Bhagyam and Aishwariya which are good candidates for chemical EOR. Screening and core flood studies have been completed and field implementation development plans for converting these fields on water flood to chemical EOR floods is under progress.

The Mangla ASP pilot was concluded after drilling core wells and the recovery from the pilot area was ascertained. The results from the pilot were very promising and further work is ongoing to prepare a development plan based on the results of the pilot. Bhagyam and Aishwariya ASP studies were also initiated.

Chapter 9

Supplementary Information



Contribution to Govt. Exchequer

MoUs

Environment

9 Supplementary Information

9.1 CONTRIBUTION TO GOVERNMENT EXCHEQUER

9.1.1 Profit Petroleum

During the Financial Year 2015-16, Profit Petroleum of Rs. 4624 Crores was contributed to Government Exchequer from the E & P operations under PSC regime. The cumulative profit petroleum earned upto 31st March 2016 was of the order of Rs. 74988 Crores.

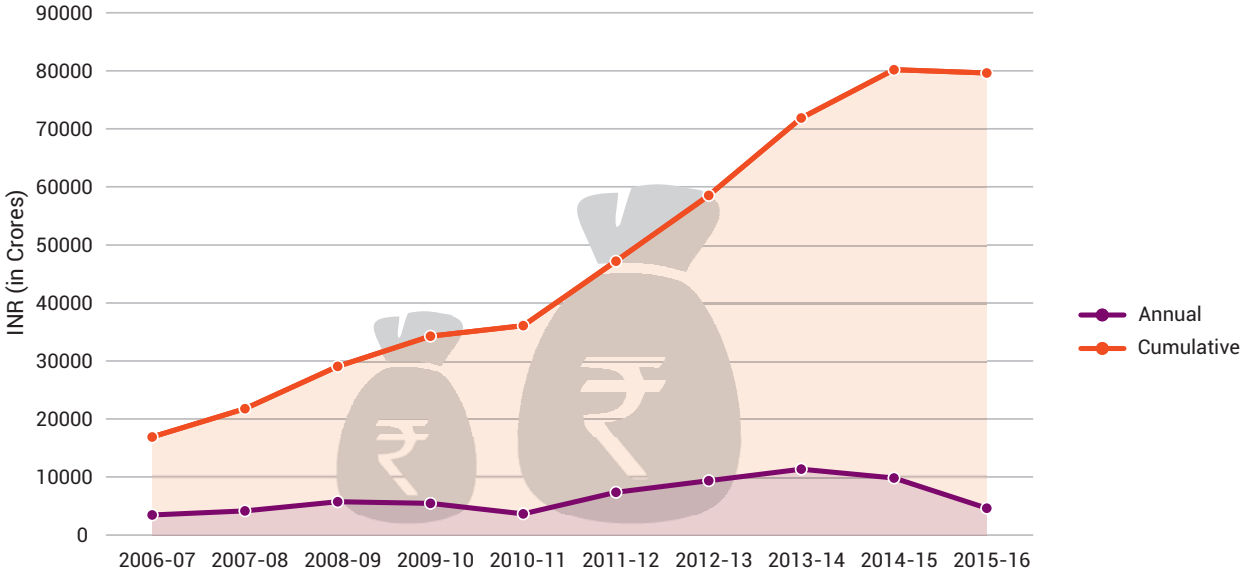


Fig. 9.1

9.1.2 Royalty

During the Financial Year 2015-16, Royalty received by Central Government was of the order of Rs. 4208 Crores. The cumulative Royalty contributing to central exchequer till 31st March 2016 amounted to be Rs.45039 Crores.

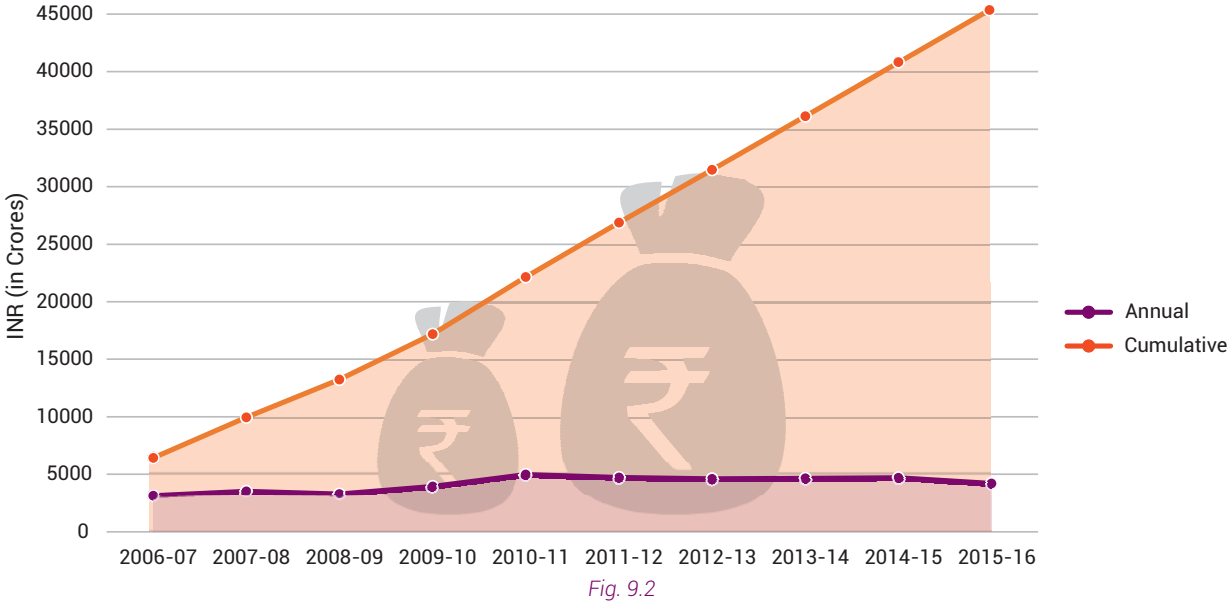


Fig. 9.2

9.2 MEMORANDUM OF UNDERSTANDING (MOU)

Table 9.1: Status of active MoUs signed between MoP&NG/DGH & National and International Organisations in the area of upstream E&P sector

Sl. No.	MoU signed between	Agency, Country	MoU Signed on	Valid upto	Objectives
1	Lebniz Institute of Marine Sciences (IFM- GEOMAR)of Germany & DGH	IFM- GEOMAR, Germany	30.08.2010	29.08.2015	Joint Researches in Marine Gas Hydrate, Research and Development
2	GFZ German Research Centre for Geosciences & DGH	GFZ Potsdam, Germany	17.04.2012	16.04.2017	Collaborative research in Gas Hydrate Laboratory Studies
3	Japan Oil, Gas Metals National Corporation (JOGMEC) & DGH	JOGMEC, Japan	16.02.2007	Extended 15.02.2019	Exchanges of technical knowledge and information, workshops, meetings on Gas Hydrates Research and Development
4	U.S. Geological Survey (USGS) of The Department of Interior of The United States of America & DGH	USGS, USA	16.12.2008	Open ended	Resource exploration hazards and environmental issues associated with Gas Hydrates, Field studies & research for Gas hydrate
5	The Minerals Management Service of The Department of the Interior of The United States of America & DGH	US MMS USA (now US BOEM)	21.08.2009	20.08.2014 extension of MoU is underway	Leasing/ Tendering programs, Resource estimation and Methane Hydrate R&D activities and Human resource development
6	Department of State (DoS), USA & MoP&NG GoI	DOS, USA	06.11.2010	Open ended	Exchange of knowledge and expertise in the areas concerning Shale Gas resource characterization and assessment in India
7	Norwegian Petroleum Directorate & DGH	NPD, Norway	21.09.2012	20.09.2017	Petroleum Resource Management; Human Resource Development; Petroleum related R&D and technology sharing
8	IOCL & DGH	IOCL, India	03.01.2013	02.01.2016	IOCL has studied samples provided by DGH.

9.3 RTI ANNUAL RETURN INFORMATION IN THE YEAR 2015-16

Table 9.2

Ministry/ Department/ Organization	Quarter	Opening balance of requests (as on start of Quarter)	No. of application received as transfer from other PAs u/s 6(3)	No. of requests received during Quarter	Total no. of Request (Column 3+4)	No. of Request transferred to other PAs	Decisions where Applications for information rejected	Number of cases where disciplinary action taken against any officer in respect of administration of RTI Act
1	2	3	4	5	6	7	8	9
Directorate General of Hydrocarbons	1st Quarter (April-June 15)	5	0	29	34	1	0 (0%)	0
	2nd Quarter (July - September 15)	33	3	20	53	0	0 (0%)	0
	3rd Quarter (October 15 - December 15)	53	0	14	67	2	0 (0%)	0
	4th Quarter (January-March 16)	65	1	20	86	0	0 (0%)	0

9.4 ENVIRONMENTAL PROTECTION, INITIATIVES AND CLEARANCES

9.4.1 Recent initiatives in environmental protection in exploration and exploitation in oil and gas sector :

The Ministry of Environment, Forest & Climate Change (MoEF&CC) is the nodal agency for implementation of regulations related to environment, forests and wildlife. For sustainable development, MoEF&CC has notified relevant laws and regulation from time to time and has made the Environmental Clearance (EC) mandatory for various projects, including E&P sector, under the Environmental Impact Assessment Notification of 14th September, 2006. For facilitating preparation of Environmental Impact Assessment reports, standard Terms of Reference for preparation of Environmental Impact Assessment (EIA) reports for offshore and onshore Oil and Gas exploration, have been finalised along with the technical manuals. Further, online submission of EIA reports for EC has been introduced along with project tracking system for transparency. These are displayed on the website (www.envfor.nic.in).

Exploration and Production of Oil and Gas is a permissible activity under the Coastal Regulation Zone (CRZ) Notification 2011 , but permission would be required from MoEF&CC based on recommendations of the State Government(s).

If the E&P operations involve diversion of forestland, the Forest Clearance (FC) under the Forest (Conservation) Act,1980, is required. Forest (Conservation) Rules have also been revised in April, 2014 to give special considerations for exploration surveys including for Oil and Gas and Annexure –C has been added. As in case of EC, details can be viewed on website (www.envfor.nic.in).

A plan has been drawn to conduct 2D seismic survey in "to be appraised areas" of sedimentary basins of India where no /only scanty data are available for understanding the geology and hydrocarbon prospectivity. For facilitating the 2D surveys, at the request of DGH, the MoEF&CC has issued clarifications on the applicability of the EIA notification , 2006 and Forest (Conservation) Act, 1980 during such surveys. It is clarified that 2D seismic survey activity is exempted from the process of environmental clearance. Further, MoEF&CC has clarified that the para 1.3 of the guidelines under the Forest (Conservation) Act,1980 issued by the Ministry provides that among other, seismic surveys will not attract the provisions of the Forest (Conservation) Act 1980 as long as these surveys do not involve any clearing of forest , and operations are restricted to cleaning of bushes and lopping of tree branches for purpose of sighting. These clarifications are expected to help in time bound implementation of various plans for 2D seismic surveys and are uploaded on website of DGH.

Further, Forest Cover and Forest Type maps are being procured for the "to be appraised areas" from the Forest Survey of India, Dehradun for finalising the line alignments for the proposed 2D seismic surveys .

For collection and analysis of data relating to the Environment related clearances , a matrix has been developed for integration with MIS of DGH and uploading of data for various exploration blocks has been initiated.

In compliance of the policy for extension of exploration phases under NELP and Pre–NELP Production Sharing Contract, cases have been examined and recommended for excusable delays where

demonstrable delays on account of delayed environmental/ forest / wildlife clearances were justified.

The environmental clearance to the flagship R&D project on National Gas Hydrate Project-2 (NGHP-2) was issued by MoEF&CC on 27.08.2014. After completion of the expedition in July 2015, the compliance report on various environmental clearance conditions has been finalised.

Following two important technical studies were initiated in DGH for adopting best international practices relating to Oil and Gas sector:

i. Study on Good International Petroleum Industry Practices (GIPIP)

ii. Study of Site Restoration Guidelines for Petroleum Operations

Recommendations have been now finalised, including the integration of environmental aspects and the Ministry of Environment, Forest and Climate Change (MoEF&CC) is to develop necessary guidelines for use by the operator.

9.4.2 ONGC - Ecological Restoration and Environmental Remediation

E&P activities often interact with the ecosystem and may have Physio-chemical & bio-geochemical impact on the surrounding environment. ONGC, being a responsible Corporate not only cares and preserves the environment but also makes efforts for its protection. ONGC has put in place an effective Environment Management Plan and is also taking advance preventive actions so that environment is protected and its activities can remain in harmony with nature. ONGC has taken requisite measures to minimize the impact of E&P activities and taken various measures to mitigate the pollution. It has introduced clean technologies for emission control including design and construction facilities for different, gaseous, liquid and solid effluent generated due to drilling, production and processing facilities from onshore and offshore operations.

1. Measures taken for mitigating Air Pollution

In ONGC, there are no major sources of air pollution like process industry. The source of air emissions are flaring of natural gas, exhaust from running of DG sets, use of heavy equipments, construction activities, movement of vehicles, etc. In order to reduce the gas flaring, generators have been installed in the field to utilize low pressure gas for generation of electricity for internal consumption. Regular ambient air quality monitoring studies are carried out around drill sites & production installations as per statutory requirement to measure and monitor concentration of air pollutants in ambient air. The concentration of air pollutants have been found to be within the permissible limits.

Gaseous Emissions control through Box flare:

Box flare facilities have been installed at Uran Terminal, Hazira Gas Processing platform and Assam Group Gathering Stations to achieve following:

- Complete combustion of the flared gases using several stage multiple burners.
- Use of low NOx burners.
- Cladded in refractory shells with steel enclosures to control the effect of heat and light radiations.
- Acoustical insulation for noise control.

Smokeless Flaring: The smokeless flare is achieved by properly designed tall stacks with following facilities:

- Use of steam injections
- Providing additional Oxygen
- Height of the stack is maintained in such a way that when emissions strike the ground, they should have ground level concentration within permissible limits.

Real Time Monitoring Stations (RTMS): The 5 nos. of RTMS are installed each at Uran Terminal and Hazira Gas Processing complex to monitor the ambient air quality in and around plants round the clock for following parameters viz.(SO_2, NO_x, CO, H_2S, PM 2.5, PM10).

Reduction in Gas Flaring/ Low Carbon Fuel: In order to reduce GHG emissions, the low pressure gases and other natural gas is being utilised to operate Compressors, Turbines and DG Sets.

Vapour Recovery System: Vapour Recovery system has been installed at the crude oil storage tanks to prevent release of fugitive emissions, VOCs, etc. besides to check the loss of HC.

De-sulphurization of Sour Gas: The sour gas produced from South Bassein Field of West Coast is sweetened at processing plant through Sulphur Recovery Units (SRUs) to avoid the release of acidic gas to the atmosphere.

2. Measures taken for mitigating Water Pollution and its Management

Conservation of Water: Towards conservation of an important natural resource 'water' through its replenishment in the aquifer to prevent its further depletion and to sustain ground water table. Six wells to collect the discharge water at different locations of the KDMIPE campus are active.

Waste Water Management: ONGC monitors the use of water resources and quality of effluent discharge. Effluent Treatment Plants have been installed in work centres to treat effluent generated during processing of oil and gas to meet statutory requirements for discharge of treated effluent at surface/ sub-surface.

Water Conservation through Rain Water Harvesting: For conservation of water, ONGC has a policy on Rain Water Harvesting which is mandatory for all future projects. Currently, Rainwater harvesting project had been established at Baroda colony, Tatipaka GCS, Rajahmundry.

Treated water is used for the various purposes during drilling at drill site and injecting into the formation for the purpose of maintaining formation pressure. Treated effluent is also used for gardening purpose, floor cleaning and other utilities. ONGC follows the policy of Recycle, Reuse and Recovery for water conservation.

Effluent Treatment Plants: In view to maintain the clean and uncontaminated surface and ground water, ONGC has set up 23 nos. of ETPs at different work centres of ONGC to treat about 70,000 m3/d of waste water produced during E&P operations.

Besides, there are 17 new upcoming facilities expected to be installed, in the current fiscal year, due to increase in exploration and development activities.

Lining of drill site waste pit with High Density Poly Ethylene Sheets (HDPE): To avoid contamination of ground water quality of surrounding areas, HDPE lining is laid in waste pit at drill site. In this way, percolation of waste water in the ground during drilling of wells is checked and ground water quality is protected.

Produced Water Conditioners (PWCs): Produced Water Conditioners (PWCs) have been installed for treatment of offshore effluent (produced water). For treatment of sewage water being generated at living quarters at offshore platforms, Sewage Treatment Plants (STPs) have been installed before discharging it at offshore. Therefore, the waste water separated from oil and gas is treated and pollutant's values are maintained as per prescribed limits before discharging it at onshore/ offshore.

3. **Offshore Monitoring to check Marine pollution at West & East Coast:**

To study the impact of E&P operations on Marine Environment, ONGC has instituted regular offshore monitoring at West Coast & East Coast covering the entire operational areas, i.e. Mumbai high; Neelam & Heera; Bassein & Satellite and G-1 field & Block 98/2 at West Coast and East Coast respectively. The reports are regularly submitted to regulatory authorities.

4. **Oil Spill Management - Response and Combat :**

ONGC has the capability to handle 700 MT of oil spillage using its Oil Spill Response equipment stockpile kept on 5 different Multi-Support Vessels (MSVs) which are strategically positioned 24 x7 round the year to cover the entire operational area to ensure minimum response time during emergency. It has also in place Contingency Plan duly approved by the Indian Coast Guard for both West & East Coast. For oil spills of Tier – 3 level, i.e. > 10,000 MT. ONGC has an agreement with Oil Spill Response Limited (OSRL), UK for Oil spill combatment. Besides, ONGC participates in various National Level Exercises with Indian Coast Guard. By this, ONGC ensures its commitment for Marine Environment Protection.

5. **Soil Pollution Control:**

Bio-remediation: The oil is recovered from the oily waste produced during drilling operation as far as possible. The remaining waste and Oil contaminated soil is subjected to Bio-remediation where the oil content is reduced to less than 1% TPH using a consortium of Hydrocarbon degrading bacteria by the OTBL since March 26, 2011.

6. **Noise Pollution Control: Following mitigation measures to control noise impacts:**

- Regular noise monitoring is done to measure and monitor sound levels around these equipments and machineries and high noise areas are demarcated.
- Acoustic enclosures are provided around gen-sets to reduce noise pollution.
- Personnel Protective Equipment (PPE) like ear muff/plugs is provided to personnel working in noise prone areas.
- Green belt is developed and maintained around major installations in mitigating noise pollution.

7. **Creating Green and Clean Environment:**

Green belts have been developed up to one third of total area around all the production installations and processing plants in ONGC to comply with the stipulations of various permissions obtained from state as well as central government. Towards creating green and clean environment, a tree plantation programme was organized at KDMIPE campus on 21st August, 2015. Five saplings each of Kanak Champa and Buddha Coconut trees were planted in front area of KDMIPE. The tree plantation programme is a small step forward to protect the environment.

8. **Afforestation projects resulting in CO_2 fixation through Mangrove & Ringal Plantation by ONGC:**

In addition to regular plantation at drill sites and production installations, ONGC has undertaken following massive plantation as part ONGC's Corporate Social Responsibility for Environment Protection & for mitigation of Climate Change impacts and also to conserve biodiversity.

Mangrove plantation: A project on mangrove plantation along the shores of Dhadar River on West Coast has been taken up by ONGC to protect erosion of shoreline. In the Phase 1 of the project, more than 21.05 Lakhs mangroves have been planted in the soil erosion-prone area along the coast of the Dhadar River at Gandhar, Ankleshwar and Hazira area.

Ringal plantation: Ringal plantation (Hill bamboo) has been undertaken by ONGC in Joshimath and Kedarnath forest areas of Upper Himalayas to strengthen fragile Himalayan eco-system. Plantation of 10.75 Lakhs Ringal Plantation in Upper Himalayas already completed in the area of 430 Hectares in three phases resulting in 1.97 million tonnes of CO_2 fixation per annum. Another 7.5 Lakhs Ringal plants will be planted in two phases in an area of 300 Ha in Upper Himalayan region which shall result in additional 1.37 million tonnes of CO_2 fixation per annum.

9. **Other initiatives in the field of environment:**

a. **Pilot Project on "Waste to Fuel" project in Puri city, Odisha under Swachh Bharat Abhiyan of GoI:** Under "Swachh Bharat Abhiyan" (SBA) campaign to transform independent India into a "Clean India", MoP&NG mandated ONGC for taking up a pilot "Waste to Fuel" project in the city of Puri, Odisha for handling 80 MT of MSW everyday which are dumped in to the designated land fill sites in the city. ONGC is in the process of identification of suitable technology and contractor for setting up the project through a Construct-Operate-Maintain (COM) Model. ONGC will infuse necessary capital funding in the form of CSR grant.The pilot waste to fuel project when implemented will reduce the overall pollution and spread of disease in the area thus benefitting the local citizens and also contribute towards making a Swachh Puri in line with the objectives of "Swachh Bharat Abhiyan" of GoI. The company has also embarked upon a number of measures for reduction in use of energy and water. The company aims to sustain operations with less dependence on fresh water resources.

b. **Green Building:** ONGC acknowledges that buildings have major environmental impact over their entire life cycle. Hence, ONGC has taken up concept of constructing green building, the essence of which would be to address all these issues in an integrated and scientific manner with due compliance to the guidelines of GRIHA (Green Rating for Integrated Habitat Assessment). As part of its commitment to sustainable development, ONGC has taken up development of Green Buildings at Delhi, Mumbai, Kolkata & Dehradun. These buildings are expected to save 50% to 60% energy, save water by about 30%, harvest 100% rainwater and discharge zero sewage as compared to baseline buildings.

c. **Replacement of Halons:** Corporate HSE has obtained a clarification from the Ozone Cell, MoEF&CC regarding the issue of replacement of Halon based Fire Suppression System. The clarification issued by the Ozone Cell permitted the use of recycled/recovered Halon. Further, it was clarified that the roadmap was developed for phasing out of production and consumption of Hydro-fluorocarbons (HCFCs)

Ringal Plantation by ONGC in Upper Himalayas

in India and is not applicable for Halon. Therefore, use of ONGC's existing stock of Halon can be continued.

d. Use of Renewable Energy:

Wind Energy: ONGC's holistic focus on sustainable growth ensures its thrust on pursuing renewable sources of energy, decreasing our internal carbon footprint and exploring unconventional hydrocarbons. ONGC is setting up a 102 MW Wind Farm in Rajasthan, in addition to a 51 MW Unit already working successfully in Bhuj, Gujarat.

Solar Energy: Many of the Residential colonies in ONGC have solar water heaters and solar powered street lights. Un-manned platforms in offshore areas also use solar energy for lightning purposes.

e. Sustainable Development:

i. **Sustainable Water Management (SWM):** ONGC has developed new strategies for water management in order to achieve sustainable growth and development. In this regard, ONGC has undertaken the following projects:

» ONGC has completed water footprint studies of six Onshore Assets (Mehsana, Tripura, Cauvery, Ankleshwar, Rajahmundry and Ahmedabad); two Plants (Uran and Hazira); two Forward Base (Cachar Forward Base, Silchar and Rajasthan Forward Base, Jodhpur) and one institute - IPSHEM - Goa for comprehensive water foot print assessment of these work centres using Global Water Tool for Oil & Gas sector (developed by World Business Council for Sustainable Development). The studies were focused to assess the quantitative use of fresh water, identification of opportunities for reducing the consumption of fresh water and explore ways to minimize the discharge of waste water in to the surface water bodies.

» Proposal for setting up 20 MLD seawater desalination plant at Uran Plant: Completed feasibility study: "Techno Economic Feasibility Report" and "Environmental Impact Assessment & Environmental Management Plan" for the project

» Feasibility study for setting up desalination plants at Hazira Plant, EOA, Rajahmundry Asset, Cauvery Asset and MRPL are being undertaken

» Feasibility study on the use of produced water at Mehsana Asset: Scope of work is under finalization

» Rain Water Harvesting (RWH) projects: RWH projects are implemented at different work centres under the umbrella of Sustainable Water Management. The harvested water is being used for recharging of ground water aquifers and other beneficial purposes. RWH projects are being undertaken at Mehsana Asset and Rajahmundry Asset

» Installation of 3X100 KLD capacity Sewage Treatment Plants at ONGC Nagar, Mehsana Asset is underway

ii. Clean Development Mechanism Projects

Emission reduction through CDM projects: ONGC has 13 registered CDM projects with United Nations Framework Convention on Climate Change (UNFCCC). These are:

» Gas flare reduction at Uran

» Gas flare reduction at Hazira

» Gas flare reduction at Neelam & Heera

» Waste heat recovery at Mumbai High (South)

» Energy efficiency - Amine circulation pumps at Hazira

» Energy efficiency - Upgradation of Gas Turbine 1 and 2 at Hazira

» Green Building - Mumbai

» Green Building - Dehradun

» Green Building – Delhi

» Green Building - Kolkata

» 51 MW Wind Power project at Surajbari, Gujarat

» OTPC - Natural gas based combined cycle power plant at Tripura

» Gas flare reduction at GGS Chariali, Assam

During 2015-16, ONGC has undertaken the following CDM activities:

» Gas Flare Reduction (GFR) project at GGS Chariali, Assam: Validation and registration with UNFCCC completed.

» 102 MW Wind Power project at Rajasthan: Validation with UNFCCC completed.

» Replacement of MOL Pumps at Neelam & Heera Asset: Validation with UNFCCC is nearing completion.

» CERs monitoring and trading: Monthly, quarterly and half yearly reports were generated for monitoring the carbon market trend and deciding the opportune time for trading.

» In a commitment towards environment protection and reducing carbon foot print, the MoU project "Supply, Installations, Commissioning and testing of 3 nos. of LP Gas

compressor package and associated works for recovering flare gas at North Kadi GGS-IV Mehsana asset on turnkey basis" was completed ahead of schedule resulting into saving of about 20000 cubic metre of gas per day which otherwise was being flared.

» Certification of GHG mitigation activities as per international/ national standards by engaging accredited third party certifying agencies, as this may help in arriving at the certified figures on carbon emission reduction to be reported to MoEF&CC towards India's INDC.

Presently, 2,64,029 CERs are available in the CDM Registry Account. 1,48,936 CERs are of Commitment Period 1 which are non-tradable and the remaining 1,15,093 CERs are of Commitment Period 2. These CERs are equivalent to the reduction in the emissions of Green House Gases (GHGs) especially CO_2. All these efforts are a part of ONGC's effort towards mitigation of impact of Climate Change towards global community. The details of CERs are given below.

Table 9.3

Issuance Date	Project	Total CERs
03.02.2012	Waste heat recovery from Process Gas Compressors (PGCs), Mumbai high south (offshore platform) and using the recovered heat to heat process heating oil	4350
24.05.2013	51 MW wind power project of ONGC at Surajbari, Gujarat in India	79493
31.05.2013	Up-gradation of Gas Turbine 1 (GT 1) and Gas Turbine 2 (GT 2) at co-generation plant of Hazira Gas Processing Complex (HGPC) of Oil and Natural Gas Corporation Limited (ONGC)	6370
26.07.2013	Waste heat recovery from Process Gas Compressors (PGCs), Mumbai high south (offshore platform) and using the recovered heat to heat process heating oil	8957
05.08.2014	Amine Circulation Pumps Energy Efficiency at Hazira Plant, ONGC	1714
04.06.2014	51 MW wind power project of ONGC at Surajbari, Gujarat in India	76245
14.02.2014	Waste heat recovery from Process Gas Compressors (PGCs), Mumbai high south (offshore platform) and using the recovered heat to heat process heating oil	4527
05.08.2014	Amine Circulation Pumps Energy Efficiency at Hazira Plant, ONGC	2720
05.08.2014	Amine Circulation Pumps Energy Efficiency at Hazira Plant, ONGC	1816
27.03.2015	51 MW wind power project of ONGC at Surajbari, Gujarat in India	77837
	Total	264029

iii. Global Methane Initiative (GMI):

GMI launched by United States Environmental Protection Agency (USEPA) is a voluntary, multilateral partnership that aims to reduce methane emissions and to advance the recovery and use of methane as a clean energy source. ONGC signed a voluntary agreement with USEPA in 2007 for the purpose of reducing methane releases to the atmosphere by implementing cost effective emission reduction technologies and practices. ONGC, under this initiative, formulates yearly work plan for conducting gas leak surveys at various production installations of ONGC using Gas Find Infrared Camera for identification of methane emission reduction opportunities.

iv. GHG mitigation projects:

» Techno-commercial feasibility report on gas flare reduction scheme for ICP & NQO process complexes and for onshore installations has been prepared

» Report on replacement of wet seals of centrifugal compressor with dry seals has been prepared

» Techno-commercial feasibility report on installation of vapour recovery units (VRUs) at selected sites has been prepared

» Techno-commercial feasibility study on indoor plant lighting, lighting of process areas and energy efficiency projects related to motor/ pump replacement has been completed

» Replacement of gas pneumatic controls on all sites by instrument air has been done

» Techno-commercial feasibility study on installation of solar PV rooftop plant for replacement of grid energy has been done

9.4.3 CAIRN :

a) **Ecological Restoration / Remediation:**

Cairn restores its project sites (including camp sites) as close as possible to the original conditions. This includes restoration of preserved Top-Soil, removal of all buried and above ground structures (unless required by the land owner) and restoration of natural drainage channels and topography. In the Barmer-Salaya Pipeline Project, Cairn has restored water body, crossings, which were vulnerable to erosion, with Geo-jute and stone pitching.

b) **CO_2 Sequestration:**

Cairn has taken Project Shrishti which is an example of Cairn India's commitment to ensuring sustenance of environment. The project aims at promoting Bio-diversity, turning deserts into forest, providing livelihood support and reducing carbon footprint, over and above ensuring compliance. While several of our energy saving/carbon reduction initiatives are targeted towards our operations, we also realize that these measures need to be supplemented by creating carbon sinks for the Green House Gas emissions that do get released to the atmosphere. A reliable way to capture this released carbon is by planting trees, since trees act as natural carbon sinks.

By increasing the green cover, we are able to meet the multiple requirements of green-belt compliance, improving the biodiversity of the areas where plantation activities take place, coastal protection and increasing the carbon dioxide absorbing capacity of the planet. The primary vehicle for coordinating these activities is our in – house program called Project Shrishti coordinated by our land team. Till date, Project Shrishti has contributed in plantation of approx. 4.40 Lakhs trees over approx. 365 hectares of land across Cairn Blocks in Rajasthan, Gujarat & Andhra Pradesh and planted approx. 29 Lakhs mangrove plants over approx. 260 hectares of coastal areas of Gujarat and Andhra Pradesh.

9.5 XII PLAN - E&P PROJECTION (2012-2017)

Table 9.4 : Projection of Crude Oil Production in 12th Plan (Figs. in MMTPA)

Company	12-13	12-13*	13-14	13-14*	14-15	14-15	15-16	15-16	16-17	Total	Total
	Projected	Actual	Projected	Actual	Projected	Actual	Projected	Actual	Projected	(Projected)	(Actual)
ONGC	25.045	22.561	28.270	22.240	28.002	22.260	26.286	22.370	25.456	133.059	67.061
OIL	3.920	3.660	4.000	3.460	4.060	3.412	4.160	3.230	4.200	20.34	10.532
Pvt./JV	13.340	11.640	13.300	12.080	12.700	11.780	12.100	11.356	11.500	62.94	35.500
Total	**42.305**	**37.861**	**45.570**	**37.780**	**44.762**	**37.452**	**42.546**	**36.956**	**41.156**	**216.339**	**113.093**

* as per actual

Table 9.5 : Projection of Natural Gas Production in 12th Plan (Figs. in BCM)

Company	12-13	12-13*	13-14	13-14*	14-15	14-15	15-16	15-16	16-17	Total	Total
	Projected	Actual	Projected	Actual	Projected	Actual	Projected	Actual	Projected	(Projected)	(Actual)
ONGC	25.266	23.550	25.472	23.280	26.669	22.020	28.215	21.177	38.676	144.298	68.850
OIL	3.300	2.640	3.800	2.620	4.000	2.720	4.270	2.838	4.450	19.820	7.980
Pvt./JV	23.710	14.490	32.380	9.500	39.400	8.910	40.430	8.235	41.460	177.380	32.900
Total (BCM)	52.276	40.680	61.652	35.400	70.069	33.650	72.915	32.25	84.586	341.498	109.730
Total MMSCMD	**143.220**	**111.450**	**168.910**	**97.000**	**191.970**	**92.192**	**199.221**	**88.356**	**175.000**	**187.120**	**300.642**

* as per actual

9.6 EXTRACTS FROM BP STATISTICAL REVIEW - 2016

Table 9.6 : Oil: Extracts from BP Statistical Review - 2016

Total Proved Reserves	At the end 1995 Thousand million barrels	At the end 2005 Thousand million barrels	At the end 2014 Thousand million barrels	Thousand million barrels	At end 2015 Thousand million barrels	Share of total	R/P ratio
US	29.8	29.9	55.0	**55.0**	**6.6**	3.2%	11.9
Canada	48.4	180.0	172.2	**172.2**	**27.8**	10.1%	107.6
Mexico	48.8	13.7	10.8	**10.8**	**1.5**	0.6%	11.5
Total North America	**126.9**	**223.6**	**238.0**	**238.0**	**35.9**	**14.0%**	**33.1**
Argentina	2.4	2.2	2.4	**2.4**	**0.3**	0.1%	10.2
Brazil	6.2	11.8	16.2	**13.0**	**1.9**	0.8%	14.1
Colombia	3.0	1.5	2.4	**2.3**	**0.3**	0.1%	6.3
Ecuador	3.4	4.9	8.0	**8.0**	**1.2**	0.5%	40.4
Peru	0.8	1.1	1.4	**1.4**	**0.2**	0.1%	34.3
Trinidad & Tobago	0.7	0.8	0.8	**0.7**	**0.1**	◊	18.1
Venezuela	66.3	80.0	300.0	**300.9**	**47.0**	17.7%	313.9
Other South & Central America	1.0	1.5	0.5	**0.5**	**0.1**	◊	9.9
Total South & Central America	**83.7**	**103.6**	**331.7**	**329.2**	**51.0**	**19.4%**	**117.0**
Azerbaijan	1.2	7.0	7.0	**7.0**	**1.0**	0.4%	22.8
Denmark	0.9	1.3	0.6	**0.6**	**0.1**	◊	9.6
Italy	0.8	0.5	0.6	**0.6**	**0.1**	◊	14.7
Kazakhstan	5.3	9.0	30.0	**30.0**	**3.9**	1.8%	49.3
Norway	10.8	9.7	6.5	**8.0**	**1.0**	0.5%	11.3
Romania	1.0	0.5	0.6	**0.6**	**0.1**	◊	19.5
Russian Federation	113.6	104.4	103.2	**102.4**	**14.0**	6.0%	25.5
Turkmenistan	0.5	0.5	0.6	**0.6**	**0.1**	◊	6.3
United Kingdom	4.5	3.9	2.8	**2.8**	**0.4**	0.2%	8.0
Uzbekistan	0.3	0.6	0.6	**0.6**	**0.1**	◊	25.3
Other Europe & Eurasia	2.2	2.2	2.1	**2.1**	**0.3**	0.1%	15.0
Total Europe & Eurasia	**141.2**	**139.5**	**154.6**	**155.2**	**21.0**	**9.1%**	**24.4**
Iran	93.7	137.5	157.8	**157.8**	**21.7**	9.3%	110.3
Iraq	100.0	115.0	143.1	**143.1**	**19.3**	8.4%	97.2
Kuwait	96.5	101.5	101.5	**101.5**	**14.0**	6.0%	89.8
Oman	5.2	5.6	5.2	**5.3**	**0.7**	0.3%	15.3
Qatar	3.7	27.9	25.7	**25.7**	**2.7**	1.5%	37.1
Saudi Arabia	261.5	264.2	267.0	**266.6**	**36.6**	15.7%	60.8
Syria	2.6	3.0	2.5	**2.5**	**0.3**	0.1%	253.7
United Arab Emirates	98.1	97.8	97.8	**97.8**	**13.0**	5.8%	68.7
Yemen	2.0	2.9	3.0	**3.0**	**0.4**	0.2%	176.5
Other Middle East	0.1	0.1	0.2	**0.2**	^	◊	2.8
Total Middle East	**663.3**	**755.5**	**803.8**	**803.5**	**108.7**	**47.3%**	**73.1**

Total Proved Reserves	At the end 1995 Thousand million barrels	At the end 2005 Thousand million barrels	At the end 2014 Thousand million barrels	Thousand million barrels	At end 2015 Thousand million barrels	Share of total	R/P ratio
Algeria	10.0	12.3	12.2	**12.2**	**1.5**	0.7%	21.1
Angola	3.1	9.0	12.7	**12.7**	**1.7**	0.7%	19.0
Chad	-	1.5	1.5	**1.5**	**0.2**	0.1%	52.4
Republic of Congo	1.3	1.5	1.6	**1.6**	**0.2**	0.1%	15.8
Egypt	3.8	3.7	3.7	**3.5**	**0.5**	0.2%	13.2
Equatorial Guinea	0.6	1.8	1.1	**1.1**	**0.1**	0.1%	10.4
Gabon	1.5	2.1	2.0	**2.0**	**0.3**	0.1%	23.5
Libya	29.5	41.5	48.4	**48.4**	**6.3**	2.8%	306.8
Nigeria	20.8	36.2	37.1	**37.1**	**5.0**	2.2%	43.2
South Sudan	n/a	n/a	3.5	**3.5**	**0.5**	0.2%	64.9
Sudan	0.3	0.6	1.5	**1.5**	**0.2**	0.1%	39.2
Tunisia	0.4	0.6	0.4	**0.4**	**0.1**	◊	18.6
Other Africa	0.7	0.5	3.7	**3.7**	**0.5**	0.2%	38.3
Total Africa	**72.0**	**111.3**	**129.3**	**129.1**	17.1	**7.6%**	**42.2**
Australia	3.8	3.7	4.0	**4.0**	**0.4**	0.2%	28.3
Brunei	1.1	1.1	1.1	**1.1**	**0.1**	0.1%	23.8
China	16.4	15.6	18.5	**18.5**	**2.5**	1.1%	11.7
India	5.5	5.9	5.7	**5.7**	**0.8**	0.3%	18.0
Indonesia	5.0	4.2	3.6	**3.6**	**0.5**	0.2%	12.0
Malaysia	5.2	5.3	3.6	**3.6**	**0.5**	0.2%	14.2
Thailand	0.3	0.5	0.4	**0.4**	^	◊	2.3
Vietnam	0.8	3.1	4.4	**4.4**	**0.6**	0.3%	33.3
Other Asia Pacific	1.1	1.4	1.3	**1.3**	**0.2**	0.1%	12.0
Total Asia Pacific	**39.1**	**40.8**	**42.6**	**42.6**	5.7	**2.5%**	**14.0**
Total World	**1126.2**	**1374.4**	**1700.0**	**1697.6**	**239.4**	**100.0%**	**50.7**
of which: OECD	149.2	244.0	253.9	**255.3**	**38.0**	15.0%	29.7
Non-OECD	976.9	1130.4	1446.1	**1442.3**	**201.3**	85.0%	58.0
OPEC	786.6	927.8	1211.1	**1211.6**	**169.9**	71.4%	86.8
Non-OPEC	339.6	446.6	488.9	**486.0**	**69.4**	28.6%	24.9
European Union #	8.3	7.0	5.6	**5.6**	**0.7**	0.3%	10.1
CIS	121.5	122.2	141.9	**141.1**	**19.1**	8.3%	27.8
Canadian oil sands: Total	41.5	173.6	166.2	**166.2**	**27.0**		
of which: Under active development	3.6	10.2	24.4	**24.4**	**4.0**		
Venezuela: Orinoco Belt	-	-	221.7	**222.3**	**35.7**		

^ Less than 0.05.

◊ Less than 0.05%.

n/a not available.

Excludes Estonia and Latvia in 2005.

Table 9.7 : Oil : Production

Million Tonnes	1995	2005	2014	2015	Change 2015 over 2014	Change 2015 over 2014
US	383.6	309.0	522.8	**567.2**	8.5%	13.0%
Canada	111.9	142.3	209.6	**215.5**	2.8%	4.9%
Mexico	150.3	186.6	137.1	**127.6**	-7.0%	2.9%
Total North America	**645.8**	**637.8**	**869.5**	**910.3**	**4.7%**	**20.9%**
Argentina	37.5	39.4	29.7	**29.7**	0.1%	0.7%
Brazil	37.6	89.1	122.1	**131.8**	7.9%	3.0%
Colombia	31.0	27.7	52.2	**53.1**	1.7%	1.2%
Ecuador	21.0	28.6	29.8	**29.1**	-2.4%	0.7%
Peru	6.4	4.5	5.3	**4.7**	-11.1%	0.1%
Trinidad & Tobago	6.7	8.1	5.1	**4.9**	-4.8%	0.1%
Venezuela	155.3	169.7	138.2	**135.2**	-2.1%	3.1%
Other South & Central America	4.6	7.4	7.6	**7.4**	-1.8%	0.2%
Total South & Central America	**300.1**	**374.4**	**390.0**	**396.0**	**1.5%**	**9.1%**
Azerbaijan	9.2	22.2	42.1	**41.7**	-1.0%	1.0%
Denmark	9.1	18.5	8.1	**7.7**	-5.4%	0.2%
Italy	5.2	6.1	5.8	**5.5**	-5.1%	0.1%
Kazakhstan	20.6	61.5	80.8	**79.3**	-1.9%	1.8%
Norway	138.4	138.7	85.3	**88.0**	3.2%	2.0%
Romania	7.0	5.4	4.1	**4.0**	-1.1%	0.1%
Russian Federation	310.7	474.8	534.1	**540.7**	1.2%	12.4%
Turkmenistan	4.1	9.5	12.1	**12.7**	5.0%	0.3%
United Kingdom	129.9	84.7	39.9	**45.3**	13.4%	1.0%
USSR	n/a	n/a	n/a	**n/a**	n/a	n/a
Uzbekistan	7.6	5.4	3.1	**3.0**	-3.1%	0.1%
Other Europe & Eurasia	27.6	22.0	19.2	**18.7**	-2.4%	0.4%
Total Europe & Eurasia	**669.4**	**849.0**	**834.7**	**846.7**	**1.4%**	**19.4%**
Iran	185.5	207.8	174.7	**182.6**	4.5%	4.2%
Iraq	26.0	89.9	160.3	**197.0**	22.9%	4.5%
Kuwait	104.9	130.4	150.8	**149.1**	-1.1%	3.4%
Oman	42.8	38.5	46.2	**46.6**	0.8%	1.1%
Qatar	21.8	52.6	79.6	**79.3**	-0.4%	1.8%
Saudi Arabia	437.2	521.3	543.4	**568.5**	4.6%	13.0%
Syria	29.6	22.3	1.6	**1.3**	-18.2%	◊
United Arab Emirates	112.3	135.7	166.6	**175.5**	5.3%	4.0%
Yemen	16.7	19.8	6.6	**2.1**	-67.8%	◊
Other Middle East	2.4	9.1	10.5	**10.4**	-0.5%	0.2%
Total Middle East	**979.2**	**1227.4**	**1340.3**	**1412.4**	**5.4%**	**32.4%**

Million Tonnes	1995	2005	2014	2015	Change 2015 over 2014	Change 2015 over 2014
Algeria	56.6	86.4	68.8	**68.5**	-0.4%	1.6%
Angola	31.2	62.9	83.0	**88.7**	6.8%	2.0%
Chad	n/a	9.1	4.3	**4.1**	-4.8%	0.1%
Republic of Congo	9.3	12.7	14.2	**14.3**	0.4%	0.3%
Egypt	46.6	33.2	35.1	**35.6**	1.4%	0.8%
Equatorial Guinea	0.3	16.4	13.1	**13.5**	3.3%	0.3%
Gabon	17.8	13.5	11.8	**11.6**	-1.4%	0.3%
Libya	67.9	82.2	23.3	**20.2**	-13.4%	0.5%
Nigeria	97.5	123.3	114.8	**113.0**	-1.5%	2.6%
South Sudan	n/a	n/a	7.7	**7.3**	-4.9%	0.2%
Sudan	0.1	14.5	5.9	**5.2**	-12.3%	0.1%
Tunisia	4.5	3.7	3.4	**2.9**	-14.1%	0.1%
Other Africa	7.8	8.6	12.1	**13.1**	7.9%	0.3%
Total Africa	**339.6**	**466.4**	**397.5**	**398.0**	**0.1%**	**9.1%**
Australia	26.7	25.3	19.1	**17.0**	-10.9%	0.4%
Brunei	8.5	10.1	6.2	**6.2**	0.4%	0.1%
China	149.0	181.4	211.4	**214.6**	1.5%	4.9%
India	36.6	34.9	41.6	**41.2**	-1.1%	0.9%
Indonesia	76.5	53.7	41.2	**40.0**	-3.0%	0.9%
Malaysia	33.3	34.6	29.8	**31.9**	6.9%	0.7%
Thailand	3.6	11.4	16.3	**17.2**	6.0%	0.4%
Vietnam	7.7	19.0	18.1	**17.4**	-3.4%	0.4%
Other Asia Pacific	10.6	12.4	12.9	**13.1**	1.4%	0.3%
Total Asia Pacific	**352.3**	**382.8**	**396.6**	**398.6**	**0.5%**	**9.1%**
Total World	**3286.4**	**3937.8**	**4228.7**	**4361.9**	**3.2%**	**100.0%**
of which: OECD	976.0	926.1	1042.0	**1087.9**	4.4%	24.9%
Non-OECD	2310.4	3011.7	3186.6	**3274.0**	2.7%	75.1%
OPEC	1317.2	1690.8	1733.3	**1806.6**	4.2%	41.4%
Non-OPEC	1969.2	2247.1	2495.4	**2555.3**	2.4%	58.6%
European Union #	167.6	126.9	67.2	**71.7**	6.6%	1.6%
CIS	358.3	580.3	677.1	**682.0**	0.7%	15.6%

⋆ Includes crude oil, shale oil, oil sands and NGLs (natural gas liquids - the liquid content of natural gas where this is recovered separately). Excludes liquid fuels from other sources such as biomass and derivatives of coal and natural gas.
^ Less than 0.05.
w Less than 0.05%.
n/a not available.
Excludes Estonia, Latvia and Lithuania prior to 1985 and Slovenia prior to 1990.

Table 9.8 : Natural Gas : Proved Reserves

Total Proved Reserves	At the end 1995 Trillion cubic metres	At the end 2005 Trillion cubic metres	At the end 2014 Trillion cubic metres	Trillion cubic metres	At the end 2015 Trillion cubic feet	Share of total	R/P ratio
US	4.7	5.8	10.4	**10.4**	**368.7**	5.6%	13.6
Canada	1.9	1.6	2.0	**2.0**	**70.2**	1.1%	12.2
Mexico	1.9	0.4	0.3	**0.3**	**11.4**	0.2%	6.1
Total North America	**8.5**	**7.8**	**12.8**	12.8	**450.3**	**6.8%**	**13.0**
Argentina	0.6	0.4	0.3	**0.3**	**11.7**	0.2%	9.1
Bolivia	0.1	0.8	0.3	**0.3**	**9.9**	0.2%	13.5
Brazil	0.2	0.3	0.5	**0.4**	**15.0**	0.2%	18.5
Colombia	0.2	0.1	0.1	**0.1**	**4.8**	0.1%	12.2
Peru	0.2	0.3	0.4	**0.4**	**14.6**	0.2%	33.1
Trinidad & Tobago	0.3	0.5	0.3	**0.3**	**11.5**	0.2%	8.2
Venezuela	4.1	4.3	5.6	**5.6**	**198.4**	3.0%	173.2
Other South & Central America	0.2	0.1	0.1	**0.1**	**2.2**	◊	24.0
Total South & Central America	**5.9**	**6.9**	**7.6**	7.6	**268.1**	**4.1%**	**42.5**
Azerbaijan	n/a	0.9	1.2	**1.1**	**40.6**	**0.6%**	63.2
Denmark	0.1	0.1	^	^	**1.1**	◊	6.7
Germany	0.2	0.2	^	^	**1.4**	◊	5.4
Italy	0.3	0.1	^	^	**1.6**	◊	7.3
Kazakhstan	n/a	1.3	0.9	**0.9**	**33.1**	0.5%	75.7
Netherlands	1.6	1.3	0.7	**0.7**	**23.8**	0.4%	15.7
Norway	1.4	2.4	1.9	**1.9**	**65.6**	1.0%	15.9
Poland	0.1	0.1	0.1	**0.1**	**3.3**	0.1%	23.1
Romania	0.4	0.6	0.1	**0.1**	**3.9**	0.1%	10.7
Russian Federation	31.1	31.2	32.4	**32.3**	**1139.6**	17.3%	56.3
Turkmenistan	n/a	2.3	17.5	**17.5**	**617.3**	9.4%	241.4
Ukraine	n/a	0.7	0.6	**0.6**	**21.3**	0.3%	34.7
United Kingdom	0.7	0.5	0.2	**0.2**	**7.3**	0.1%	5.2
Uzbekistan	n/a	1.2	1.1	**1.1**	**38.3**	0.6%	18.8
Other Europe & Eurasia	0.3	0.2	0.2	**0.2**	**7.0**	0.1%	31.4
Total Europe & Eurasia	**40.2**	**43.0**	**57.0**	56.8	**2005.1**	**30.4%**	**57.4**
Bahrain	0.1	0.1	0.2	**0.2**	**6.1**	0.1%	11.1
Iran	19.4	27.6	34.0	**34.0**	**1201.4**	18.2%	176.8
Iraq	3.4	3.2	3.7	**3.7**	**130.5**	2.0%	*
Israel	^	^	0.2	**0.2**	**6.4**	0.1%	21.9
Kuwait	1.5	1.6	1.8	**1.8**	**63.0**	**1.0%**	119.1
Oman	0.5	1.0	0.7	**0.7**	**24.3**	0.4%	19.7

Total Proved Reserves	At the end 1995 Trillion cubic metres	At the end 2005 Trillion cubic metres	At the end 2014 Trillion cubic metres	Trillion cubic metres	At the end 2015 Trillion cubic feet	Share of total	R/P ratio
Qatar	8.5	25.6	24.5	**24.5**	**866.2**	13.1%	135.2
Saudi Arabia	5.5	6.8	8.3	**8.3**	**294.0**	4.5%	78.2
Syria	0.2	0.3	0.3	**0.3**	**10.1**	0.2%	66.0
United Arab Emirates	5.9	6.1	6.1	**6.1**	**215.1**	3.3%	109.2
Yemen	0.3	0.3	0.3	**0.3**	**9.4**	0.1%	100.0
Other Middle East	^	^	^	^	**0.2**	◊	44.9
Total Middle East	**45.3**	**72.6**	**80.1**	**80.0**	**2826.6**	**42.8%**	**129.5**
Algeria	3.7	4.5	4.5	**4.5**	**159.1**	2.4%	54.3
Egypt	0.6	1.9	1.8	**1.8**	**65.2**	1.0%	40.5
Libya	1.3	1.3	1.5	**1.5**	**53.1**	0.8%	118.0
Nigeria	3.5	5.2	5.1	**5.1**	**180.5**	2.7%	102.1
Other Africa	0.8	1.2	1.2	**1.1**	**38.8**	0.6%	53.9
Total Africa	**9.9**	**14.1**	**14.1**	**14.1**	**496.7**	**7.5%**	**66.4**
Australia	1.2	2.2	3.5	**3.5**	**122.6**	1.9%	51.8
Bangladesh	0.3	0.4	0.2	**0.2**	**8.2**	0.1%	8.7
Brunei	0.4	0.3	0.3	**0.3**	**9.7**	0.1%	21.7
China	1.7	1.6	3.7	**3.8**	**135.7**	2.1%	27.8
India	0.7	1.1	1.4	**1.5**	**52.6**	0.8%	50.9
Indonesia	2.0	2.5	2.8	**2.8**	**100.3**	1.5%	37.8
Malaysia	2.3	2.5	1.2	**1.2**	**41.3**	0.6%	17.1
Myanmar	0.3	0.5	0.5	**0.5**	**18.7**	0.3%	27.0
Pakistan	0.6	0.9	0.5	**0.5**	**19.2**	0.3%	12.9
Papua New Guinea	^	^	0.2	**0.1**	**5.0**	0.1%	14.3
Thailand	0.2	0.3	0.2	**0.2**	**7.8**	0.1%	5.5
Vietnam	0.1	0.2	0.6	**0.6**	**21.8**	0.3%	57.9
Other Asia Pacific	0.4	0.4	0.3	**0.3**	**9.9**	0.2%	15.8
Total Asia Pacific	**10.1**	**13.0**	**15.4**	**15.6**	**552.6**	8.4%	28.1
Total World	**119.9**	**157.3**	**187.0**	**186.9**	**6599.4**	**100.0%**	**52.8**
of which: OECD	14.5	14.9	19.7	**19.6**	**690.8**	10.5%	15.1
Non-OECD	105.4	142.4	167.3	**167.3**	**5908.6**	89.5%	74.5
European Union	3.6	3.0	1.3	**1.3**	**46.0**	0.7%	10.8
CIS	31.1	37.6	53.7	**53.6**	**1891.3**	28.7%	71.3

* More than 500 years.

^ Less than 0.05.

w Less than 0.05%.

n/a. not available.

Table 9.9 : Natural Gas : Production

Billion Cubic Metres	1995	2005	2014	2015	Change 2015 over 2014	2015 Share of total
US	526.7	511.1	728.5	**767.3**	5.4%	22.0%
Canada	159.8	187.1	162.0	**163.5**	0.9%	4.6%
Mexico	30.0	52.2	57.1	**53.2**	-6.8%	1.5%
Total North America	**716.4**	**750.5**	**947.7**	**984.0**	**3.9%**	**28.1%**
Argentina	25.0	45.6	35.5	**36.5**	2.9%	1.0%
Bolivia	3.2	12.0	21.0	**20.9**	-0.7%	0.6%
Brazil	5.1	10.9	22.6	**22.9**	1.3%	0.6%
Colombia	4.4	6.7	11.8	**11.0**	-6.5%	0.3%
Peru	0.4	1.5	12.9	**12.5**	-3.3%	0.4%
Trinidad & Tobago	7.6	33.0	42.1	**39.6**	-5.8%	1.1%
Venezuela	27.5	27.4	28.6	**32.4**	13.2%	0.9%
Other South & Central America	2.5	3.2	2.6	**2.6**	0.2%	0.1%
Total South & Central America	**75.6**	**140.5**	**177.1**	**178.5**	**0.7%**	**5.0%**
Azerbaijan	6.0	5.2	17.6	**18.2**	3.4%	0.5%
Denmark	5.3	10.4	4.6	**4.6**	-0.4%	0.1%
Germany	16.1	15.8	7.7	**7.2**	-6.9%	0.2%
Italy	18.2	11.1	6.5	**6.2**	-5.3%	0.2%
Kazakhstan	3.8	9.0	12.2	**12.4**	1.7%	0.3%
Netherlands	67.6	62.5	55.7	**43.0**	-22.8%	1.2%
Norway	27.8	85.8	108.8	**117.2**	7.7%	3.3%
Poland	3.5	4.3	4.1	**4.1**	-1.2%	0.1%
Romania	18.0	12.4	9.7	**10.3**	5.9%	0.3%
Russian Federation	532.6	580.1	581.7	**573.3**	-1.5%	16.1%
Turkmenistan	29.2	57.0	69.3	**72.4**	4.5%	2.0%
Ukraine	16.5	18.6	17.9	**17.4**	-2.8%	0.5%
United Kingdom	70.8	88.2	36.8	**39.7**	7.8%	1.1%
USSR	n/a	n/a	n/a	**n/a**	n/a	n/a
Uzbekistan	43.9	54.0	57.3	**57.7**	0.8%	1.6%
Other Europe & Eurasia	16.0	10.4	6.5	**6.3**	-4.0%	0.2%
Total Europe & Eurasia	**875.2**	**1024.8**	**996.5**	**989.8**	**-0.7%**	**27.8%**
Bahrain	7.2	10.7	15.5	**15.5**	0.4%	0.4%
Iran	33.7	102.3	182.0	**192.5**	5.7%	5.4%
Iraq	3.2	1.5	0.9	**1.0**	13.5%	◊
Kuwait	9.3	12.2	15.0	**15.0**	-0.4%	0.4%
Oman	5.1	22.1	33.3	**34.9**	4.8%	**1.0%**
Qatar	13.5	45.8	174.1	**181.4**	4.2%	5.1%
Saudi Arabia	42.9	71.2	102.4	**106.4**	4.0%	3.0%
Syria	2.5	5.5	4.7	**4.3**	-7.9%	0.1%
United Arab Emirates	31.3	47.8	54.2	**55.8**	2.8%	1.6%
Yemen	-	-	9.3	**2.7**	-71.5%	0.1%
Other Middle East	0.3	1.9	7.7	**8.4**	9.6%	0.2%
Total Middle East	**149.1**	**321.0**	**599.1**	**617.9**	**3.1%**	**17.4%**

Billion Cubic Metres	1995	2005	2014	2015	Change 2015 over 2014	2015 Share of total
Algeria	58.7	88.2	83.3	**83.0**	-0.4%	2.3%
Egypt	12.5	42.5	48.8	**45.6**	-6.6%	1.3%
Libya	6.3	11.3	11.8	**12.8**	8.0%	0.4%
Nigeria	4.8	25.0	45.0	**50.1**	11.1%	1.4%
Other Africa	2.9	10.0	19.0	**20.4**	7.1%	0.6%
Total Africa	85.3	177.0	208.0	**211.8**	1.8%	6.0%
Australia	28.3	39.2	61.3	**67.1**	9.4%	1.9%
Bangladesh	7.0	13.8	23.9	**26.8**	12.2%	0.8%
Brunei	11.8	12.0	11.9	**12.7**	7.1%	0.4%
China	18.5	51.0	131.6	**138.0**	4.8%	3.9%
India	18.8	29.6	30.4	**29.2**	-3.8%	0.8%
Indonesia	60.7	75.1	75.3	**75.0**	-0.3%	2.1%
Malaysia	26.8	63.8	66.7	**68.2**	2.2%	1.9%
Myanmar	1.6	12.2	16.8	**19.6**	16.4%	0.6%
Pakistan	15.6	39.1	41.9	**41.9**	◊	1.2%
Thailand	11.4	23.7	42.1	**39.8**	-5.4%	1.1%
Vietnam	0.1	6.4	10.2	**10.7**	4.4%	0.3%
Other Asia Pacific	7.5	11.1	22.7	**27.7**	21.8%	0.8%
Total Asia Pacific	**208.2**	**377.0**	**534.8**	**556.7**	**4.1%**	**15.7%**
Total World	**2109.8**	**2790.9**	**3463.2**	**3538.6**	**2.2%**	**100.0%**
of which: OECD	**975.2**	**1086.1**	**1253.6**	**1293.2**	**3.2%**	**36.8%**
Non-OECD	1134.6	1704.8	2209.6	**2245.5**	1.6%	63.2%
European Union #	213.9	213.7	130.5	**120.1**	-8.0%	3.4%
CIS	632.3	724.1	756.2	**751.6**	-0.6%	21.1%

Source: Includes data from Cedigaz.

* Excludes gas flared or recycled. Includes natural gas produced for Gas-to-Liquids transformation.
^ Less than 0.05.
w Less than 0.05%
n/a not available.
Excludes Estonia, Latvia and Lithuania prior to 1985 and Slovenia prior to 1990.

9.7 SEDIMENTARY BASINS OF INDIA

The existing 26 Sedimentary Basins have an area of approximately 3.14 million Sq. Kms.

The sedimentary basins of the country have been classified into four categories and are as defined below:

Category-I

Basins with established commercial production.

Cambay, Mumbai Offshore, Rajasthan, Krishna Godavari, Cauvery, Assam Shelf and Assam-Arakan Fold Belt.

Category-II

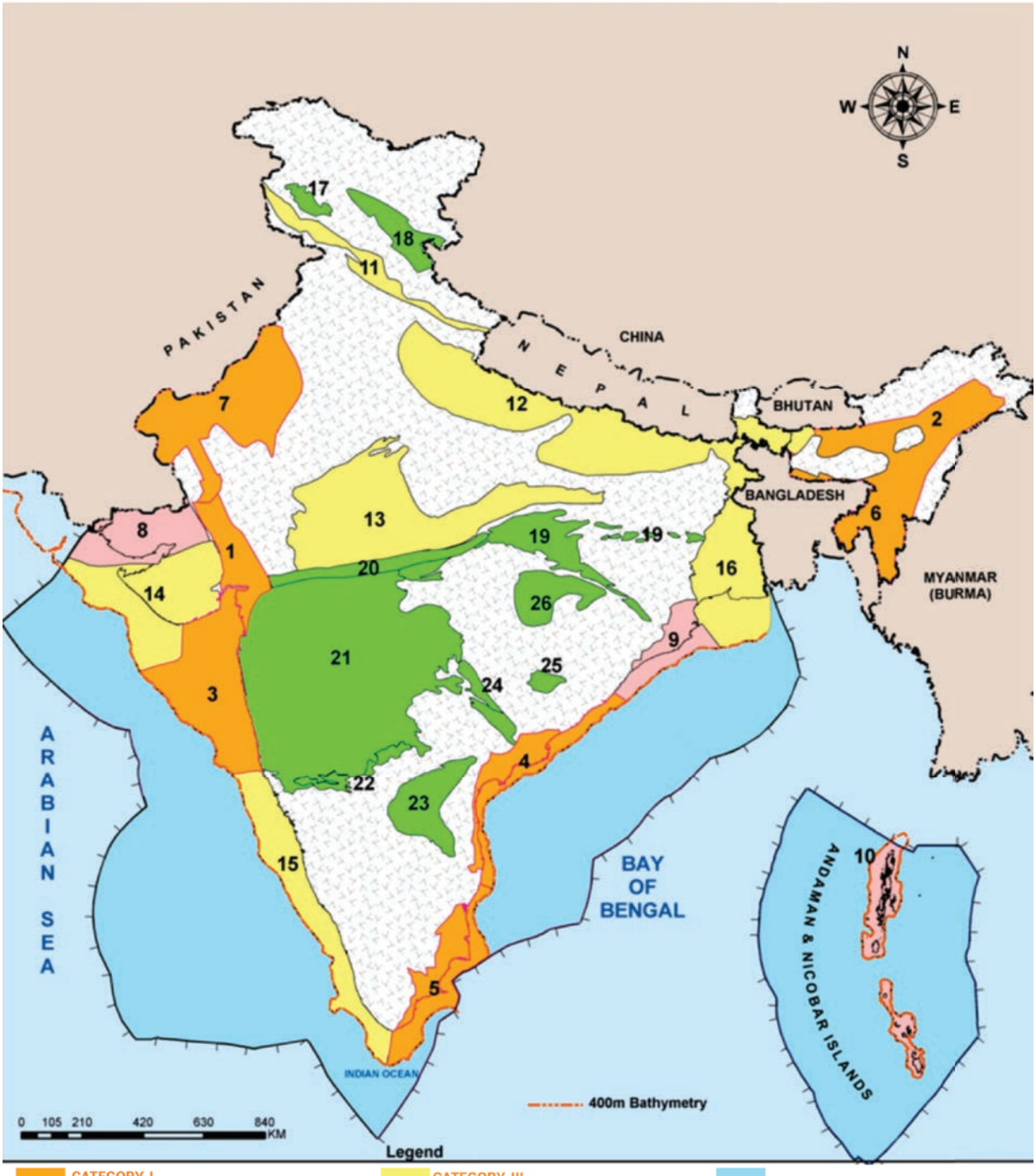
Basins with known accumulation of hydrocarbons but no. of commercial production achieved so far, Kutch Basin, Mahanadi-NEC (North East Coast) Basin, Andaman-Nicobar Basin.

Category-III

Basins having hydrocarbon shows that are considered geologically prospective: Himalayan Foreland Basin, Ganga Basin, Vindhyan Basin, Saurashtra Basin, Kerala-Konkan-Lakshadweep Basin and Bengal Basin.

Category-IV

Basins having uncertain potential which may be prospective by analogy with similar basins in the world. Karewa Basin, Spiti-Zanskar Basin, Satpura-South Rewa Damodar Basin, Chhattisgarh Basin, Narmada Basin, Deccan Syneclise Basin, Bhima Kaladgi Basin, Bastar Basin, Pranhita-Godavari Basin and Cuddapah Basin.



Category-I	Category-II	Category-III	Category-IV
1. Cambay Basin	8. Kutch Basin	11. Himalayan Foreland	17. Karewa Basin
2. Assam Shelf Basin	9. Mahanadi Basin	12. Ganga Basin	18. Spiti - Zanskar Basin
3. Mumbai Offshore Basin	10. Andaman - Nicobar Basin	13. Vindhyan Basin	19. Satpura - South Rewa - Damodar Basin
4. Krishna - Godavari Basin		14. Saurashtra Basin	20. Narmada Basin
5. Cauvery Basin		15. Kerala - Konkan - Lakshadweep Basin	21. Deccan Syneclise Basin
6. Assam - Arakan Fold Belt		16. Bengal Basin	22. Bhima - Kaladgi Basin
7. Rajasthan Basin			23. Cuddapah Basin
			24. Pranhita - Godavari Basin
			25. Bastar Basin
			26. Chhattisgarh Basin

ONGC'S Rig mounted platform - RS12

Chapter 10

Appendices

NELP Rounds Status

PEL-ML Status

Basin-wise Maps

10 Appendices

Table 10.1: Blocks awarded under Pre-NELP Exploration Rounds

Sl. No.	Basin	Block Name	Ref. no. on Map	Consortium (Participating Interest In %)	Date of Signing Contract	Awarded Area	Relinq. Area	Present Area
						(in sq.km)		
CURRENT ACTIVE BLOCKS (12 BLOCKS)								
ONLAND (9 Blocks)								
1	RJ	RJ-ON-90/1	17	CIL(35), CEHL(35)&ONGC (30)	15-05-1995	11108	7996.73	3111.27
2		RJ-ON/6	16	FEL(10),ISIL(65)&NOCL(25)	30-06-1998	5378	3203	2175
3	CB	CB-ON/7	22	HOEC(50)&GSPCL(50)	-	492	484.36	7.64
4		CB-ON/2	23	GSPC(80), GGR(20)	12-04-2000	1618	408	1210
5		CB-ON/3	19	ESSAR OIL LTD.(100)	16-07-1998	574	560.27	13.73
6	GK	GK-ON/4	21	FEL(100)	30-06-1998	1550	775	775
7	AA	AAP-ON-94/1	14	HOEC(40.32), OIL(16.12)&IOC(43.56)	30-06-1998	870	565	305
8		AA-ON/7#	13	CRL(65)#, ACL(35)#	19-02-1999	1934	1615	319
9		AA-ONJ/2	11	ONGC(100)	07-11-2003	1595	318	1277
SUB TOTAL						**25119**	**15925.36**	**9193.64**
SHALLOW WATER (3 Blocks)								
10	CB	CB-OS/1	6	ONGC(55.26),HOEC(38.04)&TPL(6.7)	19-11-1996	3290	3230	60
11		CB-OS/2	7	CIL(40),ONGC(50)&TPL(10)	-	3315	3110	205
12	CY	CY-OS-90/1(PY3)	-	HARDY(18),ONGC(40),TPL(21) &HOEC(21)	-	81	0	81
SUB TOTAL						**6686**	**6340**	**346**
SUB TOTAL ACTIVE BLOCKS						**31805**	**22265.36**	**9539.64**
RELINQUISHED BLOCKS/PROPOSED FOR RELINQUISHMENT (16 BLOCKS)								
13	AA	AA-ON/3	26	OKLAND(100)	-	3000	3000	0
14	CR	CR-ON-90/1	12	PONEI(29),EOL(16),IOC(35)&OIL(20)	30-06-1998	2570	2570	0
15	RJ	RJ-ON-90/5	15	EOL(75)&POGC(25)	-	16030	16030	0
16		RJ-ON-90/4	28	EOL(75), POGC (25)	-	16600	16600	0
17	GK	GK-ON-90/2	20	OKLAND(100)	-	11820	11820	0
18		GK-OS/5*	3	RIL(40),TIOL(50)&OKLAND(10)	16-07-1998	5000	5000	0
19		GK-OSJ/1	1	RIL(50),TIOL(25)&ONGC(25)	-	1275	1275	0
20	KG	KG-ON/1	25	RIL(40)&TOIL(60)	-	4180	4180	0
21		KG-OS/6	10	CAIRN(50)&VPL(50)	-	8775	8775	0
22		KG-OS-90/1	27	HARDY(30), HOEC (30), NIKO (30), NAGA FERTI (10)	-	3720	3720	0
23	MB	BB-OS/5	5	ESSAR(79)&PETROM SA(21)	-	9095	9095	0

Sl. No.	Basin	Block Name	Ref. no. on Map	Consortium (Participating Interest In %)	Date of Signing Contract	Awarded Area	Relinq. Area	Present Area
						(in sq.km)		
24	CY	CY-OS/2##	9	HEPI(75)&GAIL(25)	19-11-1996	5010	5010	0
25	GS	SR-OS-94/1	4	RIL(100)	12-04-2000	9150	9150	0
26	PG	GN-ON-90/3	24	HOEC(75)&MIL(25)	29-09-1993	29200	29200	0
27		CB-ON/1*	18	RIL(40),TOIL(50)&OOHL(10)	16-07-1998	6133	6133	0
28	GK	GK-OSJ/3*	2	RIL(60),ONGC(25)&OIL(15)	06-09-2001	5725	5725	0
SUB TOTAL RELINQUISHED/PFR BLOCKS						**137283**	**137283**	**0**
TOTAL AREA:						**169088**	**159548.36**	**9539.64**

NOTE: #Execution of new PSC after resolution of Nagaland issue.CRL's operatorship has been terminated by GoI. ACL has requested to transfer the PI.
##Arbitral award pronounced in favour of HEPI. Govt. challenged the arbitral award.
*PROPOSED FOR RELINQUISHMENT

-Bold indicates Operatorship

AA	-	Assam-Arakan	**MB**	-	Mumbai
AN	-	Andaman Nicobar	**MN**	-	Mahanadi - NEC
PG	-	Pranhita Godavari	**KK**	-	Kerala Konkan
CB	-	Cambay	**SR**	-	South Rewa
RJ	-	Rajasthan	**WB**	-	Bengal
GK	-	Gujarat Kutch	**VN**	-	Vindhyan
GS	-	Gujarat Saurashtra	**DS**	-	Deccan Syneclise
GV	-	Ganga Valley	**PR**	-	Palar
HF	-	Himalayan Foreland	**PA**	-	Purnea
KG	-	Krishna Godavari	**MZ**	-	Mizoram
CY	-	Cauvery			

Table 10.2 : Blocks awarded under Pre-NELP Small & Medium Discovered Field Rounds

Sl. No.	Basin	Block Name	Ref. no. on Map	Consortium (Participating Interest In %)	Date of Signing Contract	Awarded Area	Relinq. Area	Present Area
						(in sq.km)		
				CURRENT ACTIVE BLOCKS (26 BLOCKS)				
				ONLAND (22 BLOCKS)				
1	AA	AMGURI		ACL (40%) (Op.), CRL. * (60%)	23-02-2001	52.75	0	52.75
2		KHARSANG		GEO-ENPRO(10%) (Op.), OIL (40%), JEPL (25%), GPI (25%)	16-06-1995	10	0	10
3	CB	ALLORA		GNRL (30%) (Op.), GSPCL (70%)	23-02-2001	6.85	0	6.85
4		ASJOL		HOEC (50%) (Op.), GSPCL (50%)	03-02-1995	15	0	15
5		BAKROL		SELAN (100%) (Op.)	13-03-1995	36	0	36
6		BAOLA		SUN PETROCHEMICAL (100%) (Op.)	05-04-1995	4	0	4
7		BHANDUT		OILEX (40%) (Op.), GSPCL (60%)	23-09-1994	6	0	6
8		CAMBAY		OILEX (30%) (Op.), GSPCL (55%), OILEX-NL (15%)	23-09-1994	161	0	161
9		DHOLASAN		GNRL (30%) (Op.), GSPCL (70%)	23-02-2001	8.8	0	8.8
10		DHOLKA		JTI (100%) (Op.)	20-02-1995	48	0	48
11		HAZIRA		NIKO (33.33%) (Op.), GSPCL (66.67%)	23-09-1994	50	0	50
12		INDRORA		SELAN (100%) (Op.)	13-03-1995	130	0	130
13		KANAWARA		GNRL (30%) (Op.), GSPCL (70%)	23-02-2001	6.3	0	6.3
14		KARJISAN		SELAN (100%) (Op.)	16-02-2004	5	0	5
15		LOHAR		SELAN (100%) (Op.)	13-03-1995	5	0	5
16		MODHERA		SUN PETROCHEMICAL (100%) (Op.)	23-02-2001	12.7	0	12.7
17		N. KATHANA		GNRL (30%) (Op.), GSPCL (70%)	23-02-2001	12.2	0	12.2
18		N.BALOL		HOEC (25%) (Op.), GSPCL (45%), GNRL (30%)	23-02-2001	27.3	0	27.3
19		OGNAJ		SELAN (100%) (Op.)	16-02-2004	13.65	0	13.65
20		SANGANPUR		HRDC (50%) (Op.), PRIZE (50%)	23-02-2001	4.4	0	4.4
21		UNAWA		GSPCL (70%) (Op.), GNRL (30%)	23-02-2001	5.65	0	5.65
22		WAVEL		JTI (100%) (Op.)	20-02-1995	9	0	9
SUB TOTAL						**629.6**	**0**	**629.6**
				SHALLOW WATER (4 BLOCKS)				
23	CY	PY-1		HOEC (100%) (Op.)	06-10-1995	75	0	75
24	KG	RAVVA		CEIL (22.5%) (Op.), ONGC (40%), RAVVA (12.5%), VIDEOCON (25%)	28-10-1994	331.26	0	331.26
25	MB	MID&SOUTH TAPTI		BGEPL (30%) (Op.), RIL (30%)(Op.), ONGC (40%)(Op.)	22-12-1994	1471	0	1471
26		PANNA-MUKTA		BGEPL (30%) (Op.), RIL (30%)(Op.), ONGC (40%)(Op.)	22-12-1994	1207	0	1207
SUB TOTAL						**3084.26**	**0**	**3084.26**
SUB TOTAL ACTIVE BLOCKS						**3713.86**	**0**	**3713.86**
				RELINQUISHED BLOCKS/PROPOSED FOR RELINQUISHMENT (2 BLOCKS)				
27	CB	MATAR		NIKO (65%) (Op.), GSPCL (35%)	23-09-1994	6.2	6.2	0
28		SABARMATI		OILEX (40%) (Op.), GSPCL (60%)	23-09-1994	5.8	5.8	0
				SUB TOTAL RELINQUISHED/PFR BLOCKS		12	12	0
TOTAL AREA:						**3725.86**	**12**	**3713.86**

NOTE: * PROPOSED FOR RELINQUISHMENT

Table 10.3 : Blocks awarded under First Round of NELP (NELP-I)

Sl. No.	Basin	Block Name	Ref. no. on Map	Consortium (Participating Interest In %)	Date of Signing Contract	Awarded Area	Relinq. Area	Present Area
						(in sq.km)		
CURRENT ACTIVE BLOCKS (4 BLOCKS)								
DEEP WATER (3 BLOCKS)								
1	KG	KG-DWN-98/2	D2	ONGC(100)	12-04-2000	9757	2462	7295
2		KG-DWN-98/3#	D3	RIL(60),BPEAL(30) & NIKO(10)	12-04-2000	7645	6198.88	1446.12
3	MN	MN-DWN-98/3	D7	ONGC(100)	12-04-2000	10005	5017	4988
SUB TOTAL						**27407**	**13677.88**	**13729.12**
ONLAND (1 BLOCK)								
4	MN	NEC-OSN-97/2	N-15	RIL(60),BPEAL(30) & NIKO(10)	12-04-2000	14535	9895	4640
SUB TOTAL						**14535**	**9895**	**4640**
SUB TOTAL ACTIVE BLOCKS						**41942**	**23572.88**	**18369.12**
RELINQUISHED BLOCKS/PROPOSED FOR RELINQUISHMENT(20 BLOCKS)								
5	MN	NEC-OSN-97/1	N-16	GAZPROM(100)	03-10-2000	10425	10425	0
6	MN	MN-OSN-97/3*	N-14	ONGC(85) & GAIL(15)	12-04-2000	5420	5420	0
7	KG	KG-DWN-98/4	D4	ONGC(85) & OIL(15)	12-04-2000	9940	9940	0
8		KG-OSN-97/4	N-10	RIL(100)	12-04-2000	4020	4020	0
9		KG-OSN-97/3	N-11	RIL(100)	12-04-2000	2460	2460	0
10		KG-OSN-97/2	N-12	RIL(100)	12-04-2000	4790	4790	0
11		KG-OSN-97/1	N-13	ONGC(100)	12-04-2000	4485	4485	0
12	CY	CY-OSN-97/1	N-9	Mosbacher(20) & HOEC(80)	08-01-2001	4940	4940	0
13	CY	CY-OSN-97/2	N-8	OIL(100)	12-04-2000	5215	5215	0
14	KK	KK-OSN-97/2	N-6	RIL(100)	12-04-2000	19450	19450	0
15		KK-OSN-97/3	N-7	ONGC(100)	12-04-2000	15910	15910	0
16	MB	MB-OSN-97/2	N-3	RIL(100)	12-04-2000	5270	5270	0
17		MB-OSN-97/3	N-4	RIL(100)	12-04-2000	5740	5740	0
18		MB-OSN-97/4	N-5	ONGC(70) &IOC(30)	12-04-2000	18870	18870	0
19	SR	SR-OSN-97/1	N-2	RIL(100)	12-04-2000	5040	5040	0
20	GK	GK-OSN-97/1	N-1	RIL(100)	12-04-2000	1465	1465	0
21	GV	GV-ONN-97/1	N-17	ONGC(40),IOC(30), CEIL(15)& CEEPC(15)	12-04-2000	36750	36750	0
22	KG	KG-DWN-98/1	D1	RIL(70) & BPEAL(30)	12-04-2000	10810	10810	0
23		KG-DWN-98/5	D5	ONGC(85) & OIL(15)	12-04-2000	8980	8980	0
24	MN	MN-DWN-98/2*	D6	RIL(100)	12-04-2000	9605	9605	0
SUB TOTAL RELINQUISHED/PFR BLOCKS						**189585**	**189585**	**0**
TOTAL AREA:						**231527**	**213157.88**	**18369.12**

NOTE: #1148.12 SQ.KM Area converted to PML, 298 Sq.Km is tentative PEL area.
*PROPOSED FOR RELINQUISHMENT

Table 10.4 : Blocks awarded under Second Round of NELP (NELP-II)

Sl. No.	Basin	Block Name	Ref. no. on Map	Consortium (Participating Interest In %)	Date of Signing Contract	Awarded Area	Relinq. Area	Present Area
						(in sq.km)		
CURRENT ACTIVE BLOCKS (4 BLOCKS)								
SHALLOW WATER (2 BLOCKS)								
1	GS	GS-OSN-2000/1	N18	RIL (90), HEPI (10)	17-07-2001	8841	8241	600
2	MN	MN-OSN-2000/2	N24	ONGC (40), GAIL (20), IOC (20), OIL (20)	17-07-2001	8330	4264	4066
SUB TOTAL						**17171**	**12505**	**4666**
ONLAND (2 BLOCKS)								
3	CB	CB-ONN-2000/1	N29	GSPC (50), GAIL (50)	17-07-2001	1424	983.29	440.71
4		CB-ONN-2000/2	N30	NIKO (100)	17-07-2001	419	394.75	24.25
SUB TOTAL						**1424**	**983.29**	**464.96**
SUB TOTAL ACTIVE BLOCKS						**19014**	**13883.04**	**5130.96**
RELINQUISHED BLOCKS/PRPOSED FOR RELINQUISHMENT (19 BLOCKS)								
5	KK	KK-DWN-2000/1	D12	RIL (100)	17-07-2001	18113	18113	0
6		KK-DWN-2000/2	D13	ONGC (85), GAIL (15)	17-07-2001	20998	20998	0
7		KK-DWN-2000/3	D14	RIL (100)	17-07-2001	14889	14889	0
8		KK-DWN-2000/4	D15	ONGC (100)	17-07-2001	26149	26149	0
9		KK-OSN-2000/1	N20	ONGC (100)	17-07-2001	16125	16125	0
10	CY	CY-OSN-2000/1	N21	ONGC (100)	17-07-2001	5920	5920	0
11		CY-OSN-2000/2	N22	ONGC (100)	17-07-2001	3530	3530	0
12	GS	GS-DWN-2000/1	D8	ONGC (100)	17-07-2001	13937	13937	0
13		GS-DWN-2000/2	D9	ONGC (85), GAIL (15)	17-07-2001	14825	14825	0
14	MB	MB-DWN-2000/1	D10	ONGC (85), IOC (15)	17-07-2001	11239	11239	0
15		MB-DWN-2000/2	D11	ONGC (50), GAIL (15) IOC (15), OIL (10), GSPC (10)	17-07-2001	19106	19106	0
16		MB-OSN-2000/1	N19	ONGC (75), IOC (15), GSPC (10)	17-07-2001	18414	18414	0
17	MN	MN-OSN-2000/1*	N23	ONGC (100)	17-07-2001	6730	6730	0
18		MN-ONN-2000/1	N31	ONGC (20), GAIL (20), IOC (20), OIL(25), SUNTERA (15)	17-07-2001	7900	7900	0
19	WB	WB-OSN-2000/1	N25	ONGC (85), IOC (15)	17-07-2001	6700	6700	0
20		WB-ONN-2000/1	N26	ONGC (85), IOC (15)	17-07-2001	12505	12505	0
21	GV	GV-ONN-2000/1	N27	ONGC (85), IOC (15)	17-07-2001	23500	23500	0
22	RJ	RJ-ONN-2000/1	N28	OIL (60), SUNTERA (40)	17-07-2001	2535	2535	0
23	AA	AS-ONN-2000/1	N32	RIL (90), HARDY (10)	17-07-2001	5754	5754	0
SUB TOTAL RELINQUISHED/PFR BLOCKS						**248869**	**248869**	**0**
TOTAL AREA:						**267883**	**262752.04**	**5130.96**

NOTE: *PROPOSED FOR RELINQUISHMENT

Table 10.5 : Blocks awarded under Third Round of NELP (NELP-III)

Sl. No.	Basin	Block Name	Ref. no. on Map	Consortium (Participating Interest In %)	Date of Signing Contract	Awarded Area	Relinq. Area	Present Area
						(in sq.km)		
CURRENT ACTIVE BLOCKS (5 BLOCKS)								
DEEP WATER (1 BLOCK)								
1	CY	CY-DWN-2001/2	D20	RIL (70), BPEAL (30)	04-02-2003	14325	11290.65	3034.35
SUB TOTAL						**14325**	**11290.65**	**3034.35**
SHALLOW WATER (1 BLOCK)								
2	KG	KG-OSN-2001/3	N38	GSPC (80), GGR(10), & JOGPL(10)	04-02-2003	1870.5	1340	530.5
SUB TOTAL						**1870.5**	**1340**	**530.5**
ONLAND (3 BLOCKS)								
3	AA	AA-ONN-2001/1	N39	ONGC (100)	04-02-2003	3010	2050	960
4		AA-ONN-2001/2	N40	ONGC (80) & IOC (20)	04-02-2003	5340	2680	2660
5	CB	CB-ONN-2001/1	N45	ONGC (100)	04-02-2003	215	189	26
SUB TOTAL						**8565**	**4919**	**3646**
SUB TOTAL ACTIVE BLOCKS						**24760.5**	**17549.65**	**7210.85**
RELINQUISHED BLOCKS/PROPOSED FOR RELINQUISHMENT (18 BLOCKS)								
6	KK	KK-DWN-2001/3	D18	ONGC (100)	04-02-2003	21775	21775	0
7		KK-DWN-2001/2	D17	RIL (70), BPEAL (30)	04-02-2003	31515	31515	0
8		KK-DWN-2001/1	D16	RIL (70), BPEAL (30)	04-02-2003	27315	27315	0
9		KK-OSN-2001/2*	N34	ONGC (100)	04-02-2003	14120	14120	0
10		KK-OSN-2001/3*	N35	ONGC (100)	04-02-2003	8595	8595	0
11	CY	CY-DWN-2001/1	D19	ONGC (80), OIL (20)	04-02-2003	12425	12425	0
12		CY-PR-DWN-2001/3	D21	RIL (70), BPEAL (30)	04-02-2003	8600	8600	0
13		CY-PR-DWN-2001/4	D22	RIL (70), BPEAL (30)	04-02-2003	10590	10590	0
14	KG	KG-DWN-2001/1	D24	RIL (60), BPEAL (30) & HEPI (10)	04-02-2003	11605	11605	0
15		KG-OSN-2001/1	N36	RIL (100)	04-02-2003	1100	1100	0
16		KG-OSN-2001/2	N37	RIL (100)	04-02-2003	210	210	0
17	GS	GS-OSN-2001/1	N33	ONGC (100)	04-02-2003	9468	9468	0
18	RJ	RJ-ONN-2001/1	N44	ONGC (30), OIL(40) & SUNTERA(30)	04-02-2003	3425	3425	0
19	PG	PG-ONN-2001/1	N46	ONGC (100)	04-02-2003	6920	6920	0
20	HF	HF-ONN-2001/1*	N43	ONGC (100)	04-02-2003	3175	3175	0
21	PR	PR-DWN-2001/1	D23	RIL (70), BPEAL (30)	04-02-2003	8255	8255	0
22	AA	AA-ONN-2001/3	N41	ONGC (85) & OIL (15)	04-02-2003	110	110	0
23		AA-ONN-2001/4	N42	ONGC (100)	04-02-2003	645	645	0
SUB TOTAL RELINQUISHED/PFR BLOCKS						**179848**	**179848**	**0**
TOTAL AREA:						**204608.5**	**197397.65**	**7210.85**

NOTE: *PROPOSED FOR RELINQUISHMENT

Table 10.6 : Blocks awarded under Fourth Round of NELP (NELP-IV)

Sl. No.	Basin	Block Name	Ref. no. on Map	Consortium (Participating Interest In %)	Date of Signing Contract	Awarded Area	Relinq. Area	Present Area
						(in sq.km)		
CURRENT ACTIVE BLOCKS (4 BLOCKS)								
ONLAND (4 BLOCKS)								
1	AA	AA-ONN-2002/1	N47	JOGPL (20) & GAIL (80)	06-02-2004	1680	420	1260
2	CB	CB-ONN-2002/1	N52	ONGC (100)	06-02-2004	135	118	17
3		CB-ONN-2002/3	N54	GSPC(55), JEPL (20), PPCL (15) & GGR(10)	06-02-2004	285	263.71	21.29
4	CY	CY-ONN-2002/2	N56	ONGC (60) & BPRL (40)	06-02-2004	280	140	140
SUB TOTAL ACTIVE BLOCKS						**2380**	**941.71**	**1438.29**
RELINQUISHED BLOCKS/PROPOSED FOR RELINQUISHMENT (16 BLOCKS)								
5	GV	GV-ONN-2002/1	N50	CIL(50) & CESL(50)	06-02-2004	15550	15550	0
6	GS	GS-DWN-2002/1	D25	ONGC(100)	06-02-2004	21450	21450	0
7	RJ	RJ-ONN-2002/1	N51	OIL(60) & ONGC(40)	06-02-2004	9900	9900	0
8	KK	KK-DWN-2002/2*	D26	ONGC(80) & HPCL(20)	06-02-2004	22810	22810	0
9		KK-DWN-2002/3	D27	ONGC(80) & HPCL(20)	06-02-2004	20910	20910	0
10	MN	MN-DWN-2002/1	D29	ONGC(36), ENI(34), OIL(20) & BPCL(10)	06-02-2004	9980	9980	0
11		MN-DWN-2002/2	D30	ONGC(100)	06-02-2004	11390	11390	0
12		NEC-DWN-2002/1	D31	RIL(100)	06-02-2004	25565	25565	0
13		NEC-DWN-2002/2*	D32	ONGC (100)	06-02-2004	15465	15465	0
14	AN	AN-DWN-2002/2*	D34	ONGC(100)	06-02-2004	12495	12495	0
15	AN	AN-DWN-2002/1	D33	ONGC(100)	06-02-2004	10990	10990	0
16	KG	KG-DWN-2002/1*	D28	ONGC(70), OIL(20) & BPCL(10)	06-02-2004	10600	10600	0
17	CB	CB-ONN-2002/2	N53	JOGPL(30), GSPC(60) & GGR(10)	06-02-2004	125	125	0
18	CY	CY-ONN-2002/1	N55	JOGPL(30), GAIL(50) & GSPC(20)	06-02-2004	680	680	0
19	AA	AA-ONN-2002/4	N49	ONGC (90) & OIL (10)	06-02-2004	1060	1060	0
20		AA-ONN-2002/3*	N48	OIL(30) & ONGC (70)	06-02-2004	1460	1460	0
SUB TOTAL RELINQUISHED/PFR BLOCKS						**190430**	**190430**	**0**
TOTAL AREA:						**192810**	**191371.71**	**1438.29**

NOTE: * PROPOSED FOR RELINQUISHMENT

Table 10.7 : Blocks awarded under Fifth Round of NELP (NELP-V)

Sl. No.	Basin	Block Name	Ref. no. on Map	Consortium (Participating Interest In %)	Date of Signing Contract	Awarded Area	Relinq. Area	Present Area
						(in sq.km)		
CURRENT ACTIVE BLOCKS (6 BLOCKS)								
DEEP WATER (1 BLOCK)								
1	AN	AN-DWN-2003/2	D40	ENI (40), ONGC(45) & GAIL(15)	23-09-2005	13110	0	13110
SUB TOTAL						**13110**	**0**	**13110**
SHALLOW WATER (1 BLOCK)								
2	CB	CB-OSN-2003/1	N57	ONGC(100)	23-09-2005	2394	1892.0	502.0
SUB TOTAL						**2394**	**1892**	**502.0**
ONLAND (4 BLOCKS)								
3	RJ	RJ-ONN-2003/2	N65	FEL(10), BIL(40) & XOIL(50)	23-09-2005	13195	11796.16	1398.84
4	CB	CB-ONN-2003/1	N66	RIL (70) & BPEAL (30)	23-09-2005	635	159.60	475.40
5		CB-ONN-2003/2	N67	GSPC(50), GAIL(20), JSPL(20) & GGR(10)	23-09-2005	448	276	172
6	KG	KG-ONN-2003/1	N69	CIL(49) & ONGC(51)	23-09-2005	1697	1382	315
SUB TOTAL						**15975**	**13614**	**2361**
SUB TOTAL ACTIVE BLOCKS						**31479**	**15506**	**15973.24**
RELINQUISHED BLOCKS/PROPOSED FOR RELINQUISHMENT (14 BLOCKS)								
7	CY	CY-ONN-2003/1	N70	NIKO(100)	23-09-2005	957	957	0
8	KK	KK-DWN-2003/1	D35	RIL(100)	23-09-2005	18245	18245	0
9		KK-DWN-2003/2	D36	RIL(100)	23-09-2005	12285	12285	0
10	GS	GS-OSN-2003/1	N58	ONGC(51) & CE7L(49)	23-09-2005	5970	5970	0
11	AA	AA-ONN-2003/2 (Arunachal Pradesh)	N60	GPI(30), NTPC(40), CRL(15) & Brownstone (15)	23-09-2005	295	295	0
12		AA-ONN-2003/3	N61	OIL(85) & HPCL(15)	23-09-2005	275	275	0
13	AA	AA-ONN-2003/1*	N59	JOGPL(10), JSPL(35), GSPC(20) & GAIL(35)	16-12-2005	81	81	0
14	GV	GV-ONN-2003/1	N62	CEIL(24), CE1L(25) & ONGC(51)	23-09-2005	7210	7210	0
15	RJ	RJ-ONN-2003/1	N64	ENI(34),ONGC(36) & CIL(30)	23-09-2005	1335	1335	0
16	DS	DS-ONN-2003/1	N68	GGR(100)	23-09-2005	3155	3155	0
17	MN	MN-DWN-2003/1*	D38	RIL(55) NIKO(15) & BPEAL(30)	23-09-2005	17050	17050	0
18	AN	AN-DWN-2003/1*	D39	ONGC(100)	23-09-2005	9970	9970	0
19	VN	VN-ONN-2003/1	N63	ONGC(100)	23-09-2005	3585	3585	0
20	KG	KG-DWN-2003/1	D37	RIL(60), BPEAL(30) & HEPI(10)	23-09-2005	3288	3288	0
SUB TOTAL RELINQUISHED/PFR BLOCKS						**83701**	**83701**	**0**
TOTAL AREA						**115180**	**99207**	**15973.2**

NOTE: *PROPOSED FOR RELINQUISHMENT

Table 10.8 : Blocks awarded under Sixth Round of NELP (NELP-VI)

Sl. No.	Basin	Block Name	Ref. no. on Map	Consortium (Participating Interest In %)	Date of Signing Contract	Awarded Area	Relinq. Area	Present Area
						(in sq.km)		
CURRENT ACTIVE BLOCKS (12 BLOCKS)								
SHALLOW WATER (4 BLOCKS)								
1	GS	GS-OSN-2004/1	1	ONGC (100)	02-03-2007	6589	6037	552
2	CB	CB-OSN-2004/1	2	FEL(10) & NEWBURY (90)	02-03-2007	2616	0	2616
3	PR	PR-OSN-2004/1	5	CIL(35), ONGC(35) & TATA(30)	02-03-2007	9417	0	9417
4	KG	KG-OSN-2004/1	6	ONGC (100)	02-03-2007	1151	20	1131
SUB TOTAL						**19773**	**6057**	**13716**
ONLAND (8 BLOCKS)								
5	MZ	MZ-ONN-2004/1	7	OIL(85) & SHIV-VANI(15)	02-03-2007	3213	0	3213
6	VN	VN-ONN-2004/1	17	ONGC (100)	02-03-2007	5801	1470	4331
7	RJ	RJ-ONN-2004/2	20	OIL (75) & GEOGLOBAL (25)	02-03-2007	2196	2185.76	10.24
8	CB	CB-ONN-2004/1	22	ONGC(50), GSPC(40) & HERAMEC (10)	02-03-2007	32	22.27	9.73
9		CB-ONN-2004/2	23	ONGC(55), GSPC(45)	02-03-2007	423	132.29	290.71
10		CB-ONN-2004/3	24	ONGC(65), GSPC(35)	02-03-2007	113	0	113
11	KG	KG-ONN-2004/1	28	OIL(90) & GEOGLOBAL(10)	02-03-2007	549	195.54	353.46
12	CY	CY-ONN-2004/2	31	ONGC (80) & BRPL(20)	02-03-2007	375	0	375
SUB TOTAL						**12702**	**4006**	**8696**
SUB TOTAL ACTIVE BLOCKS						**32475**	**10063**	**22412**
RELINQUISHED BLOCKS/PROPOSED FOR RELINQUISHMENT (40 BLOCKS)								
13	KK	KK-DWN-2004/1	D1	ONGC(45), CIL(40) & TATA(15)	02-03-2007	12324	12324	0
14	KG	KG-DWN-2004/1	D10	ONGC(70), GSPC(10), HPCL(10) & GAIL(10)	02-03-2007	11951	11951	0
15		KG-DWN-2004/2	D11	ONGC(60),GSPC(10),HPCL(10), GAIL(10)&BPCL(10)	02-03-2007	11851	11851	0
16		KG-DWN-2004/3	D12	ONGC(70), GSPC(10), HPCL(10) & GAIL(10)	02-03-2007	6205	6205	0
17		KG-DWN-2004/4	D13	RIL(70) & BPEAL (30)	02-03-2007	11904	11904	0
18		KG-DWN-2004/5	D14	ONGC(50), GSPC(10), HPCL(10), GAIL(10), OIL(10) & BPCL(10)	02-03-2007	11922	11922	0
19		KG-DWN-2004/6	D15	ONGC(60),GSPC(10),HPCL(10), GAIL(10) & OIL (10)	02-03-2007	10907	10907	0
20		KG-ONN-2004/2*	29	GSPC (40), GAIL (40) & PETROGAS (20)	02-03-2007	1140	1140	0
21		KG-DWN-2004/7	D16	RIL (70) & BPEAL (30)	02-03-2007	11856	11856	0
22	MN	MN-DWN-2004/1*	D17	RIL (70) & BPEAL (30)	02-03-2007	9885	9885	0
23		MN-DWN-2004/2*	D18	RIL (70) & BPEAL (30)	02-03-2007	11813	11813	0
24		MN-DWN-2004/3*	D19	RIL (70) & BPEAL (30)	02-03-2007	11316	11316	0
25		MN-DWN-2004/4*	D20	RIL (70) & BPEAL (30)	02-03-2007	8822	8822	0
26	NEC	NEC-DWN-2004/1*	D22	SANTOS (100)	02-03-2007	7790	7790	0
27		NEC-DWN-2004/2*	D23	SANTOS (100)	02-03-2007	8706	8706	0
28		MN-DWN-2004/5	D21	RIL (70) & BPEAL (30)	02-03-2007	10454	10454	0

Sl. No.	Basin	Block Name	Ref. no. on Map	Consortium (Participating Interest In %)	Date of Signing Contract	Awarded Area	Relinq. Area	Present Area
						(in sq.km)		
29	RJ	RJ-ONN-2004/3	21	OIL(60), GEOGLOBAL(25) & HPCL (15)	02-03-2007	1330	1330	0
30		RJ-ONN-2004/1*	19	GSPC(22.22), GAIL(22.22), HPCL(22.22), HALLWORTHY(PANAMA) (11.11), NITINFIRE (11.11), & BPCL (11.11)	02-03-2007	4613	4613	0
31	MZ	MZ-ONN-2004/2**	8	NAFTOGAZ(10), RNRL(10), GEOPETROL(10) & REL(70)	02-03-2007	3619	3619	0
32	AA	AA-ONN-2004/1**	9	OIL(85) & SHIV-VANI (15)	02-03-2007	144	144	0
33		AA-ONN-2004/4**	12	ADANI ENTERPRISES (35), APIPL(20), NAFTOGAZ(10) & JPIP(35)	02-03-2007	95	95	0
34		AA-ONN-2004/3	11	ESSAR OIL (10), EEHL (90)	02-03-2007	1252	1252	0
35		AA-ONN-2004/2	10	OIL (100)	02-03-2007	218	218	0
36		AA-ONN-2004/5*	13	ESSAR ENERGY(90) & ESSAR OIL (10)	02-03-2007	46	46	0
37	CB	CB-ONN-2004/4	25	ONGC(50), GSPC(40) & HERAMEC(10)	02-03-2007	70	70	0
38		CB-ONN-2004/5**	26	ADANI ENTERPRISES (35), ADANI PORT(20), NAFTOGAZ (10) & WELSPUN (35)	02-03-2007	75	75	0
39	CY	CY-DWN-2004/1	D4	ONGC(70), GSPC(10), HPCL(10) & GAIL(10)	02-03-2007	10302	10302	0
40		CY-DWN-2004/2	D5	ONGC(70), GSPC(10), HPCL(10) & GAIL(10)	02-03-2007	12059	12059	0
41		CY-DWN-2004/4	D7	ONGC(70), GSPC(10), HPCL(10) & GAIL(10)	02-03-2007	12025	12025	0
42		CY-PR-DWN-2004/2	D9	ONGC(70), GSPC(10), HPCL(10) & GAIL(10)	02-03-2007	9994	9994	0
43		CY-DWN-2004/3*	D6	ONGC(70), GSPC(10), HPCL(10) & GAIL(10)	02-03-2007	12017	12017	0
44		CY-PR-DWN-2004/1*	D8	ONGC(70), GSPC(10), HPCL(10) & GAIL(10)	02-03-2007	13451	13451	0
45		CY-ONN-2004/1*	30	ONGC (80) & BPCL(20)	02-03-2007	214	214	0
46	MB	MB-OSN-2004/1	3	GSPC(20), IOC(20), GAIL(20), HPCL(20) & PETROGAS (20)	02-03-2007	1520	1520	0
47		MB-OSN-2004/2	4	PETROGAS(20),GAIL(20),IOC(20),GSPC(20)&HPCL(20)	02-03-2007	741	741	0
48	PA	PA-ONN-2004/1	14	ONGC (100)	02-03-2007	2537	2537	0
49	GV	GV-ONN-2004/1	15	ONGC (100)	02-03-2007	8354	8354	0
50	SR	SR-ONN-2004/1*	16	PRIZE PETROLEUM (10) & JAIPRAKASH ASSOCIATES LTD. (90)	02-03-2007	13277	13277	0
51	DS	DS-ONN-2004/1*	27	GEOGLOBAL RESOURCES (BARBADOS) (100)	02-03-2007	2649	2649	0
52	VN	VN-ONN-2004/2*	18	ONGC (100)	02-03-2007	4466	4466	0
SUB TOTAL RELINQUISHED/PFR BLOCKS						**273914**	**273914**	**0**
TOTAL AREA:						**306389**	**283976.86**	**22412.14**

NOTE: *PROPOSED FOR RELINQUISHMENT ** PSC TERMINATED BY MoP&NG

Table 10.9 : Blocks awarded under Seventh Round of NELP (NELP-VII)

Sl. No.	Basin	Block Name	Ref. no. on Map	Consortium (Participating Interest In %)	Date of Signing Contract	Awarded Area	Relinq. Area	Present Area
						(in sq.km)		
CURRENT ACTIVE BLOCKS (14 BLOCKS)								
SHALLOW WATER (3 BLOCKS)								
1	MB	MB-OSN-2005/1	S-1	ONGC (80) & GSPC (20)	22-12-2008	2811	1561	1250
2		MB-OSN-2005/2	S-2	ADAANI WELSPUN EXPLORATION LTD. (100)	22-12-2008	1191	0	1191
3		MB-OSN-2005/3	S-3	ONGC-70, ESSAR-30	22-12-2008	2810	1125	1685
SUB TOTAL						**6812**	**2686**	**4126**
ONLAND (11 BLOCKS)								
4	PA	PA-ONN-2005/2	3	ONGC (100)	22-12-2008	2552	0	2552
5	WB	WB-ONN-2005/2	5	ONGC (100)	22-12-2008	3792	0	3792
6		WB-ONN-2005/3	6	ONGC (100)	22-12-2008	4001	0	4001
7		WB-ONN-2005/4	7	ONGC (75) & OIL (25)	22-12-2008	3940	0	3940
8	SR	SR-ONN-2005/1##	11	DEEP ENERGY(10),DEEP INDUS(70), KANVEL FINANCE (10) & SAVLA ELECTRONICS (10)	22-12-2008	789	0	789
9	RJ	RJ-ONN-2005/1	14	HOEC (33.34), BPRL (33.33) & IMC (33.33)	22-12-2008	1424	273	1151
10		CB-ONN-2005/3	19	MERCATOR PETROLEUM (100)	22-12-2008	48	0	48
11		CB-ONN-2005/5	21	OMKAR NATURAL RESOUR. (100)	22-12-2008	83	0	83
12		CB-ONN-2005/9	25	MERCATOR PETROLEUM (100)	22-12-2008	170	37.8	132.20
13		CB-ONN-2005/10	26	ONGC (51) & GSPC (49)	22-12-2008	270	0	270
14	CY	CY-ONN-2005/1	29	GAIL (40), GSPC (30) & BENGAL ENERGY INTERNATIONAL(30)	22-12-2008	946	0	946
SUB TOTAL						**18015**	**311**	**17704**
SUB TOTAL ACTIVE BLOCKS						**24827**	**2997**	**21830**
RELINQUISHED BLOCKS/PROPOSED FOR RELINQUISHMENT (27 BLOCKS)								
15	KK	KK-DWN-2005/1	D-14	BHP BILLITON (26) & GVK (74)	22-12-2008	14675	14675	0
16		KK-DWN-2005/2*	D-15	ONGC (90) & GSPC (10)	22-12-2008	19234	19234	0
17	KG	KG-DWN-2005/2	D-17	BP EXPLORATION (50) & RIL (50)	22-12-2008	1949	1949	0
18		KG-OSN-2005/1	S-7	ONGC (60), GSPC (20) & HMEL (20)	22-12-2008	2810	2810	0
19		KG-OSN-2005/2	S-8	ONGC (80) & HMEL (20)	22-12-2008	1881	1881	0
20		KG-DWN-2005/1	D-16	ONGC (70), IOCL (20) & GSPC (10)	22-12-2008	1727	1727	0

Sl. No.	Basin	Block Name	Ref. no. on Map	Consortium (Participating Interest In %)	Date of Signing Contract	Awarded Area	Relinq. Area	Present Area
						(in sq.km)		
21	AN	AN-DWN-2005/1	D-19	ONGC (90) & OIL (10)	22-12-2008	11837	11837	0
22	CB	CB-ONN-2005/8**	24	VASUNDHARA RESOUR (100)	22-12-2008	133	133	0
23		CB-ONN-2005/2*	18A&B	IOCL (100)	22-12-2008	81	81	0
24		CB-ONN-2005/4*	20	ONGC (51) & GSPC (49)	22-12-2008	31	31	0
25		CB-ONN-2005/6	22	OMKAR NATURAL RESOUR. (100)	22-12-2008	102	102	0
26		CB-ONN-2005/7*	23	IOCL (100)	22-12-2008	199	199	0
27		CB-ONN-2005/11	27	QUEST (20), QQVS (40), SREI (20), VIPL(10) & PRIM (10)	22-12-2008	257	257	0
28	GV	GV-ONN-2005/3	10	ONGC (80) & TATA PETRO (20)	22-12-2008	2227	2227	0
29	MB	MB-DWN-2005/2	D-6	BHP BILLITON (26) & GVK (74)	22-12-2008	3660	3660	0
30		MB-DWN-2005/3	D-7	BHP BILLITON (26) & GVK (74)	22-12-2008	3097	3097	0
31		MB-DWN-2005/4	D-8	BHP BILLITON (26) & GVK (74)	22-12-2008	3408	3408	0
32		MB-DWN-2005/5	D-9	BHP BILLITON (26) & GVK (74)	22-12-2008	3169	3169	0
33		MB-DWN-2005/7	D-11	BHP BILLITON (26) & GVK (74)	22-12-2008	3324	3324	0
34		MB-DWN-2005/9	D-13	BHP BILLITON (26) & GVK (74)	22-12-2008	3138	3138	0
35		MB-OSN-2005/5*	S-5	ONGC (70) & GSPC (30)	22-12-2008	2402	2402	0
36		MB-OSN-2005/6*	S-6	ONGC (80) & GSPC (20)	22-12-2008	2820	2820	0
37	AA	AA-ONN-2005/1	1	ONGC (60), OIL (30) & ACL (10)	22-12-2008	363	363	0
38	PA	PA-ONN-2005/1	2	ONGC (100)	22-12-2008	1096	1096	0
39	RJ	RJ-ONN-2005/3*	16	GSPC (60) & ONGC (40)	22-12-2008	1217	1217	0
40		RJ-ONN-2005/2*	15	OIL(60), HOEC(20), HPCL & Mittal Energy Ltd.(20)	22-12-2008	1517	1517	0
41	PR	PR-ONN-2005/1*	28	ONGC (80) & TATA PETRO. (20)	22-12-2008	1807	1807	0
SUB TOTAL RELINQUISHED/PFR BLOCKS						**88161**	**88161**	**0**
TOTAL AREA:						**112988**	**91158**	**21830**

NOTE: * PROPOSED FOR RELINQUISHMENT
** PSC TERMINATED BY MoP&NG
PEL AWAITED.

Table 10.10 : Blocks awarded under Eighth Round of NELP (NELP-VIII)

Sl. No.	Basin	Block Name	Ref. no. on Map	Consortium (Participating Interest In %)	Date of Signing Contract	Awarded Area	Relinq. Area	Present Area
						(in sq.km)		
CURRENT ACTIVE BLOCKS (19 BLOCKS)								
DEEP WATER (1 BLOCK)								
1	MB	MB-DWN-2009/1	D-1	CIL (100)	30-06-2010	2961	0	2961
SUB TOTAL						**2961**	**0**	**2961**
SHALLOW WATER (6 BLOCKS)								
2	GK	GK-OSN-2009/1	S-1	ONGC (40), GSPC (20), AWEL (20) & IOC (20)	30-06-2010	1264	747	517
3		GK-OSN-2009/2	S-2	ONGC (40), AWEL (30) & IOC (30)	30-06-2010	1242	376	866
4	CY	CY-OSN-2009/2	S-20	OIL (50) & ONGC (50)	30-06-2010	1621	0	1621
5		KG-OSN-2009/2	S-23	ONGC (90) & APGIC (10)	30-06-2010	1471	0	1471
6		KG-OSN-2009/3	S-24	CIL (100)	30-06-2010	1988	0	1988
7		KG-OSN-2009/4	S-25	ONGC (50), OIL (30), NTPC (10) & APGIC (10)	30-06-2010	835	0	835
SUB TOTAL						**8421**	**1123**	**7298**
ONLAND (12 BLOCKS)								
8	AA	AA-ONN-2009/2	2	JOGPL (47), JEKPL (17) & JODPL (36)	19-07-2010	1740	0	1740
9		AA-ONN-2009/4	4	OIL (50) & ONGC (50)	30-06-2010	84	0	84
10	VN	VN-ONN-2009/3	9	ONGC (100)	30-06-2010	1250	788	462
11	CB	CB-ONN-2009/1	11	SINTEX OIL & GAS (100)	30-06-2010	113	0	113
12		CB-ONN-2009/2	12	SINTEX OIL & GAS (100)	30-06-2010	68	0	68
13		CB-ONN-2009/3##	13	HCIL (100)	30-06-2010	71	0	71
14		CB-ONN-2009/4	14	ONGC (50) & GSPC (50)	30-06-2010	58	0	58
15		CB-ONN-2009/5	15	NTPC (100)	30-06-2010	165	0	165
16		CB-ONN-2009/6##	16	HCIL (100)	30-06-2010	177	0	177
17		CB-ONN-2009/7	17	SINTEX OIL & GAS (100)	30-06-2010	144	0	144
18		CB-ONN-2009/8	18	JPIL (87) & JPPL (13)	30-06-2010	136	0	136
SUB TOTAL						**4006**	**788**	**3218**
SUB TOTAL ACTIVE BLOCKS						**15388**	**1911**	**13477**
RELINQUISHED BLOCKS/PROPOSED FOR RELINQUISHMENT (13 BLOCKS)								
19	AA	AA-ONN-2009/3*	3	ONGC (50) & OIL (50)	30-06-2010	84	84	0
20		AA-ONN-2009/1*	1	JOGPL (47), JEKPL (17) & JODPL (36)	30-06-2010	2217	2217	0
21	KG	KG-DWN-2009/1	D-6 (A&B)	BGEPIL (30), OIL (15), ONGC (45) & APGIC (10)	30-06-2010	1800	1800	0
22	KG	KG-OSN-2009/1*	S-22	ONGC (80), APGIC (10) & NTPC (10)	30-06-2010	1472	1472	0
23	CY	CY-OSN-2009/1	S-19	Bengal Energy International Inc (100)	30-06-2010	1362	1362	0
24	AN	AN-DWN-2009/1*	D-7	ONGC (70) & OIL (30)	30-06-2010	4981	4981	0
25		AN-DWN-2009/2*	D-8	ONGC (60) & OIL (40)	30-06-2010	3995	3995	0
26		AN-DWN-2009/3*	D-9	ONGC (60) & OIL (40)	30-06-2010	3992	3992	0
27		AN-DWN-2009/5*	D-11	ONGC (90) & GSPC (10)	30-06-2010	4002	4002	0
28		AN-DWN-2009/13*	D-19	ONGC (70), NTPC (10), GAIL (10) & GSPC (10)	30-06-2010	4007	4007	0
29		AN-DWN-2009/18*	D-24	ONGC (60), OIL (30) & GAIL (10)	30-06-2010	4040	4040	0
30	MB	MB-OSN-2009/3	S-5	BHP (100)	30-06-2010	1492	1492	0
31		MB-OSN-2009/6	S-8	BHP (100)	30-06-2010	1876	1876	0
32		MB-OSN-2009/7	S-9	BHP (100)	30-06-2010	1865	1865	0
SUB TOTAL RELINQUISHED/PFR BLOCKS						**37185**	**37185**	**0**
TOTAL AREA:						**52573**	**39096**	**13477**

NOTE : * PROPOSED FOR RELINQUISHMENT

PEL NOT YET GRANTED

10.11: Blocks awarded under Ninth Round of NELP (NELP-IX)

Sl. No.	Basin	Block Name	Ref. no. on Map	Consortium (Participating Interest In %)	Date of Signing Contract	Awarded Area	Relinq. Area	Present Area
						(in sq.km)		
CURRENT ACTIVE BLOCKS (17 BLOCKS)								
SHALLOW WATER (3 BLOCKS)								
1.	GK	GK-OSN-2010/1	S-1	ONGC (60), OIL (30) & GAIL (10)	28-03-2012	1361	0	1361.00
2.		GK-OSN-2010/2	S-2	ONGC (90) & GAIL (10)	28-03-2012	1625	0	1625.00
3.	MB	MB-OSN-2010/2	S-4	OIL (50), HPCL (30) & BPRL (20)	30-08-2012	3411	0	3411.00
SUB TOTAL						**6397**	**0**	**6397.00**
ONLAND (14 BLOCKS)								
4.	A A	AA-ONN-2010/2	2	OIL(40), ONGC(30), GAIL(20) & East West Petroleum (10)	28-03-2012	396	0	396.00
5.		AA-ONN-2010/3	3	OIL(40), ONGC(40) & BPRL(20)	28-03-2012	171	0	171.00
6.	VN	VN-ONN-2010/1##	4	Deep Energy LLC(10) & KGN Industries(90)	28-03-2012	3776	0	3776.00
7.		VN-ONN-2010/2##	5	Deep Energy LLC (10), Deep Natural Resources Limited (15) & Safak WSB Energy Pvt. Ltd. (75)	28-03-2012	4909	0	4909.00
8.	RJ	RJ-ONN-2010/2##	8	FEL (10) & Birkbeck Investments Ltd. (90)	28-03-2012	535	0	535.00
9.	CB	CB-ONN-2010/1	9	ONGC (100)	28-03-2012	782	0	782.00
10.		CB-ONN-2010/3##	11	Deep Energy LLC (10) & KGN Oil & Gas Pvt. Ltd. (90)	28-03-2012	534	0	534.00
11.		CB-ONN-2010/4##	12	Pratibha Oil & Natural Gas Pvt. Ltd. (100)	28-03-2012	61	0	61.00
12.		CB-ONN-2010/5	13	Pan India Consultants (20) & Frost International Ltd. (80)	28-03-2012	49	0	49.00
13.		CB-ONN-2010/6	14	ONGC (80) & IOCL (20)	28-03-2012	39	0	39.00
14.		CB-ONN-2010/8	16A&B	BPRL(25), GAIL(25), EIL(20), BFIL(20) & MIEL(10)	30-08-2012	42	0	42.00
15.		CB-ONN-2010/9	17	ONGC (100)	30-08-2012	109.36	0	109.36
16.		CB-ONN-2010/10##	18	Sankalp Oil & Natural Resources Ltd. (100)	27-06-2012	122	0	122.00
17.		CB-ONN-2010/11	19	BPRL (25), GAIL (25), EIL (20) BFIL (15) & MIEL (15)	28-03-2012	131	0	131.00
SUB TOTAL						**11656**	**0**	**11656.36**
SUB TOTAL ACTIVE BLOCKS						**18053**	**0.00**	**18053.36**
RELINQUISHED BLOCKS/PROPOSED FOR RELINQUISHMENT(2 BLOCKS)								
18.	MB	MB-DWN-2010/1	D-2	BGEPIL (50) & BHP (50)	10-09-2012	7963	7963	0.00
19.	A A	AA-ONN-2010/1	1	PPCL(20) & ABGEL (80)	30-08-2012	401	401	0.00
SUB TOTAL RELINQUISHED/PFR BLOCKS						**8364**	**8364**	**0.00**
TOTAL AREA :						**26417**	**8364.00**	**18053.36**

NOTE : ## PEL NOT YET GRANTED

Table 10.12 : Basin-wise distribution of PEL areas under operation (Pre-NELP & NELP blocks) (as on 01.04.2016)

Location Type	Basin	Pre-NELP	NELP's									Grand Total
			I	II	III	IV	V	VI	VII	VIII	IX	
Onland	Assam-Arakan Fold Belt (1)							3213				3213
	Assam-Arakan Shelf (10)	1901			3620	1260				1824	567	9172
	Bengal (3)								11733			11733
	Cambay (27)	1231.37		440.71	26	38.29	648	122.73	533.2	684	1152.36	4876.66
	Cauvery (3)					140		375	946			1461
	Ganga (1)								2552			2552
	Krishna Godavari (2)						315	353.46				668.46
	Kutch (1)	775										775
	Rajasthan (4)	2000					2164	10.24	1151			5325.24
	Vindhyan (2)							4331		1250		5581
Onland Total (54)		**5907.37**	**-**	**440.71**	**3646**	**1438.29**	**3127**	**8405.43**	**16915.2**	**3758**	**1719.36**	**45357.36**
Shallow Water	Cambay (3)	60					1795.5	2616				4471.5
	Cauvery (2)							9417		1621		11038
	Krishna Godavari (5)				530.5			1131		4294		5955.5
	Kutch (4)									2506	2986	5492
	Mahanadi (2)		4140	4061								8201
	Mumbai (4)								5687		3411	9098
	Saurashtra (2)			600				4942				5542
Shallow Water Total (22)		**60**	**4140**	**4661**	**530.5**	**-**	**1795.5**	**18106**	**5687**	**8421**	**6397**	**49798**
Deep-water	Andaman-Nicobar (1)						13110					13110
	Cauvery (1)				3034.38							3034.38
	Krishna Godavari (2)		7593									7593
	Mahanadi (1)		4988									4988
	Mumbai (1)									2961		2961
Deep Water Total (6)			**12581**	**-**	**3034.38**	**-**	**13110**	**-**	**-**	**2961**	**-**	**31686.38**
Grand Total (91)		**5967.37**	**16721**	**5101.71**	**7210.88**	**1438.29**	**18032.5**	**26511.43**	**22602.2**	**15140**	**8116.36**	**126841.74**

Table 10.13 : Company-wise distribution of PEL areas under operation (Pre-NELP & NELP blocks) (as on 01.04.2016)

Operator	Blocks	Pre-NELP	NELP's									Grand Total
			I	II	III	IV	V	VI	VII	VIII	IX	
ONGC	36	1337	12283	4061	3646	157	2110.5	10901.73	19051	6120	3916.36	63583.59
OIL	8					0		3576.7	0	1705	3978	9259.7
CAIRN	3							9417		4949		14366
ENI	1						13110					13110
RIL	5		4438	600	3034.38		476					8548.38
FOCUS	5	2775					2164	2616				7555
JOGPL	2					1260				1740		3000
GSPC	5	1210		440.71	530.5	21.29	172					2374.5
HOEC	3	312.64							1151			1463.64
Adani Welspun	1								1191			1191
GAIL	1								946			946
SINTEX Oil & GAS	3									325		325
ACL	1	319										319
Mercator Petr.	2								180.2			180.2
BPRL	2										173	173
NTPC	1									165		165
JPIL	1									136		136
Omkar Natural	1								83			83
PAN India / Frost Int. Ltd.	1										49	49
ESSAR	1	13.73						0				13.73
Grand Total	**83**	**5967.37**	**16721**	**5101.71**	**7210.88**	**1438.29**	**18032.5**	**26511.4**	**22602.2**	**15140**	**8116.36**	**126841.74**

Table 10.14 : PELs operated by OIL as on 01.04.2016

Sl. No.	Basin	Block Name	Ref. No. on Map	Effective Date of PEL	Area (Sq. Km.)	Total Area (Sq. Km.)
		NOMINATION BLOCKS				
1	Assam-Arakan	Tinsukia	OA-6	01.04.02	471	
		Namchik	OA-10	01.05.05	195	
		Jairampur Extn.	OA-11	01.04.06	23.25	
		Dibrugarh	OA-14	01.04.02	427	
		Deomali	OA-17	18.02.05	113.5	1229.75
NOMINATION TOTAL						**1229.75**
		PRE-NELP / NELP BLOCKS				
2	Rajasthan	RJ-ONN-2004/2	20	21.01.08	10.24	10.24
3	Assam-Arakan	AA-ONN-2009/4	4	09.12.11	84	
		AA-ONN-2010/2	2	29.12.14	396	
		AA-ONN-2010/3	3	12.12.13	171	651
4	Mizoram	MZ-ONN-2004/1	7	22.05.07	3213	3213
5	Krishna-Godavari	KG-ONN-2004/1	28	16.02.08	353.46	353.46
6	Cauvery	CY-OSN-2009/2	S-20	02.08.10	1621	1621
7	Mumbai	MB-OSN-2010/2	S-4	26.09.12	3411	3411
PRE-NELP / NELP TOTAL						**9259.7**
GRAND TOTAL PELs OPERATED BY OIL						**10489.45**

Table 10.15 : PELs operated by ONGC as on 01.04.2016

Sl. No.	Basin	Block Name	Ref. No. on Map	Effective Date of PEL	Area (Sq. Km.)	Total Area (Sq. Km.)
			NOMINATION BLOCKS			
1	Assam - Arakan	Sibsagar District	UA-1	01.04.02	87.1	
2		Golaghat District	DH-4	20.01.01	54.4	
3		Bhagty Bhandari	NG-1	28.04.06	620	
4		Singphan	NG-2	28.04.06	320	
5		Dimapur	NG-3	28.04.06	650	1731.5
6	Himalayan Foreland	Kangra-Mandi	HP-1	10.11.03	1828	1828
TOTAL ONLAND NOMINATION BLOCKS						**3559.5**
			OFFSHORE BLOCKS			
7	Gujarat-Kutch Offshore	GK-DW-1	K-5	01.10.04	16557	16557
8	Mumbai Offshore	BB-OS-DW-I	B-9	28.12.04	7537	
9		BB-OS-DW-II	B-10	28.12.04	8950	16487
10	K-G Offshore	KG-OS-DW-III	KGO-7	15.05.03	1190	1190
TOTAL OFFSHORE NOMINATION BLOCKS						**34234**
TOTAL NOMINATION BLOCKS						**37793.5**
			PRE-NELP / NELP BLOCKS			
11	Cambay	CB-OS/1	6	19.11.06	60	
12		CB-ONN-2001/1	N45	19.08.03	26	
13		CB-ONN-2002/1	N52	18.10.04	17	
14		CB-OSN-2003/1	N57	05.12.05	1795.5	
15		CB-ONN-2004/1	22	20.10.07	9.73	
16		CB-ONN-2004/3	24	17.05.07	113	
17		CB-ONN-2005/10	26	20.11.09	270	
18		CB-ONN-2009/4	14	06.09.11	58	
19		CB-ONN-2010/1	9	16.03.13	782	
20		CB-ONN-2010/6	14	16.02.13	39	
21		CB-ONN-2010/9	17	01.02.14	109.36	3279.59
22	Cauvery Onland	CY-ONN-2002/2	N56	31.08.04	140	
23		CY-ONN-2004/2	31	30.05.08	375	515
24	Assam-Arakan	AA-ONJ/2	11	07.11.08	1277	
25		AA-ONN-2001/1	N39	01.05.03	960	
26		AA-ONN-2001/2	N40	29.07.03	2660	
27	Purnea	PA-ONN-2005/2	3	23.12.09	2552	7449
28	Vindhyan	VN-ONN-2004/1	17	17.01.08	4331	
29		VN-ONN-2009/3	9	30.06.10	1250	5581
30	Gujarat - Kutch	GS-OSN-2004/1	1	25.04.07	4942	
31	Saurashtra Offshore	GK-OSN-2009/1	S-1	05.08.10	1264	
32		GK-OSN-2009/2	S-2	05.08.10	1242	
33		GK-OSN-2010/1	S-1	04.05.12	1361	
34		GK-OSN-2010/2	S-2	09.05.12	1625	10434
35	Mumbai Offshore	MB-OSN-2005/1	S-1	27.01.09	2811	
36		MB-OSN-2005/3	S-3	04.02.09	1685	4496
37	K-G Offshore	KG-DWN-98/2	D2	12.04.00	7295	
38		KG-ONN-2003/1	N69	08.02.07	315	
39		KG-OSN-2004/1	6	25.05.07	1131	
40		KG-OSN-2009/2	S-23	30.07.10	1471	
41		KG-OSN-2009/4	S-25	02.08.10	835	11047
42	Mahanadi-NEC Offshore	MN-DWN-98/3	D7	19.05.00	4988	
43		MN-OSN-2000/2	N24	02.08.01	4061	9049
44	Bengal	WB-ONN-2005/2	5	23.12.09	3792	
45		WB-ONN-2005/3	6	23.12.09	4001	
46		WB-ONN-2005/4	7	23.12.09	3940	11733
TOTAL PELs IN PRE-NELP/NELP						**63583.59**
GRAND TOTAL PELs OPERATED BY ONGC						**101377.09**

Table 10.16 : PELs under Pre-NELP Exploration and NELP : Blocks with Pvt./JV companies (as on 01.04.2016)

Sl. No.	Company / Operator	Basin	Block Name	Ref. No. on Map	Effective Date of PEL	Area (Sq. km.)	Total Area (Sq.km.)
1	RIL	K-G Offshore	KG-DWN-98/3	D3	07.06.00	298	
2		Cauvery Offshore	CY-DWN-2001/2	D20	03.04.03	3034.38	
3		Mahanadi-NEC Offs.	NEC-OSN-97/2	N15	07.06.00	4140	
4		Gujarat-Saurashtra	GS-OSN-2000/1	N18	16.08.01	600	
5		Cambay	CB-ONN-2003/1 (A&B)	N66	05.06.06	476	8548.38
6	CAIRN	Krishna Godavari	KG-OSN-2009/3	S-24	05.08.09	1988	
7		Palar offshore	PR-OSN-2004/1	5	24.04.07	9417	
8		Mumbai offshore	MB-DWN-2009/1	D-1	02.08.10	2961	14366
9	ESSAR	Cambay	CB-ON/3	19	11.02.03	13.73	
10	HOEC	Assam - Arakan	AAP-ON-94/1	14	28.11.00	305	
11		Rajasthan	RJ-ONN-2005/1	14	13.07.09	1151	
12		Cambay	CB-ON/7	22	-	7.64	1477.37
13	FOCUS	Rajasthan	RJ-ON/6	16	21.08.99	2000	
14			RJ-ONN-2003/2	N65	28.01.06	2164	
15		Gujarat-Kutch	GK-ON/4	21	19.04.03	775	
16		Cambay	CB-OSN-2004/1	2	28.05.07	2616	7555
17	CRL*	Assam-Arakan	AA-ON/7	13	27.03.01	319	319
18	GSPC	Cambay	CB-ON/2	23	23.11.00	1210	
19			CB-ONN-2000/1	N29	17.07.01	440.71	
20			CB-ONN-2002/3	N54	29.07.04	21.29	
21			CB-ONN-2003/2	N67	01.04.06	172	
22		Krishna Godavari	KG-OSN-2001/3	N38	12.03.03	530.5	2374.5
23	JOGPL	Assam-Arakan	AA-ONN-2002/1	N47	07.04.04	1260	
24			AA-ONN-2009/2	2	15.11.10	1740	3000
25	GAIL	Cauvery	CY-ONN-2005/1	29	03.03.10	946	946
26	Adani Welspun	Mumbai offshore	MB-OSN-2005/2	S-2	04.02.09	1191	1191
27	Mercator Petr.	Cambay	CB-ONN-2005/3	19	03.06.10	48	
28			CB-ONN-2005/9	25	03.06.10	132.2	180.2
29	Omkar Natural	Cambay	CB-ONN-2005/5	21	07.10.09	83	83
30	SINTEX Oil & Gas	Cambay	CB-ONN-2009/1	11	15.10.10	113	
31			CB-ONN-2009/2	12	04.01.11	68	
32			CB-ONN-2009/7	17	04.01.11	144	325
33	NTPC	Cambay	CB-ONN-2009/5	15	22.09.11	165	165
34	JPIL	Cambay	CB-ONN-2009/8	18	22.10.10	136	136
35	PAN India / Frost Int. Ltd.	Cambay	CB-ONN-2010/5	13	-	49	49
36	BPRL/ GAIL	Cambay	CB-ONN-2010/8	16 A&B	01.03.08	42	
37			CB-ONN-2010/11	19	15.03.13	131	173
38	ENI	Andaman	AN-DWN-2003/2	D40	23.09.05	13110	13110
TOTAL PELs BY PVT./JV COs.							**53998.45**

*CRL's operatorship has been terminated by Government. ACL has requested to transfer the PI

Table 10.17 : Company wise PEL areas

Company/ Operator	PEL Area	
	Sq. Km.	(%)
ONGC	101377.09	61.12%
OIL	10489.45	6.32%
Adani Welspun	1191	0.72%
ACL	319	0.19%
BPRL/ GAIL	173	0.10%
CAIRN	14366	8.66%
ENI	13110	7.90%
ESSAR	13.73	0.01%
FOCUS	7555	4.55%
GAIL	946	0.57%
GSPC	2374.5	1.43%
HCIL		0.00%
HOEC	1463.64	0.88%

Company/ Operator	PEL Area	
	Sq. Km.	(%)
IOCL	0	0.00%
JPIL	136	0.08%
JOGPL	3000	1.81%
Mercator Petr.	180.2	0.11%
NTPC	165	0.10%
Omkar Natural	83	0.05%
PAN India/ Frost Int. Ltd.	49	0.03%
RIL	8548.38	5.15%
SINTEX Oil & GAS	325	0.20%
Grand Total	**165864.99**	**100%**

Company-wise PEL Areas

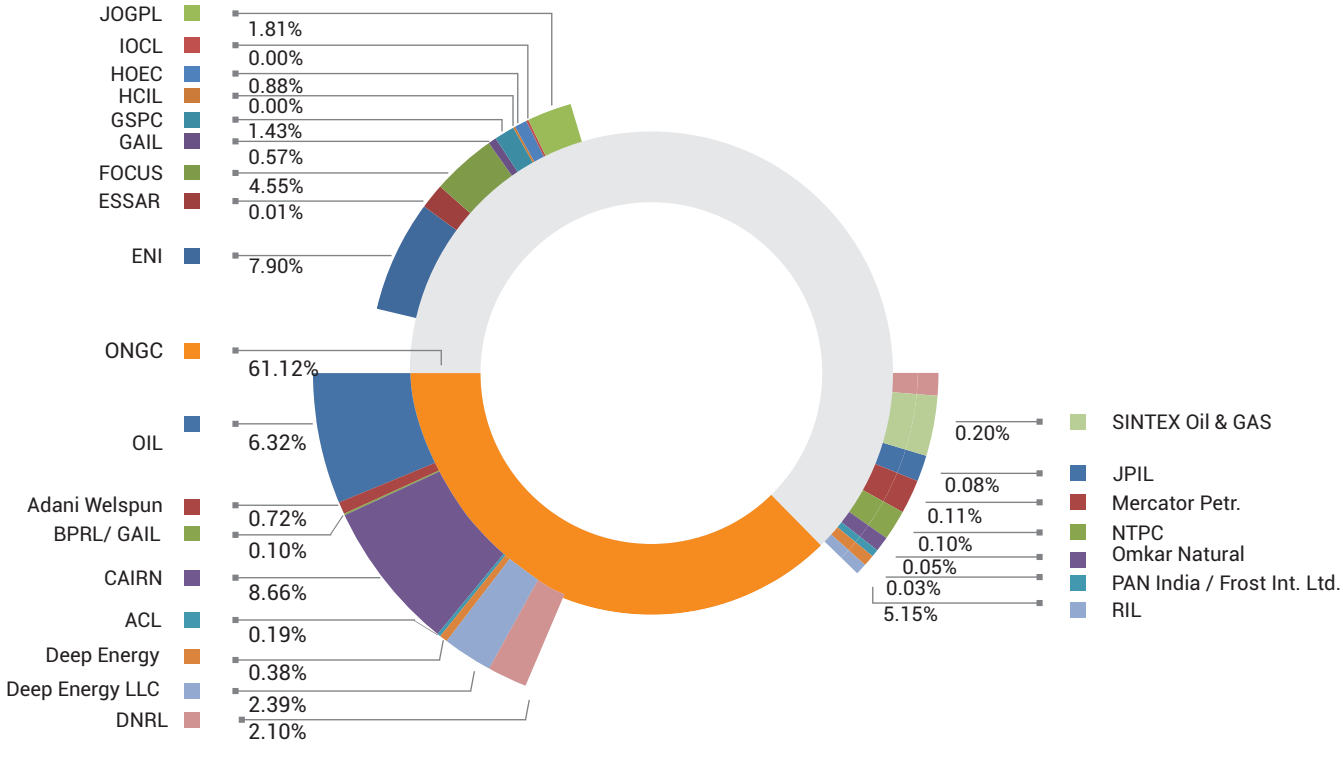


Table 10.18 : State-wise PEL distribution

Offshore/Onland	STATE	PEL Area	
		Sq. Km	(%)
Offshore	Eastern Offshore	55109.88	33.23%
	Western Offshore	60608.5	36.54%
	Offshore Total	**115718.38**	**69.77%**
Onland	Andhra Pradesh	668.46	0.40%
	Arunanchal Pradesh	331.75	0.20%
	Assam	3591.5	2.17%
	Gujarat	5651.66	3.41%
	Himachal Pradesh	1828	1.10%
	Madhya Pradesh	1250	0.75%
	Manipur	1740	1.05%
	Mizoram	5873	3.54%
	Nagaland	1590	0.96%
	Rajasthan	9656.24	5.82%
	Tamil Nadu	1461	0.88%
	Tripura	2220	1.34%
	West Bengal	14285	8.61%
	Onland Total	**50146.61**	**30.23%**
	Grand Total	**165864.99**	**100.00%**

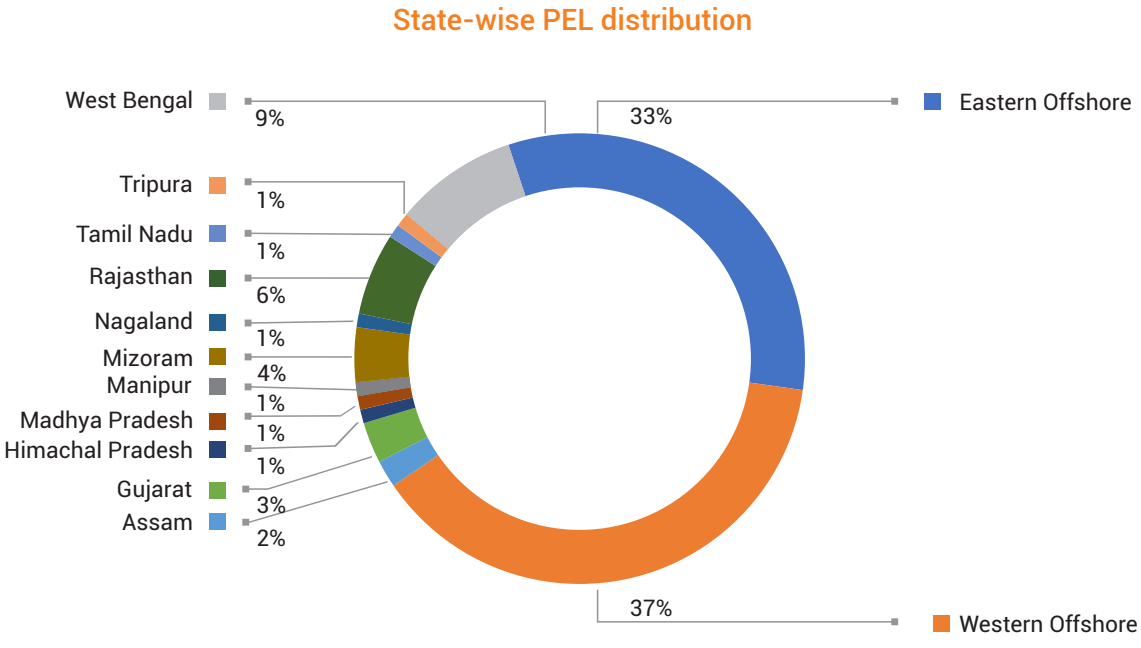


Table 10.19 : Nomination ML areas operated by ONGC and OIL in India

Sl. No.	Company / Operator	Basin	Block Name	Ref. No. on Map	Effective Date of ML	Valid Date of PML	PML Area (Sq. Km.)	Total PML Area (Sq. Km.)
1	**ONGC**	Rajasthan	Manherra Tibba	RJM-1	01-05-2014	30-04-2034	24.00	
2			Bakriwala	RJM-2	10-01-2001	09-01-2021	1.00	
3			Ghotaru Ext. - I	RJM-3	10-01-2001	09-01-2021	564.60	
4			Chinnewala Tibba	RJM-4	15-10-2003	14-10-2023	114.86	
5			South-Kharatar	RJM-5	25-03-2011	24-03-2031	180.39	**884.85**
6		Vindhyan	Nohta-Damoh-Jabera	MPM-01	10-02-2015	09-02-2022	1150.00	**1150**
7		Cambay	Lanwa	MM-1	09-12-2002	08-12-2022	30.00	
8			Balol	MM-2	25-05-2010	24-05-2030	24.00	
9			Jotana Ext.-I	MM-3	28-11-2006	27-11-2026	57.70	
10			West Sobhasan	MM-4	23-04-2003	22-04-2023	9.60	
11			Mehsana City	MM-5	08-08-2016	07-08-2036	8.85	
12			Mehsana City Ext.-II	MM-6	18-07-2015	17-07-2035	7.58	
13			Sobhasan	MM-7	20-08-2013	19-08-2033	35.89	
14			Geratpur	MM-8	20-08-2000	19-08-2020	18.31	
15			Linch Ext.-II	MM-9	24-03-2007	23-03-2017	13.35	
16			North Sobhasan Ext.-I	MM-10	12-03-2001	11-03-2021	56.85	
17			Jotana	MM-11	26-07-2000	25-07-2020	39.50	
18			Santhal	MM-12	09-06-2014	08-06-2034	19.46	
19			Bechraji	MM-13	31-08-2011	30-08-2028	37.11	
20			Bechraji Ext.-I	MM-14	29-03-2004	28-03-2024	3.06	
21			Charada Mansa	MM-15	23-10-2012	22-10-2027	187.50	
22			N. Kadi Ext.-I (New)	MM-16	03-05-2013	02-05-2029	61.43	
23			Kadi	MM-17	18-08-2008	17-08-2028	64.49	
24			Linch Ext.- I	MM-18	18-03-2007	17-03-2017	34.25	
25			Linch	MM-19	16-10-2013	15-10-2033	43.73	
26			Nandasan Ext.-I	MM-20	18-07-2015	17-07-2035	26.39	
27			Mansa	MM-21	26-07-2015	25-07-2035	58.72	
28			Nandasan - Langnaj	MM-22	27-04-2006	26-04-2026	61.90	
29			Chanasma	MM-23	28-09-2016	27-09-2036	2.81	
30			Dedana (ML)	MM-24	04-11-2016	03-11-2036	5.44	
31			Lanwa Ext.-I	MM-25	16-12-2016	15-12-2036	2.15	
32			Jotana Ext.-II	MM-26	16-06-1997	15-06-2017	0.87	
33			Jakasna(ML)	MM-27	02-06-2001	01-06-2021	9.80	
34			South Patan	MM-28	16-06-1997	15-06-2017	6.99	
35			N. Sobhasan Pt. A+B	MM-29	25-01-1999	24-01-2019	12.05	
36			East Sobhasan	MM-30	28-06-2002	27-06-2022	22.42	
37			North Sobhasan Ext.-II	MM-31	17-11-2001	16-11-2021	23.00	
38			West Mewad(ML)	MM-32	11-10-2000	10-10-2020	13.20	
39			Langhnaj-Wadasma	MM-33	05-02-2001	04-02-2021	13.84	
40			Sanganpur ML	MM-34	05-06-2002	04-06-2022	6.97	
41			Langhnaj ML	MM-35	23-07-2002	22-07-2022	17.92	
42			Chandrora	MM-36	16-02-2004	15-02-2024	1.39	

Sl. No.	Company / Operator	Basin	Block Name	Ref. No. on Map	Effective Date of ML	Valid Date of PML	PML Area (Sq. Km.)	Total PML Area (Sq. Km.)
43	ONGC		Kadi Asjol	MM-37	28-08-2003	27-08-2023	0.72	
44			Jotana-Warosan	MM-38	24-06-2005	23-06-2025	38.05	
45			Charada Mansa Extn.-I	MM-39	20-09-2008	19-09-2028	12.50	
46			Jotana-South	MM-40	10-03-2008	09-03-2024	23.00	
47			Kamboi	MM-41	25-12-2007	24-12-2018	2.35	
48			Patan-Tharad	MM-42	04-09-2013	03-09-2033	13.62	
49			Balol Extn.-I	MM-43	26-12-2013	25-12-2018	5.83	
50			Charda	MM-44	06-10-2009	05-10-2019	10.60	
51			Rajpur	AM-1	26-06-2015	25-06-2035	6.76	
52			Wadu	AM-2	26-05-2010	25-05-2030	15.41	
53			Kalol North-East	AM-3	15-03-2010	14-03-2030	9.44	
54			Paliyad-Kalol-Limbodra	AM-4	26-06-2015	25-06-2035	161.48	
55			Limbodra	AM-5	21-12-2005	01-12-2025	15.75	
56			Limbodra Ext.-I	AM-6	25-03-1998	24-03-2018	14.96	
57			Halisa	AM-7	30-01-1998	29-01-2018	143.44	
58			Kalol (Main)	AM-8	13-05-2004	12-05-2024	35.84	
59			Kalol Ext.-I	AM-9	04-08-2006	03-08-2026	159.92	
60			Kalol Ext.-II	AM-10	11-04-2009	10-04-2029	15.50	
61			Motera Ext.-II	AM-11	25-03-1998	24-03-2018	26.02	
62			Motera	AM-12	14-08-2016	13-08-2036	15.69	
63			Motera Ext.-I	AM-13	25-03-1997	24-03-2017	23.65	
64			Wamaj	AM-14	25-03-1997	24-03-2017	19.44	
65			Viraj	AM-15	26-07-2000	25-07-2020	17.49	
66			Lohar	AM-16	16-11-2004	15-11-2024	8.29	
67			Sanand	AM-17	10-05-2009	09-05-2029	81.36	
68			Sanand Ext.-I	AM-18	30-04-2013	29-04-2033	18.51	
69			Sanand Ext.-II	AM-19	23-03-1999	22-03-2019	10.37	
70			Sanand Ext.-III	AM-20	11-11-2011	11-11-2031	19.30	
71			Gamij	AM-21	26-06-2015	25-06-2035	39.16	
72			Gamij Ext.-I	AM-22	25-03-1997	24-03-2017	81.22	
73			Hirapur	AM-23	24-10-1997	23-10-2017	87.92	
74			Ahmedabad-Bakrol	AM-24	05-08-2009	04-08-2029	30.16	
75			Ahmedabad Ext.-I	AM-25	22-02-2001	21-02-2021	17.29	
76			Ahmedabad Ext.-II	AM-26	29-07-2008	28-07-2028	5.98	
77			Ahmedabad Ext.-III	AM-27	11-11-2011	10-11-2031	34.75	
78			Nandej East	AM-28	26-06-2015	25-06-2035	20.92	
79			Nandej	AM-29	25-03-1997	24-03-2017	90.18	
80			Nawagam Main	AM-30	28-03-2007	27-03-2027	72.23	
81			Nawagam Ext.-I	AM-31	21-03-2003	20-03-2023	2.77	
82			Wadu Ext.-I	AM-32	19-05-1997	18-05-2017	55.17	
83			Ahmedabad Ext.-IV	AM-33	08-10-1998	07-10-2018	10.21	
84			Rajpur Ext.-I	AM-34	02-02-1999	01-02-2019	8.70	
85			Asmali ML	AM-35	15-06-1998	14-06-2017	43.26	
86			Kadi Ext-III	AM-36	02-02-1999	01-02-2019	16.07	

Sl. No.	Company / Operator	Basin	Block Name	Ref. No. on Map	Effective Date of ML	Valid Date of PML	PML Area (Sq. Km.)	Total PML Area (Sq. Km.)
87	ONGC		Nawagam Ext.-II	AM-37	26-11-1999	25-11-2019	14.66	
88			Ahmedabad Ext-V	AM-38	08-05-2000	07-05-2020	17.75	
89			Gamij Ext.-III ML	AM-39	08-02-2002	07-02-2022	15.41	
90			Nandej Ext.-I	AM-40	08-02-2002	07-02-2022	56.18	
91			Gamij Ext. - II	AM-41	04-04-2001	03-04-2021	116.22	
92			South Wamaj ML	AM-42	28-06-2002	27-06-2022	18.29	
93			Nawagam Ext. - III	AM-43	31-08-2000	30-08-2020	56.00	
94			Kalol West Extn.-I	AM-44	03-02-2006	02-02-2022	54.25	
95			Kalol West ML	AM-45	21-11-2003	01-11-2023	14.53	
96			Nawagam South Ext.-I	AM-46	21-11-2003	20-11-2023	30.88	
97			Nawagam South Ext.-II	AM-47	21-11-2003	20-11-2023	43.94	
98			Rupal	AM-48	29-10-2004	28-10-2024	14.06	
99			Kadi Extn.-IV	AM-49	13-11-2003	12-11-2023	5.28	
100			Nawagam South Ext.-III	AM-50	13-12-2005	12-12-2025	53.71	
101			Valod	AM-51	07-11-2007	06-11-2017	8.58	
102			Kalol West Ext.-II	AM-52	20-09-2007	19-09-2022	20.00	
103			Balasar	AM-53	08-06-2009	07-06-2030	12.00	
104			Varsoda-Halisa Extn.-I	AM-54	22-11-2010	21-11-2028	169.00	
105			Kadi Extn.-V	AM-55	22-11-2010	21-11-2027	13.00	
106			Valod Extn.-I	AM-56	22-11-2010	21-11-2027	110.00	
107			Varsoda-Halisa	AM-57	29-08-2008	28-08-2025	155.00	
108			Valod Extn.-II	AM-58	10-09-2013	09-09-2033	30.27	
109			Cambay	CM-1	14-12-2004	13-12-2024	2.60	
110			Siswa	CM-2	12-02-2000	11-02-2020	37.78	
111			Kathana	CM-3	20-11-2008	19-11-2028	16.95	
112			Padra Field	CM-4	03-09-2013	02-09-2033	172.24	
113			Akholjuni	CM-14	27-07-2000	26-07-2020	81.25	
114			Anklav Ext.-I	CM-15	15-02-2002	14-02-2022	61.00	
115			Kathana Ext.-I	CM-16	15-03-2004	14-03-2024	16.99	
116			Chaklasi-Rasnol	CM-18	06-12-2007	05-12-2027	42.00	
117			Vasad-Kathol Ext.-III	CM-19	08-07-2011	07-07-2029	103.18	
118			Chaklasi-Rasnol Extn.-I	CM-20	16-11-2010	15-11-2027	168.00	
119			Dabka Ext.-I	ANM-1	23-08-2008	22-08-2028	12.85	
120			Dabka Ext.-II	ANM-2	30-06-2009	29-06-2024	0.56	
121			Dabka	ANM-3	01-05-1993	30-04-2013	21.67	
122			Umra	ANM-5	10-08-2007	09-08-2027	8.44	
123			Umra Ext.-I	ANM-6	19-10-2014	18-10-2034	9.93	
124			Malpur (ML)	ANM-7	04-06-2007	03-06-2027	1.00	
125			Nada	ANM-8	19-02-2009	18-02-2029	9.85	
126			Gandhar Ext.-IV	ANM-9	30-08-2014	29-08-2034	36.75	
127			Gandhar Ext.-I	ANM-10	08-10-2006	07-10-2026	32.75	

Sl. No.	Company / Operator	Basin	Block Name	Ref. No. on Map	Effective Date of ML	Valid Date of PML	PML Area (Sq. Km.)	Total PML Area (Sq. Km.)
128	**ONGC**		Gandhar	ANM-11	07-01-2005	06-01-2025	11.78	
129			Gandhar Ext.-II (Denwa)	ANM-12	08-07-2006	07-07-2026	54.30	
130			Gandhar Ext.-III	ANM-13	24-02-2007	23-02-2027	235.38	
131			Gandhar Ext.-V	ANM-14	22-03-1996	21-03-2016	29.43	
132			Dahej Ext.-I	ANM-15	17-04-2014	16-04-2034	90.90	
133			Dahej	ANM-16	06-02-2005	05-02-2025	18.52	
134			Pakhajan(ML)	ANM-17	21-08-2007	20-08-2027	6.25	
135			Pakhajan Ext.-I	ANM-18	10-01-2015	09-01-2020	18.00	
136			Kasiyabet	ANM-19	12-09-2009	11-09-2029	5.06	
137			Ankleshwar Ext.-I	ANM-20	26-05-2005	25-05-2025	17.43	
138			Ankleshwar (Main)	ANM-21	15-08-2001	14-08-2021	38.98	
139			Motwan	ANM-22	04-07-1999	03-07-2019	42.20	
140			Sanaokhurd	ANM-23	30-12-2016	29-12-2036	23.29	
141			Kudara	ANM-24	28-06-2002	07-06-2022	2.60	
142			Elav	ANM-25	30-03-1990	29-03-2010	10.37	
143			Kharach	ANM-26	23-03-2015	22-03-2035	0.77	
144			Kosamba	ANM-27	03-01-2008	02-01-2028	19.17	
145			Olpad (A)	ANM-28	24-11-2002	23-11-2022	2.75	
146			Dabka Ext.-IV (D#6)	ANM-29	20-02-1997	19-02-2017	1.00	
147			Kim(ML)	ANM-30	10-03-1997	09-03-2017	18.33	
148			Gandhar Ext.-VI (G#388)	ANM-31	22-01-1997	21-01-2017	44.47	
149			Nada Ext.-I	ANM-32	03-09-1998	02-09-2018	6.12	
150			Dabka Ext.-V (D#38)	ANM-33	29-06-1999	28-06-2019	2.00	
151			Gandhar Ext.-VII(G#155)	ANM-34	24-04-1999	23-04-2019	25.82	
152			Gandhar Ext.-VIII	ANM-35	16-08-2000	15-08-2020	7.23	
153			Kural (ML)	ANM-36	03-04-2001	02-04-2021	83.49	
154			Gandhar Ext. - IX	ANM-37	20-08-2002	19-08-2022	40.91	
155			Olpad - Dandi Ext. - I	ANM-38	01-01-2004	31-12-2023	94.40	
156			Pakhajan Extn. - II	ANM-39	16-09-2002	15-09-2022	38.50	
157			Kim Ext. - I	ANM-40	04-01-2002	03-01-2022	56.11	
158			Kosamba Extn.-I	ANM-41	01-03-2003	28-02-2023	39.00	
159			Umra Extn.-II	ANM-42	13-03-2003	12-03-2017	34.43	
160			South Dahej	ANM-43	12-11-2008	11-11-2025	27.00	
161			Jambusar-Dabka	ANM-44	25-03-2008	24-03-2028	101.50	
162			Matar	ANM-45	01-10-2009	30-09-2029	66.50	
163			Degam	ANM-46	25-03-2008	24-03-2025	15.47	
164			Gandhar Extn.-X	ANM-47	19-06-2009	18-06-2017	9.00	
165			Gandhar Extn.-XI	ANM-48	19-06-2009	18-06-2019	7.20	
166			Gandhar Extn.-XII	ANM-49	19-06-2009	18-06-2025	29.00	**5819.25**
167		Cauvery	Greater Bhuvanagiri	CYM-1	15-12-2007	14-12-2027	14.00	
168			Mattur	CYM-2	04-05-1994	03-05-2014	3.00	
169			Nannilam-I	CYM-3	26-04-2013	25-04-2033	4.70	
170			Kamalapuram-II	CYM-4	04-05-2014	03-05-2014	3.50	

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171	**ONGC**		Kamalapuram-I	CYM-5	27-05-1999	26-05-2019	23.50	
172			Adiyakka Mangalam	CYM-6	27-05-1999	26-05-2019	17.80	
173			Greater Kovilkalappal	CYM-7	15-05-2007	14-05-2027	33.61	
174			Nannilam-II	CYM-8	27-05-1999	26-05-2019	1.00	
175			Perungulam-Periyapattinam	CYM-9	15-07-1997	14-07-2017	75.00	
176			Tulsapatnam	CYM-10	27-05-1999	26-05-2019	3.70	
177			Pundi	CYM-11	27-05-1999	26-05-2019	1.00	
178			Kizhavalur	CYM-12	27-05-1999	26-05-2019	3.60	
179			Kuthalam	CYM-13	01-06-2001	31-05-2021	91.00	
180			Kuthalam-13	CYM-14	12-02-2004	11-02-2024	12.00	
181			Kali	CYM-15	01-06-2001	31-05-2021	19.00	
182			Vijayapuram #13	CYM-16	03-11-2002	02-11-2022	2.00	
183			Greater Kamalapuram	CYM-17	26-12-2004	24-12-2024	22.00	
184			Kuthanallur	CYM-18	26-02-2004	25-02-2024	6.25	
185			Kali-6	CYM-19	01-01-2004	31-12-2023	1.60	
186			Kanjirangudi	CYM-20	13-10-2003	12-10-2023	68.00	
187			Greater Narimanam	CYM-21	27-01-2006	26-01-2026	54.00	
188			PBS-1-1	CYM-22	01-10-2003	30-09-2023	9.00	
189			Adichapuram	CYM-23	13-04-2007	12-04-2027	2.30	
190			Neyveli	CYM-24	15-03-2008	15-03-2028	3.84	
191			Karaikal	CYM-25	10-09-2008	09-09-2028	2.00	
192			Vadatheru	CYM-26	31-12-2007	30-12-2027	15.18	
193			Tiruvarur-19	CYM-27	12-02-2004	11-02-2024	2.00	
194			Greater Kali	CYM-28	21-07-2010	20-07-2030	36.00	
195			Ramanathapuram	CYM-29	21-11-2012	20-11-2019	493.21	
196			L-I	CYM-30	31-12-2012	30-12-2019	948.16	
197			L-II	CYM-31	31-12-2012	30-12-2019	1542.02	**3513.97**
198		KG Onland	Endamuru-I	KGM-1	03-04-2012	02-04-2019	3.00	
199			Endamuru-4	KGM-2	30-04-2003	29-04-2023	6.00	
200			Pasarlapudi-9	KGM-3	23-07-2012	22-07-2032	6.60	
201			Pasarlapudi-8	KGM-4	27-06-2012	26-06-2027	5.50	
202			Tatipaka-Pasarlapudi	KGM-5	14-02-2014	13-02-2034	62.00	
203			Kesanapalli-1	KGM-6	18-07-2012	17-07-2032	3.70	
204			Mori-5	KGM-7	05-06-2014	04-06-2020	1.56	
205			Mori-1	KGM-8	07-04-2011	06-04-2031	6.50	
206			Razole-1 & 2	KGM-9	23-01-2008	22-01-2026	18.85	
207			Elamanchili	KGM-10	21-02-2011	20-02-2031	6.00	
208			Medapadu-1	KGM-11	08-07-2012	07-07-2032	16.60	
209			Penumadam-1	KGM-12	03-04-2012	02-04-2022	9.60	
210			Lingala	KGM-13	21-12-2009	20-12-2024	7.60	
211			Kaikalur-3	KGM-14	10-09-2006	09-09-2026	9.00	
212			Vadali	KGM-15	20-04-2010	19-04-2020	4.00	
213			Mandapeta	KGM-16	22-08-2015	21-08-2035	40.00	
214			Mandapeta-19	KGM-17	01-05-1998	30-04-2018	6.00	

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215	**ONGC**		Mandapeta West	KGM-18	01-06-2004	31-05-2024	20.00	
216			Addvipalem-Ponnamanda	KGM-19	30-07-2016	29-07-2036	95.00	
217			Nandigama	KGM-20	31-01-2000	30-01-2020	55.00	
218			Enugupalli	KGM-21	06-07-2000	05-07-2020	7.00	
219			Kesavadasupalem	KGM-22	30-07-2002	29-07-2022	26.50	
220			Suryaraopeta	KGM-23	30-07-2002	29-07-2022	56.00	
221			Lingala Ext. & Kaikalur-12	KGM-24	30-07-2002	29-07-2022	30.00	
222			Lakshmaneswaram	KGM-25	30-07-2002	29-07-2022	23.50	
223			Endamuru-7&9	KGM-26	19-05-2003	18-05-2023	7.30	
224			Penumadam-2	KGM-27	01-07-2004	31-05-2024	3.20	
225			Srikatpalli	KGM-28	30-07-2002	29-07-2022	163.00	
226			Turputallu	KGM-29	28-11-2013	27-11-2033	39.58	
227			Achanta	KGM-30	28-11-2008	27-11-2028	14.10	
228			Kavitam	KGM-31	12-10-2007	11-10-2027	156.35	
229			Bantumilli Extn.	KGM-32	05-01-2009	20-11-2019	155.67	
230			Manepalli Extn.	KGM-33	12-11-2009	11-11-2024	10.00	
231			West Godavari	KGM-34	01-01-2013	31-12-2019	1278.32	
232			Godavari On-land	KGM-35	01-01-2013	31-12-2019	2176.00	
233			Chintalapalli Extn.	KGM-36	12-11-2009	11-11-2019	18.56	
234			Mahadevapatnam	KGM-37	28-11-2008	27-11-2028	138.89	
235			Malleswaram	KGM-38	22-11-2011	21-11-2017	241.18	**4927.66**
236		Assam-Arakan	Sonari	UAM-1	01-08-2009	31-07-2026	30.00	
237			Banamali	UAM-2	17-12-2002	16-12-2022	50.00	
238			Lakwa	UAM-3	29-09-2008	28-09-2028	172.49	
239			Laipling-Gaon	UAM-4	13-10-2003	13-10-2023	26.00	
240			Panidihing	UAM-5	19-05-2004	18-05-2024	34.00	
241			North Rudrasagar	UAM-6	30-01-2006	29-01-2026	149.00	
242			Rudrasagar	UAM-7	30-05-2009	29-05-2029	70.50	
243			Charali	UAM-8	20-03-1999	19-03-2019	51.64	
244			Charali Ext.-I	UAM-9	20-05-1998	19-05-2018	45.00	
245			West Charali	UAM-10	23-03-2012	22-03-2032	12.00	
246			Changmaigaon	UAM-11	07-02-2004	06-02-2024	10.00	
247			Namti	UAM-12	09-11-2007	08-11-2027	35.55	
248			Geleki	UAM-13	16-08-1990	15-08-2030	27.94	
249			Geleki Ext.-I	UAM-14	23-11-2009	22-11-2029	5.01	
250			Geleki Ext.- II	UAM-15	14-12-2001	13-12-2021	2.65	
251			SE Geleki	UAM-16	30-01-2006	29-01-2026	20.50	
252			Mekeypore-Santak-Nazira	UAM-17	30-01-2006	29-01-2026	77.00	
253			Changmaigaon East	UAM-18	30-01-2006	29-01-2026	15.00	
254			Laiplingaon Extn.	UAM-19	26-09-2011	25-09-2023	30.45	
255			Charaideo-Nahorhabi	UAM-20	30-01-2006	29-01-2026	14.00	

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256	ONGC		Mekeypore-Santak-Nazira-Bihubar Extn.	UAM-21	26-09-2011	25-09-2031	50.00	
257			East Changmaigaon Extn.	UAM-22	01-12-2011	30-11-2031	35.00	
258			SE Geleki Extn.	UAM-23	26-09-2011	25-09-2031	28.00	
259			Charaideo-Nahorhabi Extn.	UAM-24	26-09-2011	25-09-2031	41.00	
260			Changpang ML	NGM-1	14-03-2007	13-03-2027	12.00	
261			Borholla	DHM-1	17-06-1998	16-06-2018	32.12	
262			Mekrang	DHM-2	19-09-1997	18-09-2017	16.00	
263			East Lakhibari	DHM-3	23-07-2003	23-07-2023	8.50	
264			East Lakhibari Extn.	DHM-4	27-01-2006	09-10-2020	49.00	
265			Khoraghat	DHM-5	27-07-2009	25-07-2024	3.00	
266			Khoraghat Ext. - I	DHM-6	17-07-2000	16-07-2020	83.00	
267			Namber	DHM-7	05-09-1999	04-09-2019	26.00	
268			Namber Extn.	DHM-8	27-01-2006	26-01-2026	20.00	
269			Kalyanpur	DHM-9	13-04-2007	12-04-2027	40.00	
270			Badarpur	CHM-1	01-08-2009	31-07-2019	2.30	
271			Banaskandi	CHM-2	21-07-1997	20-07-2017	15.00	
272			Adamtila	CHM-3	24-11-2014	23-11-2031	4.00	
273			Bhubandar	CHM-4	22-12-2002	21-12-2022	6.00	
274			Adamtila Extn.	CHM-5	03-03-2012	02-03-2032	63.00	
275			North Patharia	CHM-6	30-03-2012	29-03-2029	60.00	
276			Cachar District	CHM-7	04-01-2013	03-01-2020	732.00	
277			Sector - VC	CHM-8	30-11-2014	29-11-2034	497.00	
278			Baramura Field	TM-1	01-10-2013	30-09-2033	10.75	
279			Agartala Dome (AD-1)	TM-5	01-05-2009	30-04-2029	15.75	
280			Agartala Dome (AD-4)	TM-6	01-01-1998	31-12-2017	32.58	
281			Konaban Field	TM-7	04-03-2014	03-03-2034	33.00	
282			Manikya Nagar (RO-15)	TM-8	01-01-1998	31-12-2017	0.80	
283			Rokhia (RO-2)	TM-9	14-11-2008	13-11-2028	5.04	
284			Rokhia (RO-19)	TM-10	26-02-2012	25-02-2020	0.58	
285			Agartala Dome Extn.-II	TM-11	01-02-2006	31-01-2026	160.86	
286			Baramura Extn.-IV	TM-12	01-02-2006	31-01-2026	150.25	
287			Sundulbari-Agartala Dome	TM-13	13-12-2010	12-12-2026	301.00	
288			Manikyanagar-Sonamura Extn-I	TM-15	01-02-2006	31-01-2026	138.55	
289			Tichna block	TM-16	07-02-2006	06-02-2026	195.41	
290			Gojalia block	TM-17	07-02-2006	06-02-2026	271.17	
291			Kunjaban	TM-18	14-07-2008	13-07-2028	288.00	
292			Titabar	TM-19	24-12-2008	23-12-2023	10.00	
293			Kasomarigaon	TM-20	09-12-2009	08-12-2025	76.00	
294			Tulamura	TM-21	20-11-2009	19-11-2031	83.75	

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295	**ONGC**		Golaghat Extn. II-A	TM-22	09-12-2009	08-12-2024	85.00	
296			Agartala Dome Extn.-III	TM-23	30-03-2011	29-03-2031	60.00	
297			West Tripura	TM-24	04-01-2013	03-01-2020	1327.58	**5947.7246**
298		Mumbai Offshore	Single PML MH Field	BM-1	24-10-2010	23-10-2030	1953.83	
299			Extn. of NW-Mumbai High	BM-2	17-11-2008	16-11-2028	2480.00	
300			C-37 (BOFF I, II & III)	BM-3	12-09-2007	11-09-2027	469.17	
301			B-55	BM-4	30-06-1999	29-06-2019	135.85	
302			South Bassein	BM-5	01-10-1987	30-09-2027	743.00	
303			B-119 / B-121	BM-6	15-05-1997	14-05-2017	113.40	
304			B-173A	BM-7	01-06-1998	31-05-2018	51.95	
305			Neelam	BM-8	14-11-2009	13-11-2029	213.00	
306			Heera	BM-9	20-11-2004	19-11-2024	448.05	
307			D-1 Field	BM-10	31-07-2005	30-07-2025	25.60	
308			Bassein Field Extn. (SB-II)	BM-11	15-06-2005	14-06-2031	22.55	
309			D-18	BM-12	01-01-2005	31-12-2024	194.00	
310			North Tapti Field	BM-13	09-01-2006	08-01-2026	68.14	
311			C-Series Fields	BM-14	01-04-2006	31-03-2026	3620.00	
312			Around D-1 Field	BM-27	14-09-2009	13-09-2025	1167.00	
313			Mumbi High-NW	BM-16	01-04-2006	31-03-2026	1567.67	
314			Mumbai High-SW	BM-17	01-04-2006	31-03-2026	1064.71	
315			Mumbai High-South	BM-18	09-01-2006	08-01-2026	801.54	
316			West of Bassein	BM-19	01-04-2006	31-03-2026	835.00	
317			Vasai East	BM-20	01-04-2006	31-03-2026	103.69	
318			S&E of Bassein	BM-21	01-04-2006	31-03-2026	1447.31	
319			North Heera	BM-22	04-12-2007	03-12-2022	121.00	
320			Ratna & R-Series	BM-23	30-03-2016	30-03-2036	1005.00	
321			D-33 (BOFF I, III, SWBH)	BM-24	05-09-2006	04-09-2026	603.00	
322			BOFF	BM-25	03-01-2013	02-01-2020	11595.00	
323			SW BH Extension	BM-26	03-01-2013	02-01-2020	482.00	
324			South & West of North Tapti	BM-27	21-12-2015	20-12-2022	215.213	**31546.67**
325		K-G Offshore	GS-15 & 23	KGM-37	04-09-1998	03-09-2018	80.00	
326			G-1 Field	KGM-38	05-09-2003	04-09-2023	105.00	
327			Vainateyam	KGM-39	20-09-2008	19-09-2023	221.00	
328			GS-29	KGM-40	30-10-2009	29-10-2029	35.00	
329			GS-49	KGM-41	22-10-2009	21-10-2029	52.50	
330			Yanam	KGM-42	19-11-2009	18-11-2029	268.50	
331			Godavari	KGM-43	24-01-2008	23-01-2028	111.50	
332			Vasistha	KGM-44	15-02-2008	14-02-2028	119.00	
333			Vainateyam Extn.	KGM-45	11-01-2011	10-01-2029	78.00	
334			GS-29 Extn.	KGM-46	07-12-2011	06-12-2027	137.62	
335			GS-49 Extn.	KGM-47	06-09-2013	05-09-2033	77.68	**1285.8**

Sl. No.	Company / Operator	Basin	Block Name	Ref. No. on Map	Effective Date of ML	Valid Date of PML	PML Area (Sq. Km.)	Total PML Area (Sq. Km.)
336		Cauvery Off.	PBS-1-1 Extn.	CYM-32	01-04-2009	31-03-2025	96.83	**96.83**
337		Gujarat-Kutch	KD-Field	GKM-1	01-04-2011	31-03-2026	430.00	
338			GK-28	GKM-2	21-11-2012	09-10-2027	1242.50	**1672.5**
ONGC TOTAL								**56845.262**
339	**OIL**	Rajasthan	Dandewala (Jaisalmer)	ORJM-1	01-01-2016	31-12-2035	250.00	
340			Baghewala	ORJM-2	30-05-2003	29-05-2023	210.00	**460**
341		Assam-Arakan	Moran	OAM-1	01-11-2006	09-01-2021	429.42	
342			Moran Extn.	OAM-2	01-11-2006	31-10-2026	560.00	
343			Dum-Duma BK-A	OAM-3	26-11-2009	25-11-2029	98.42	
344			Nahorkatiya	OAM-4	04-02-2004	03-02-2024	1.42	
345			Nahorkatiya Extn.	OAM-5	10-01-2011	09-01-2031	165.76	
346			Hugrijan	OAM-6	10-01-2001	09-01-2021	725.20	
347			Dum-Duma BK-B	OAM-7	26-11-2009	25-11-2029	311.96	
348			Digboi	OAM-8	14-10-2001	13-10-2021	49.33	
349			Dum-Duma BK-C	OAM-9	26-11-2009	25-11-2029	85.47	
350			Dum-Duma BK-D	OAM-10	26-11-2009	25-11-2029	10.36	
351			Ningru	OAM-11	27-11-2003	26-11-2023	540.67	
352			Tinsukia	OAM-12	02-08-2001	06-12-2021	250.00	
353			Dibrugarh	OAM-13	06-08-2001	21-01-2018	186.00	
354			Borhapjan	OAM-14	07-08-2001	06-08-2020	87.00	
355			Dholiya	OAM-15	02-08-2001	17-10-2022	131.00	
356			Ningru Extension	OAM-16	04-06-2003	03-06-2023	75.00	
357			Chabua	OAM-17	12-06-2002	11-06-2022	189.00	
358			Tinsukia Extension	OAM-18	17-05-2003	16-05-2023	185.00	
359			Baghjan	OAM-19	14-05-2003	13-05-2023	75.00	
360			Mechaki	OAM-20	19-05-2003	18-05-2023	195.00	
361			Sapkaint (Murkong-NF)	OAM-21	24-12-2007	23-12-2027	105.00	
362			Mechaki Extension	OAM-22	06-07-2010	05-07-2030	9.00	
363			Borhat	OAM-23	13-08-2013	12-08-2033	81.00	**4546.01**
OIL TOTAL PML AREA								**5006.01**
ONGC TOTAL PML AREA								**56845.262**
NOMINATION (OIL+ONGC) TOTAL PML AREA								**61851.272**
Pvt. / JV TOTAL PML AREA								**8865.04**
GRAND TOTAL OF MLs AWARDED IN THE COUNTRY (NOC's & PVT. / JV COMPANIES)								**70716.312**

Table 10.20 : ML Areas under operation in PSC regime (as on 01.04.2016)

Operator	Basin	Block/Field Name	Field Name	Pre-NELP/ Field/ NELP	Ref No. of Map	Effective Date	Area (Sq. Km.)	Total Area (Sq.km.)
CAIRN	K-G Offshore	Ravva	Ravva	Field		28-10-1994 (On) 07-07-1997 (Off)	331.26	3756.9
	Gulf of Cambay	CB-OS/2	Lakshmi	Pre-NELP		07-07-1998	121.06	
			Gauri			-	52.7	
			Ambe			-	107.47	
			CBX			-	33.28	
	Rajasthan	RJ-ON-90/1	Mangala	Pre-NELP		21-06-2005	1859	
			Bhagyam-Shakti			15-11-2006	430.17	
			Kaameshwari West			27-10-2009	822	
ONGC	Cambay	CB-ONN-2002/1	West Patan	NELP		30-03-2015	17	67.1
		CB-ONN-2001/1	Nadiad – 1	NELP		22-04-2015	26	
		CB-ONN-2004/1	Karan nagar - 1	NELP		20-03-2015	9.73	
		CB-ONN-2004/2	Vadatal-1	NELP		20-03-2015	14.37	
BG-RIL-ONGC	Mumbai Offshore	Mid & South Tapti	Mid & South Tapti	Field		22-12-1994	1471	2678
		Panna	Panna	Field		22-12-1994	430	
		Mukta	Mukta	Field		22-12-1994	777	
GEOENPRO	Assam-Arakan	Kharsang	Kharsang	Field		21-10-1997	10	10
ACIL	Assam-Arakan	Amguri	Amguri	Field		01-11-2003	52.75	52.75
HOEC	Cambay	Asjol	Asjol	Field		09-04-1996	15	124.94
		N. Balol	N. Balol	Field		21-03-2002	27.3	
		CB-ON/7	Pramoda & Palej	Pre-NELP		21-09-2005	7.64	
	Cauvery Offshore	PY-1	PY-1	Field		06-10-1995	75	
INTERLINK	Cambay	Baola	Baola	Field		12-12-1996	4	16.7
		Modhera	Modhera	Field		19-05-2007	12.7	
JTI	Cambay	Wavel	Wavel	Field		20-02-1995	9	57
		Dholka	Dholka	Field		20-02-1995	48	
NIKO	Cambay	Hazira	Hazira	Field		23-09-1994	50	74.25
		CB-ONN-2000/2	NS-A	NELP		01-05-2004	20.22	
			Bheema			29-09-2004	4.03	
SELAN	Cambay	Lohar	Lohar	Field		13-03-1995	5	189.65
		Indrora	Indrora	Field		13-03-1995	130	
		Bakrol	Bakrol	Field		13-03-1995	36	
		Karjisan	Karjisan	Field		23-11-2005	5	
		Ognaj	Ognaj	Field		05-08-2008	13.65	

Operator	Basin	Block/Field Name	Field Name	Pre-NELP/ Field/ NELP	Ref No. of Map	Effective Date	Area (Sq. Km.)	Total Area (Sq.km.)
GNRL	Cambay	Kanawara	Kanawara	Field		04-02-2003	6.3	34.15
		Dholasan	Dholasan	Field		27-02-2006	8.8	
		Allora	Allora	Field		16-05-2003	6.85	
		N. Kathana	N. Kathana	Field		11-06-2003	12.2	
HYDROCARBON-RES. DEV.-PPC	Cambay	Sanganpur	Sanganpur	Field		27-02-2002	4.4	4.4
OILEX	Cambay	Cambay	Cambay	Field		23-09-1994	161	167
		Bhandut	Bhandut	Field		23-09-1994	6	
GSPCL	Cambay	Unawa	Unawa	Field		19-05-2003	5.65	84.39
		CB-ONN-2000/1	Ingoli/SE-01 Field	NELP		05-09-2005	15.71	
		CB-ONN-2003/2	Ank-21	NELP		25-02-2014	1.6	
		CB-ONN-2002/3	Mirroli	NELP		25-02-2014	3.29	
		CB-ONN-2002/3	Sanand	NELP		20-03-2015	18	
		CB-ON/2	Tarapur#1	Pre-NELP		12-02-2009	2.64	
			Tarapur#G	Pre-NELP		03-03-2014		
	KG Offshore	KG-OSN-2001/3	DDW	NELP		11-08-2010	37.5	
FOCUS	Rajasthan	RJ-ON/6	SGL	Pre-NELP		23-06-2010	176	176
HARDY	Cauvery Off.	CY-OS-90/1	PY-3	Pre-NELP		20-07-1998	81	81
RIL	KG Offshore	KG-DWN-98/3	D-1&3	NELP		02-03-2005	339.4	1148.1
			D-26			17-04-2008	49.72	
			D-2,6,19&22			21-06-2012	229	
			D-34			30-09-2013	530	
ESSAR	Cambay	CB-ON/3	CB-ON/3	Pre-NELP		23-04-2007	143.5	143.5
Total MLs awarded in PSC regime								**8865.9**

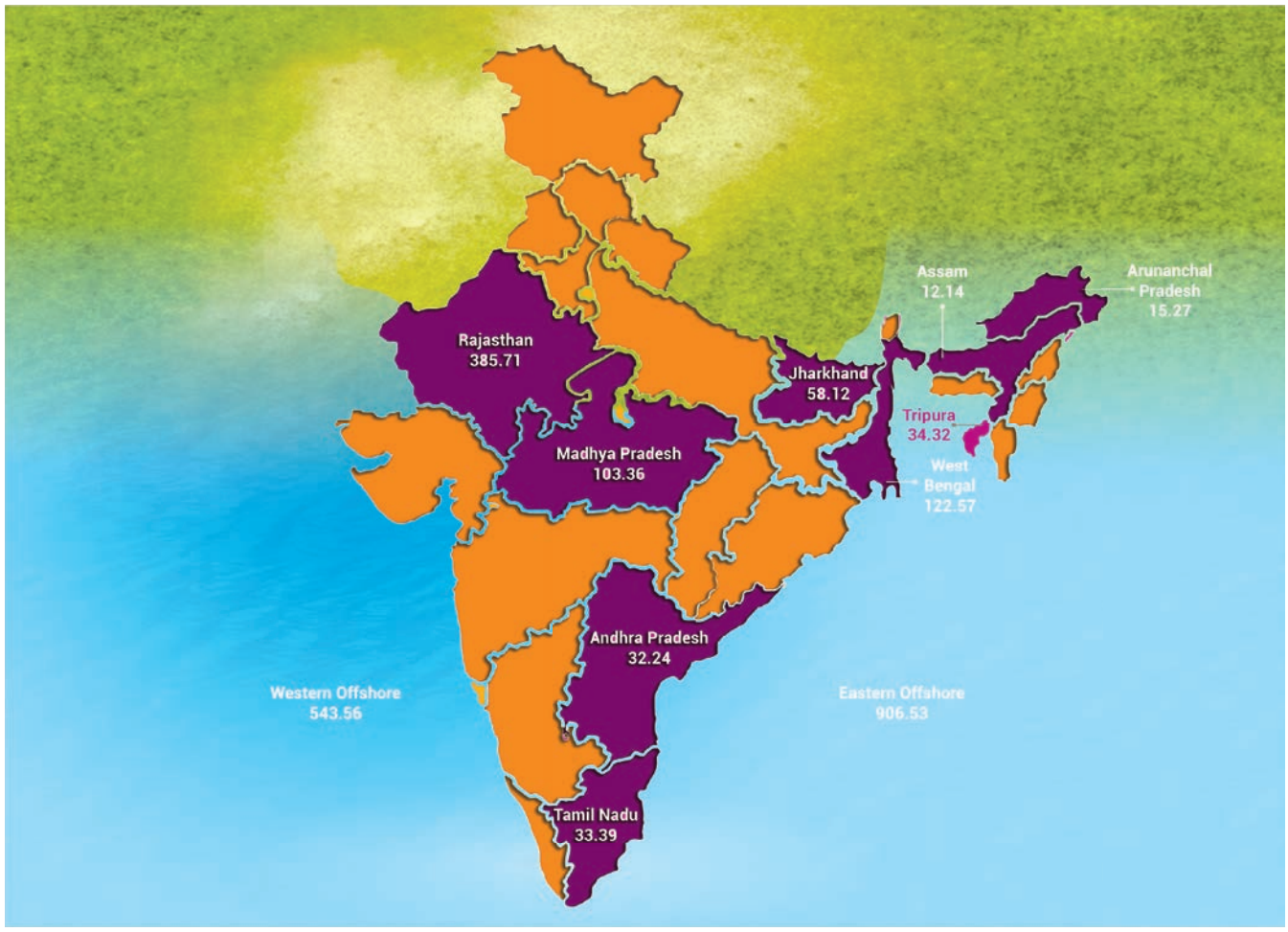
Table 10.21 : Trend in production of crude oil and natural gas in PSC regime during the period 2004-05 to 2015-16

YEAR	GAS (MMSCM)	%age Growth over previous year	Oil+Condensate (TMT)	%age Growth over previous year
2004-05	6783.79	-	4300.48	-
2005-06	7357.63	8%	4552.24	6%
2006-07	7039.70	-4%	4829.91	6%
2007-08	7727.39	10%	5086.92	5%
2008-09	8090.04	5%	4674.29	-8%
2009-10	21985.12	172%	5262.53	13%
2010-11	26774.49	22%	9681.99	84%
2011-12	21608.96	-19%	10526.96	9%
2012-13	14490.88	-33%	11640.05	11%
2013-14	9497.09	-34%	12076.41	4%
2014-15	8911.95	-6%	11785.22	-2%
2015-16	8234.64	-8%	11355.98	-4%

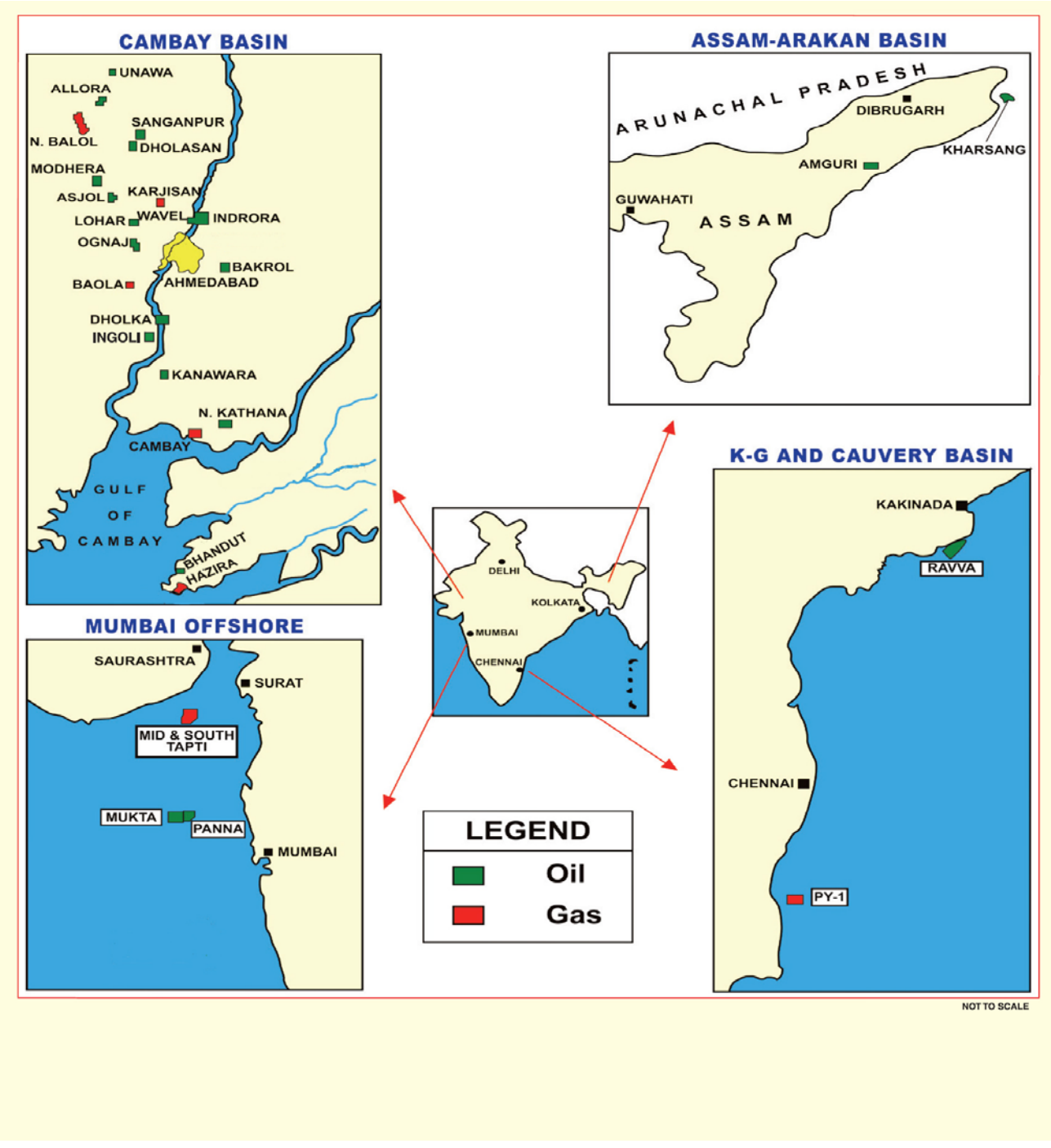
Table 10.22 : Basin-wise In-place and Ultimate reserve trend (O+OEG in MMT) under PSC regime

INITIAL								
As on	CBM	Assam-Arakan	Cambay	Cauvery	Krishna Godavari	Mahanadi	Mumbai	Rajasthan
01.04.2008	142.45	21.08	90.07	34.14	695.61	27.05	308.96	299.88
01.04.2009	142.45	20.70	109.79	34.14	686.49	27.05	308.96	310.49
01.04.2010	230.06	20.48	121.30	34.14	714.26	27.05	504.89	310.49
01.04.2011	264.04	20.48	126.29	34.36	716.86	51.97	504.89	310.49
01.04.2012	264.04	20.48	126.54	34.36	763.45	51.97	504.89	306.13
01.04.2013	281.00	20.48	138.89	34.36	764.50	51.97	504.89	325.53
01.04.2014	281.00	25.12	141.41	29.22	943.89	51.97	504.89	312.68
01.04.2015	281.00	61.99	146.96	52.56	959.94	51.97	504.89	376.23
01.04.2016	284.04	61.74	148.71	77.33	867.77	27.05	504.89	385.71
ULTIMATE								
As on	CBM	Assam-Arakan	Cambay	Cauvery	Krishna Godavari	Mahanadi	Mumbai	Rajasthan
01.04.2008	39.84	5.69	26.21	13.91	410.78	13.81	129.88	83.21
01.04.2009	39.84	7.42	33.90	13.92	401.72	13.81	129.88	87.90
01.04.2010	73.96	7.27	36.87	13.92	413.70	13.81	147.73	87.90
01.04.2011	97.74	7.27	37.56	14.08	413.70	29.59	147.73	87.90
01.04.2012	97.74	7.27	37.56	14.08	449.62	29.59	147.73	87.90
01.04.2013	101.06	7.27	39.14	14.08	450.45	29.59	147.73	87.95
01.04.2014	101.06	6.11	38.11	10.32	514.12	29.59	147.73	83.11
01.04.2015	101.06	10.31	39.66	21.37	524.55	29.59	147.73	108.39
01.04.2016	127.57	10.69	42.87	24.30	532.70	13.81	147.73	111.48

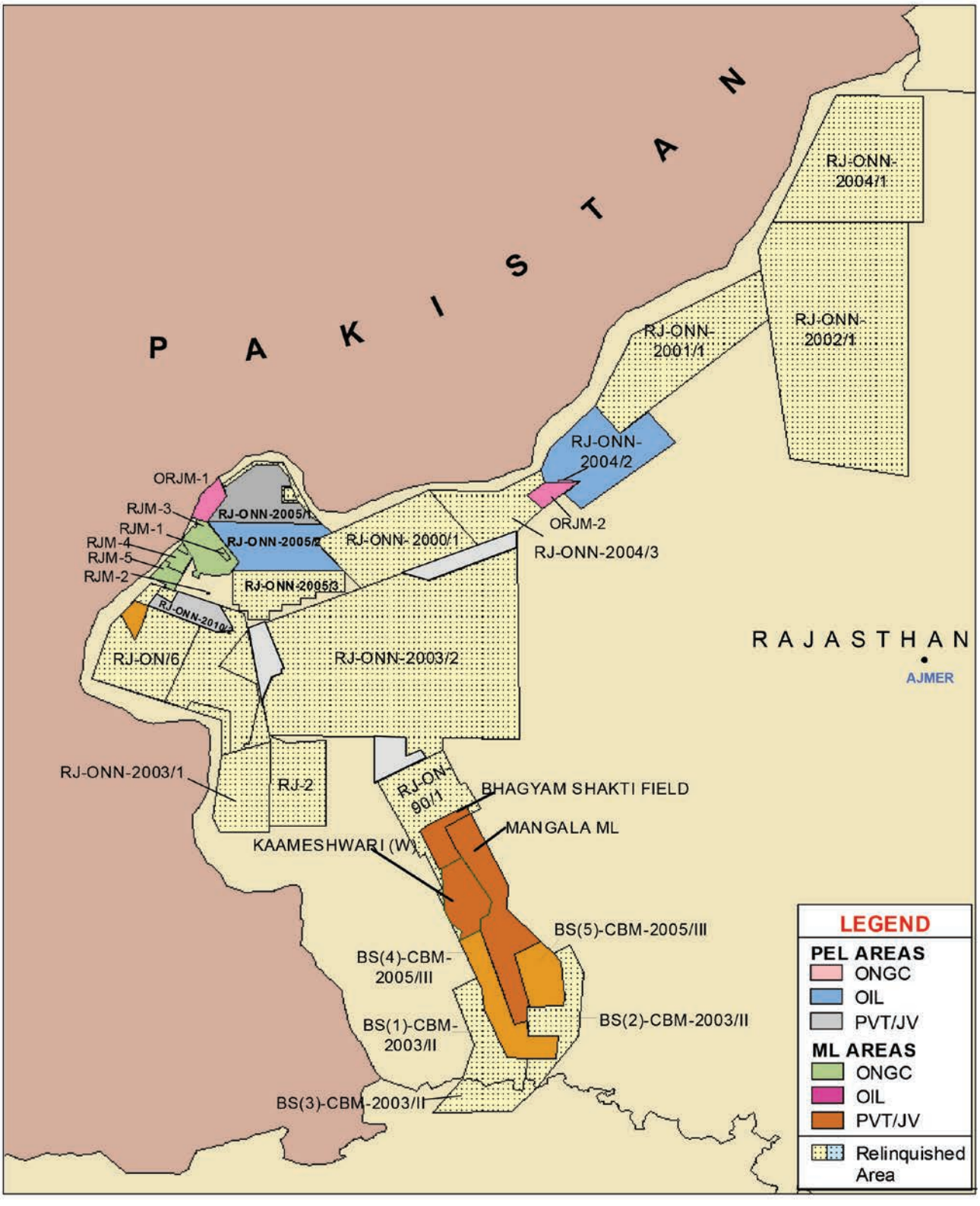
State-wise In-place volume (O+OEG) (MMT) Distribution under PSC Regime as on 01.04.2016



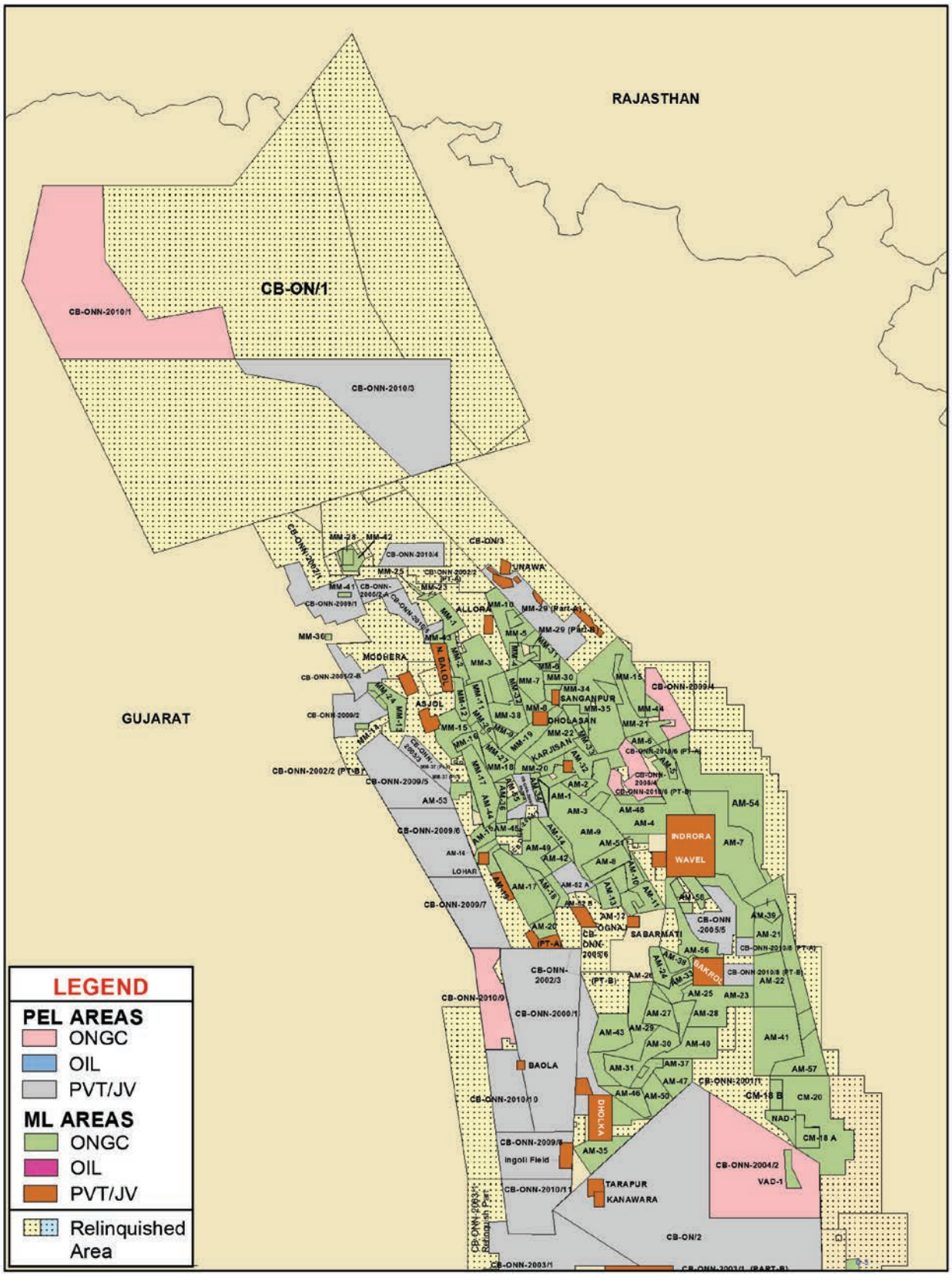
Pre-NELP Discovered (Small and Medium size) Fields



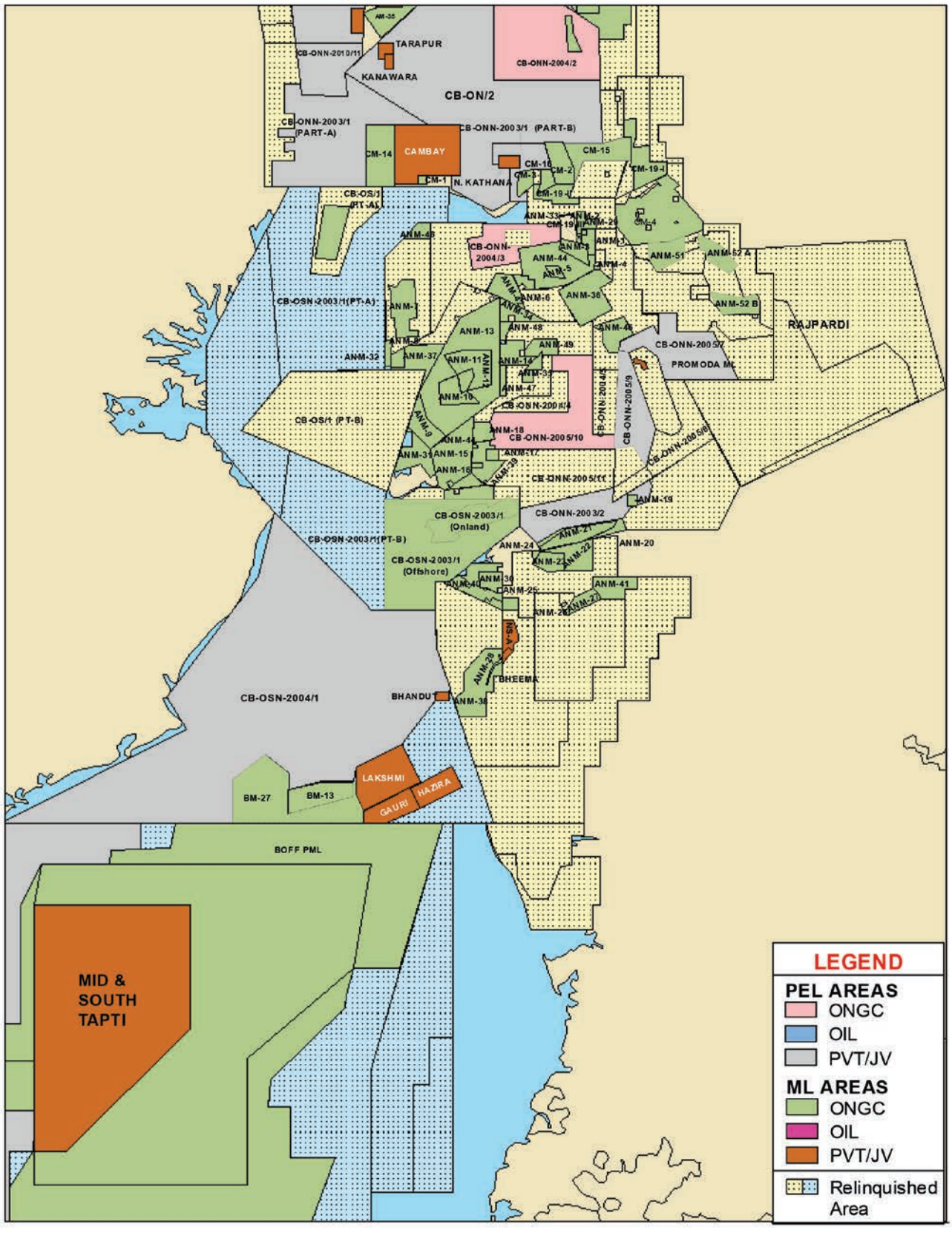
1. Rajasthan Basin



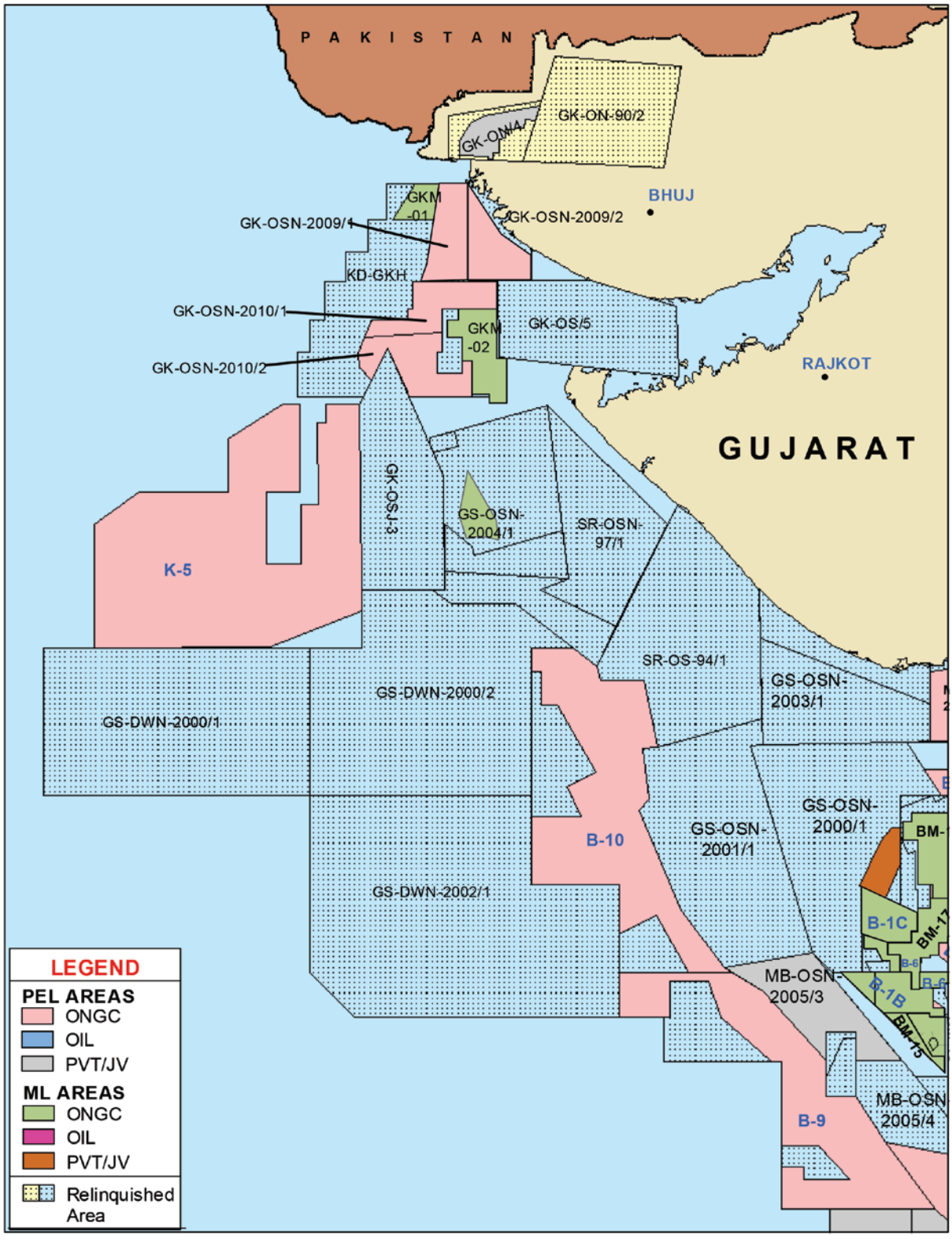
2. North Cambay Basin



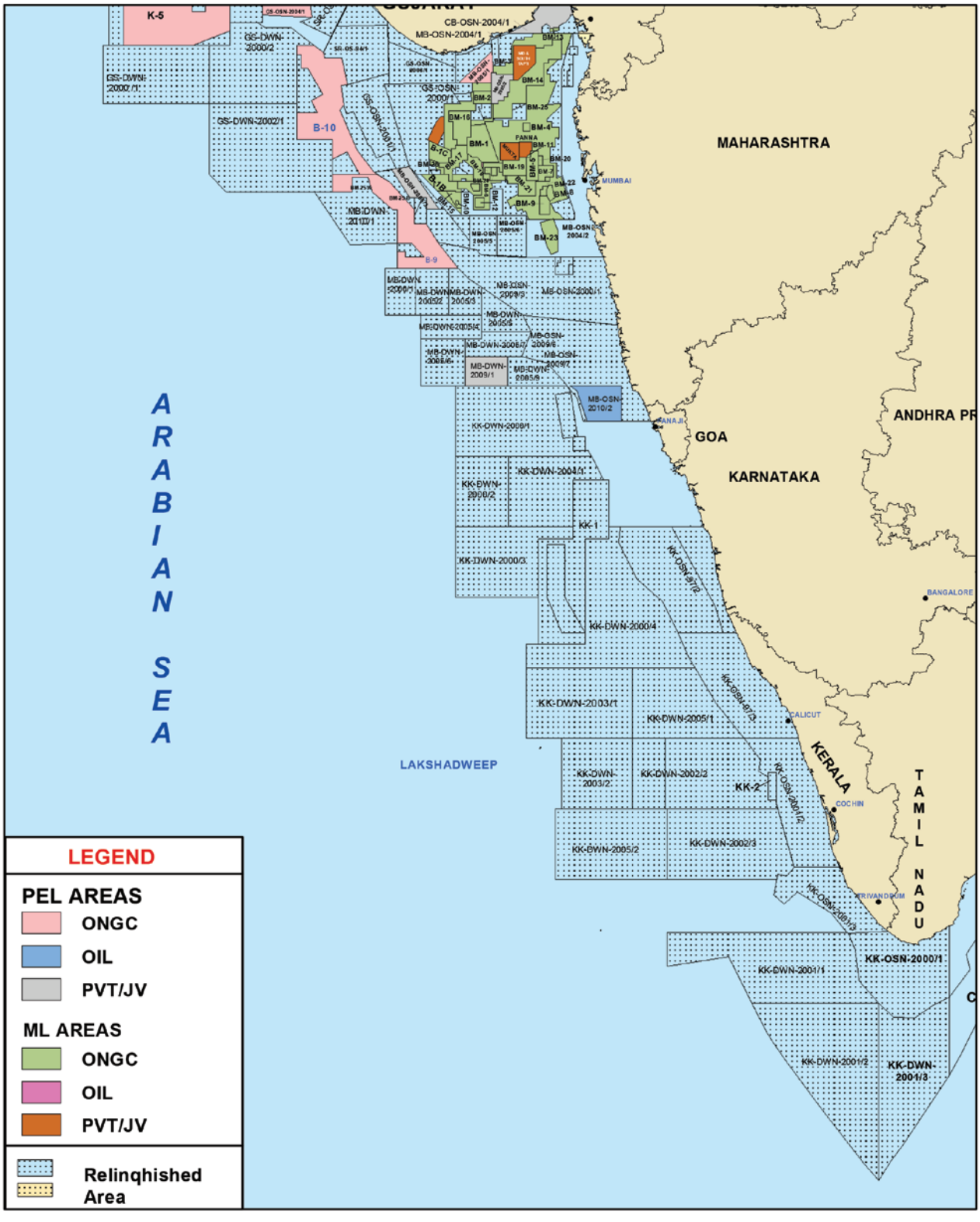
3. South Cambay Basin



4. Kutch-Saurashtra Basin



5. Mumbai Offshore & Kerala - Konkan Basin



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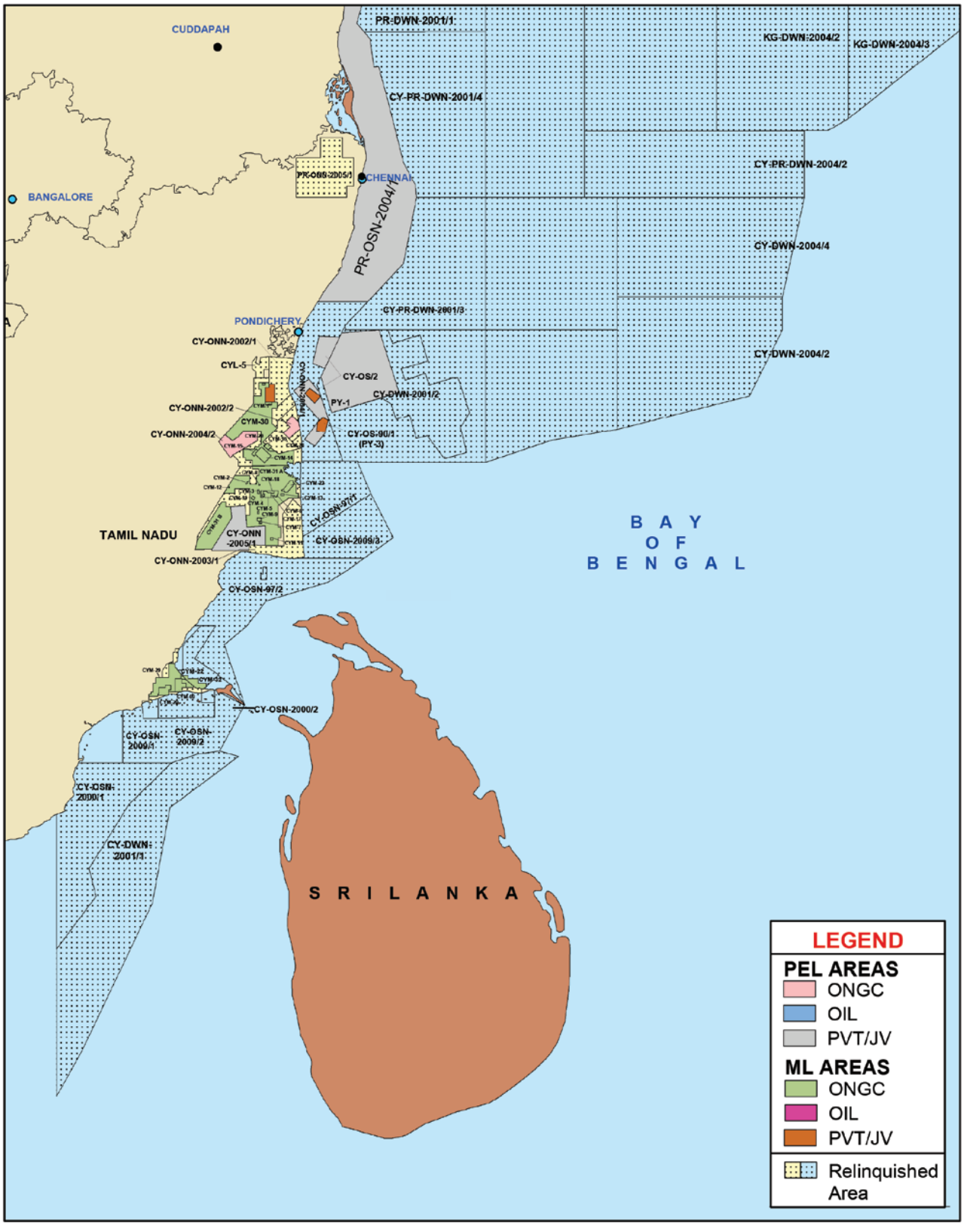
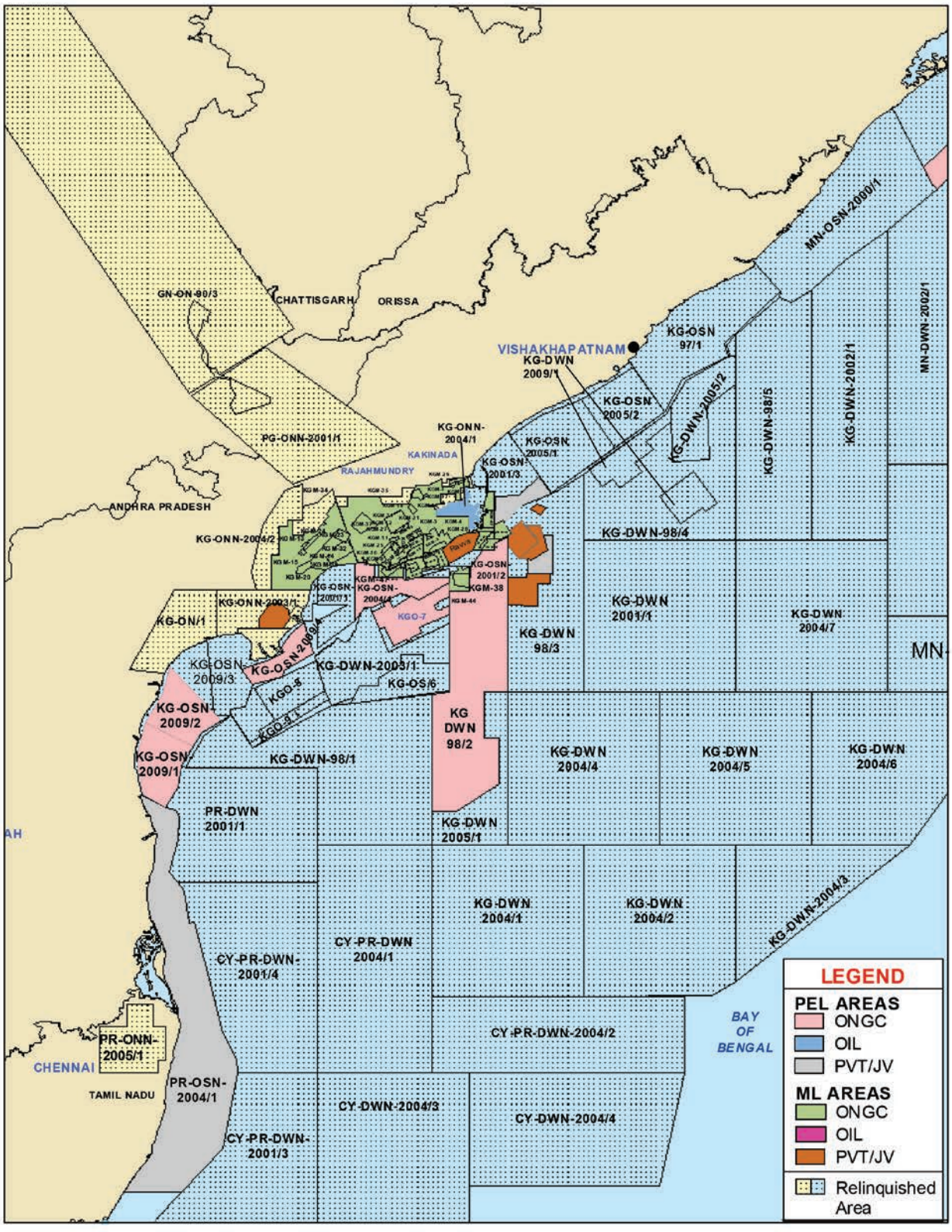
6. Cauvery Basin

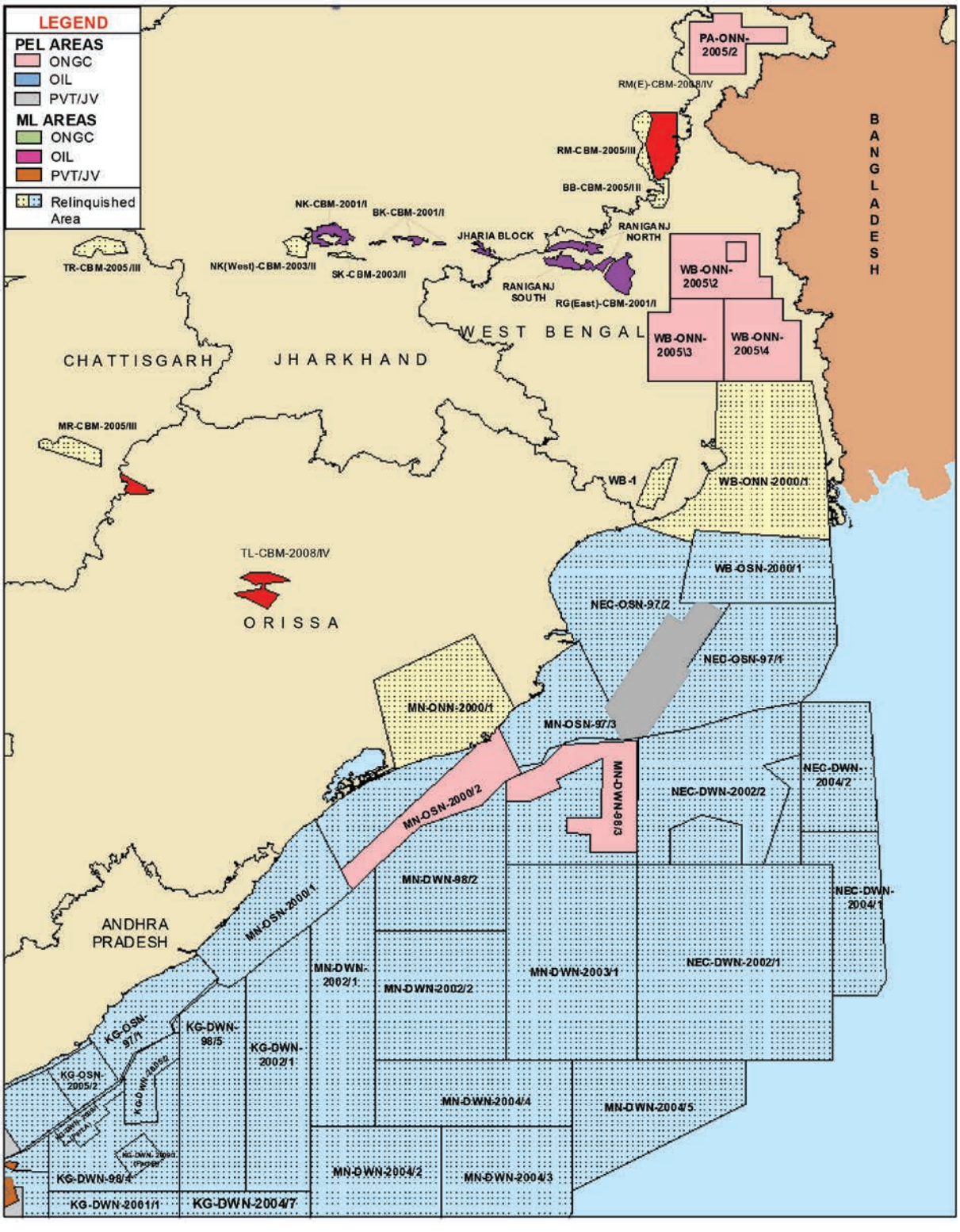


7. Krishna-Godavari Basin

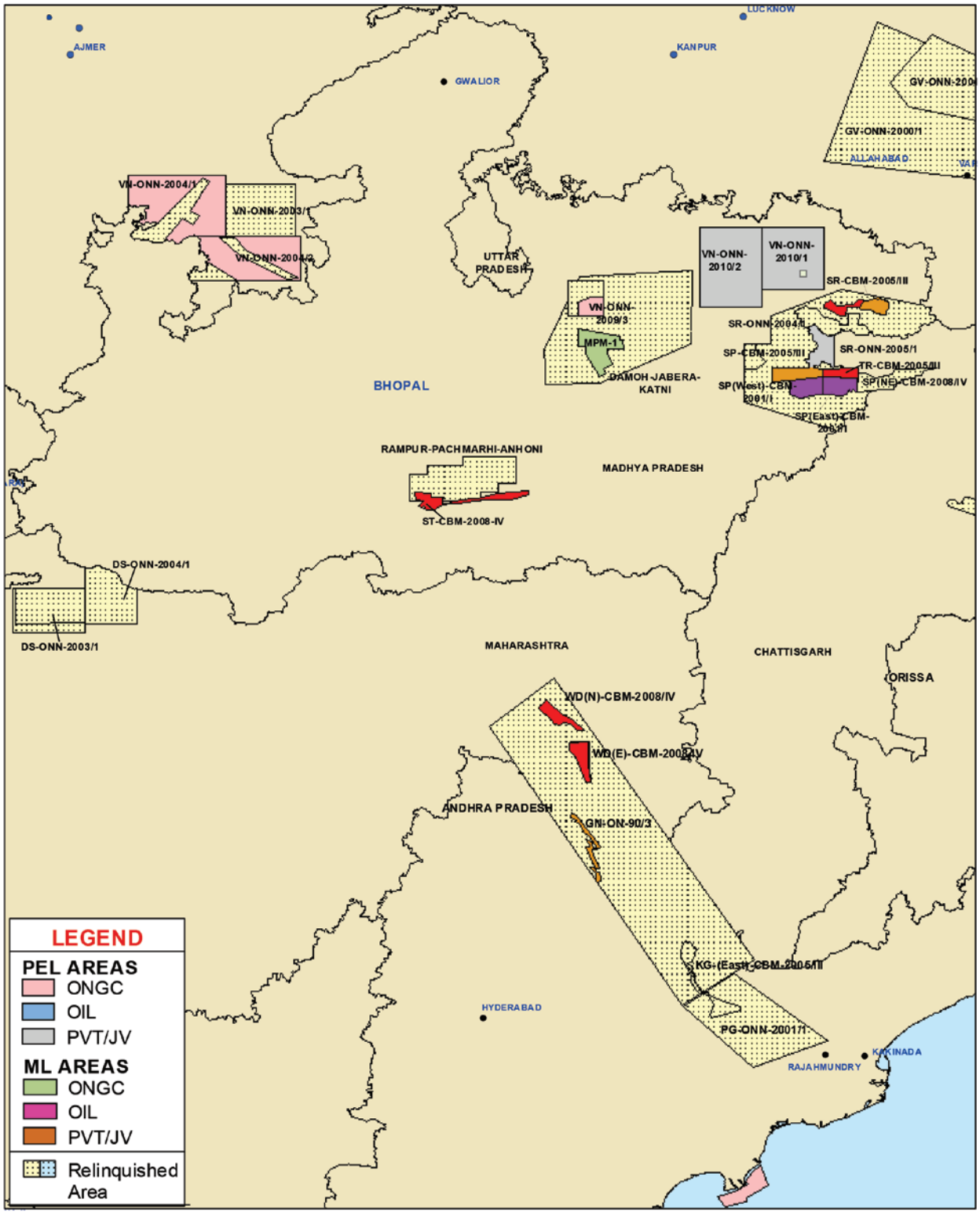


DGH

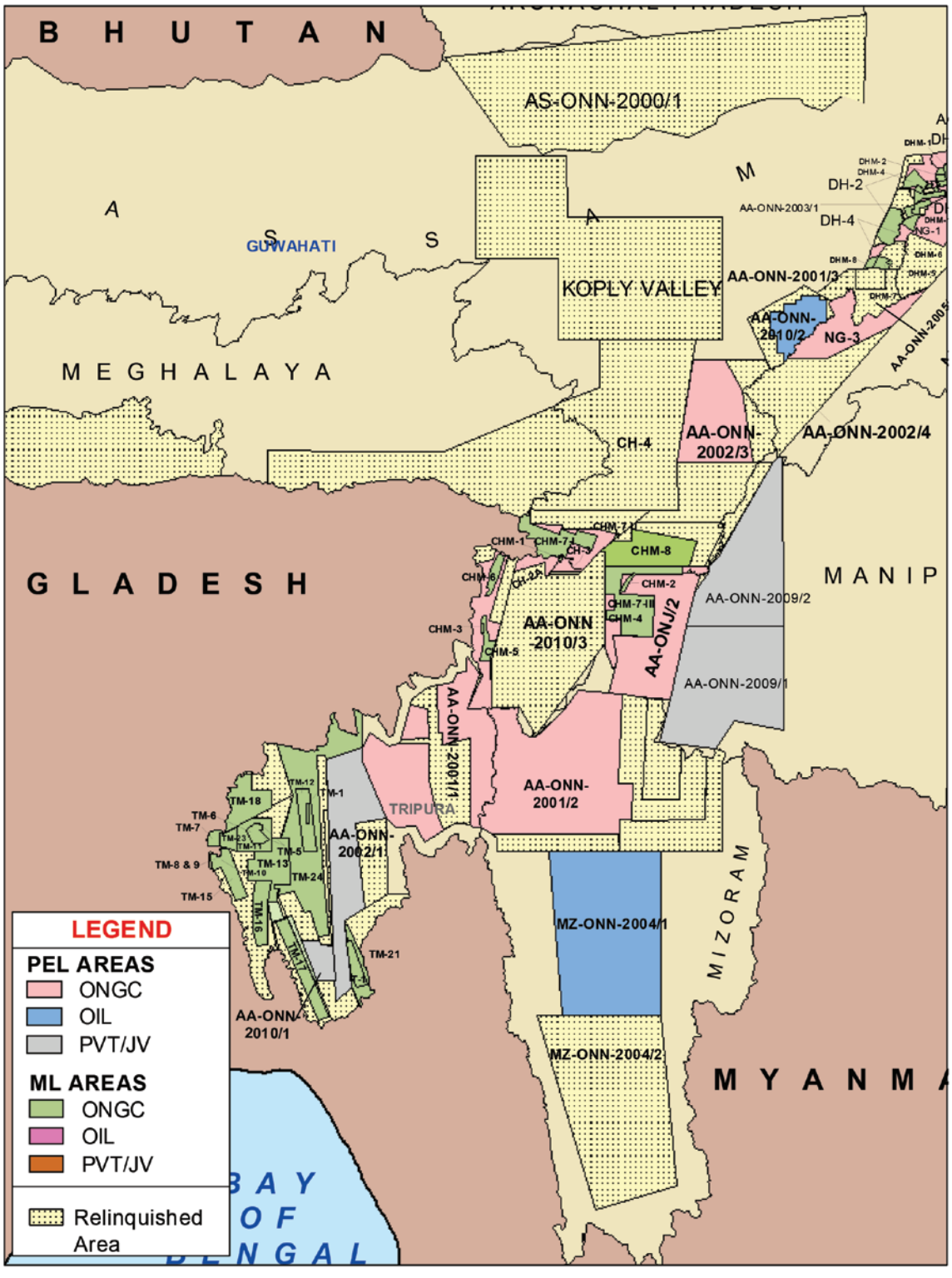
8. Mahanadi-NEC - Bengal - Damodar Basins



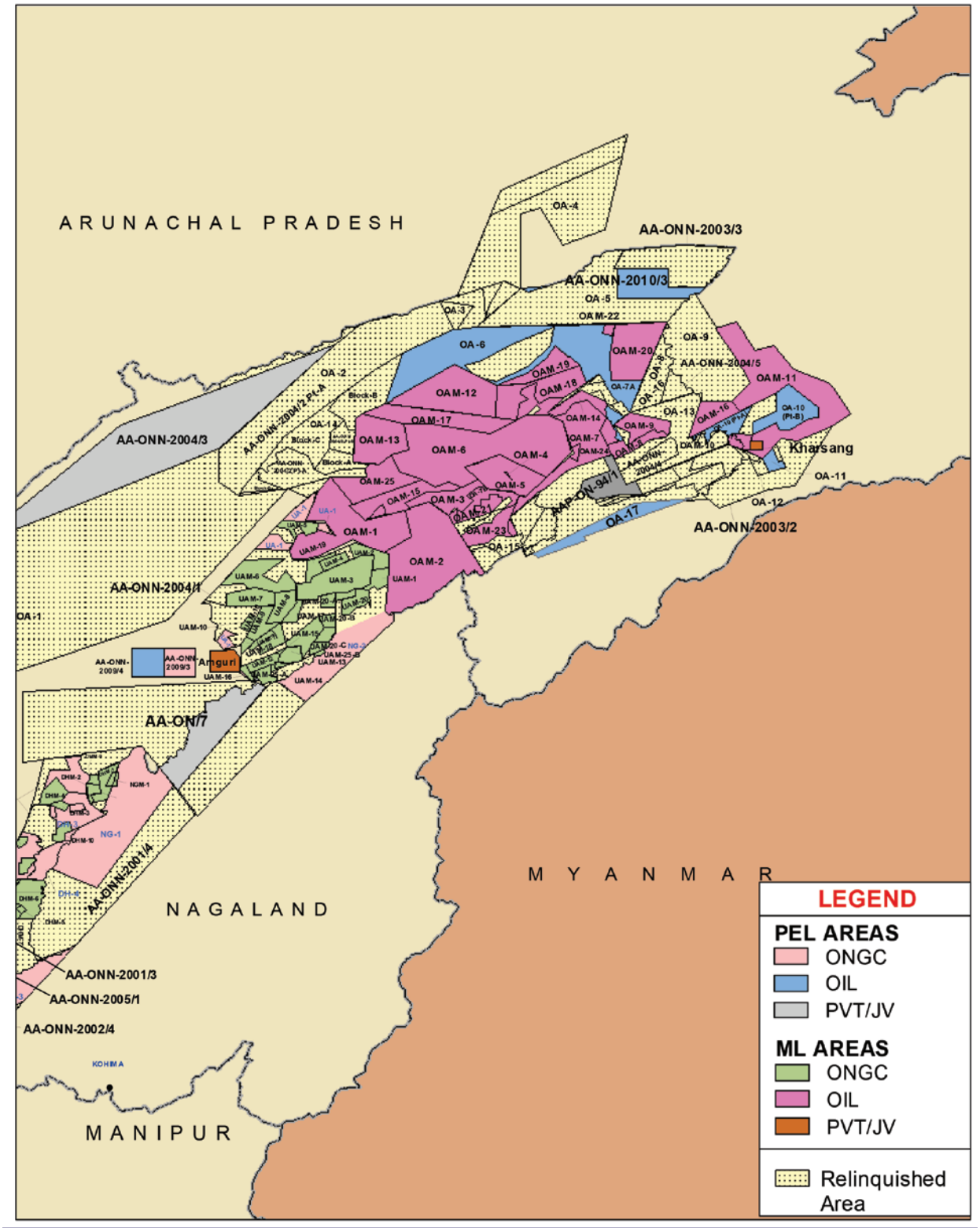
9. Satpura-Pranhita Godavari Basins



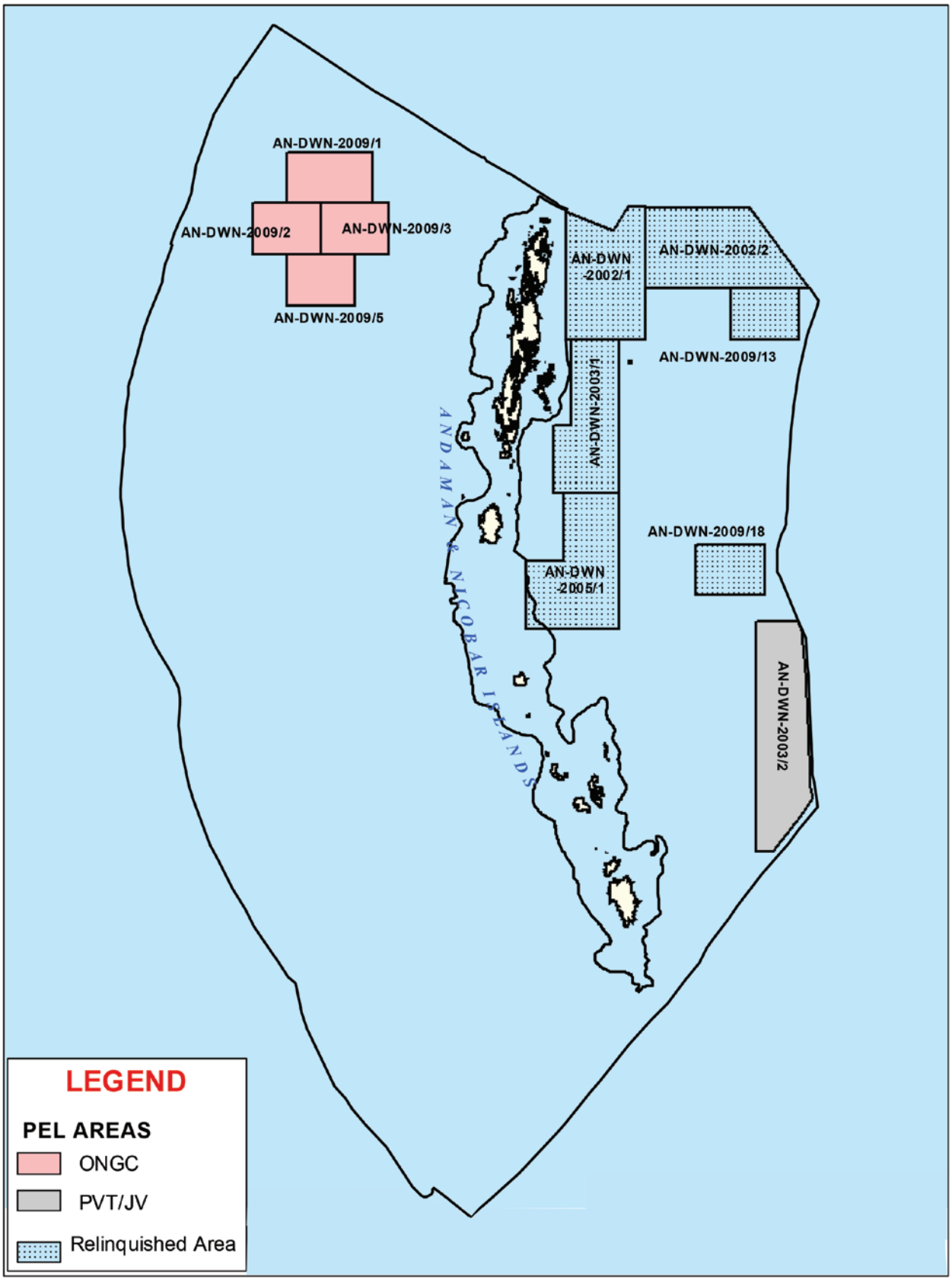
10. Assam-Arakan Basin



11. Assam-Arakan Shelf



12. Andaman-Nicobar Basin



INDIAN COMPANIES IN E&P SECTOR

PSU COMPANIES (REGISTERED OFFICE)

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E-mail: info@apgic.in Website: www.apgic.in

Bharat Petroleum Corp. Ltd.
Bharat Bhawan, 4 and 6 Currimbhoy Road, Ballard Estate, Mumbai - 400001, India
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Facsimile: 022-22713874 Website: www.bharatpetroleum.co.in

Bharat Petro Resources Ltd.
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ABBREVIATIONS

DGH	Directorate General of Hydrocarbons
2D	2 Dimension
3D	3 Dimension
AOC	Assam Oil Company
API	American Petroleum Institute
ASP	Alkaline Surfactant Polymer
ATCS	Automatic Tube Cleaning System
AVO	Amplitude Versus Offset
BCM	Billion Cubic Meter
BHT	Bottom Hole Temperature
BOC	Burma Oil Company
BOPD	Barrels of Oil Per Day
BPCL	Bharat Petroleum Corporation Limited
CBM	Coal Bed Methane
CCD	Centrifugal Cutting Driers
CCEA	Cabinet Committee of Economic Affairs
CCS	Carbon Capture Storage
CCSP	Carbon Capture and Storage Program
CCU	Carbon Capture Utilization
CMPDI	Central Mine Planning and Design Institute
CRP	Control Riser and Platform
CRZ	Coastal Regulation Zone
CSR	Conductor Slot Recovery
CSS	Cyclic Steam Stimulation
CWI	Carbonated Water Injection
CWT	Continuous Wavelet Transform
DA	Development Area
DFN	Discrete Fracture Network
DoC	Declaration of Commerciality
DRDO	Defence Research and Development Organization
DST	Drill Stem Testing
E&P	Exploration and Production
EAC	Expert Appraisal Committee
EC	Environment Clearance
ECD	Equivalent Circulating Density
EIA	Environment Impact Assessment
EPS	Early Production System
ESS	Expandable Sand Screen
EWPL	East West Pipeline
FC	Forest Clearance
FDP	Field Development Plan
FHGG	Fast Hydrating Guar Gum
FIVs	Formation Isolation Valves
FPSO	Floating Production Storage and Offloading
G&G	Geology and Geophysics
GAIL	Gas Authority of India Limited
GCM	Geo Cellular Modelling
GEM	Gas Export Manifold
GGS	Gas/Group Gathering Station
GIP	Gas In Place
GIPIP	Good International Petroleum Industry Practices
GSPC	Gujarat State Petroleum Corporation Limited
HCPV	Hydrocarbon Pore Volume
HGS	Hollow Glass Sphere
HPHT	High Pressure High Temperature
ICB	International Competitive Bidding
ICG	Indian Coast Guard
INCOIS	Indian National Centre for Ocean Information Services
IOCL	Indian Oil Corporation Limited
IOR-EOR	Improved Oil Recovery- Enhanced Oil Recovery
JIP	Joint Industry Project
JOGMEC	Japan Oil, Gas and Metals National Corporation
KDMIPE	Keshava Deva Malviya Institute of Petroleum Exploration
KLPD	Kilo Litres Per Day
LCM	Lost Circulation Material
LCMD	Lakh Cubic Meters per Day
LD	Liquidated Damages
LKM	Line Kilometer
LWD	Logging While Drilling
MC	Management Committee
MCA	Multi Channel Analyzer
mD	Milli Darcy
MEOR	Microbial Enhanced Oil Recovery
MMbbls	Million Barrels
MMBO	Million Barrels of Oil
MMSCF	Million Standard Cubic Feet
MMSCMD	Million Standard Cubic Meters per Day
MMT	Million Metric Tonne
MoC	Ministry of Coal
MoD	Ministry of Defence
MoEF&CC	Ministry of Environment , Forest and Climate Change
MoHA	Ministry of Home affairs
MoP&NG	Ministry of Oil and Natural Gas
MoU	Memorandum of Understanding
MPD	Managed Pressure Drilling
MPT	Mangala Processing Terminal
MT	Magnetotelluric/Thousand Tonnes
MWP	Minimum Work Program
NDR	National Data Repository
NELP	New Exploration Licensing Policy
NGHP	National Gas Hydrate Program
NIOT	National Institute of Ocean Technology
NoCs/Pvt/ JV	National Oil Company/Private/Joint Venture
NOS-DCP	National Oil Spill - Disaster Contigency Plan
O+OEG	Oil plus Oil Equivalent Gas
OALP	Open Acreage Licensing Policy
OIDB	Oil Industry Development Board
OIL	Oil India Limited
ONGC	Oil and Natural Gas Corporation Limited
ONGD	Oil and Natural Gas Directorate
OOSA	Online Oil Spill Advisory
PCI	Potential Commercial Interest
PDB	Paraffin Deposition Bacteria
PEL	Petroleum Exploration License
PHPA	Partially Hydraulised Polyacrylamide
PLEMs	Pipeline End Manifold
PML	Petroleum Mining Lease
PSC	Production Sharing Contract
PSDM	Post Stack Depth Migration
PSI	Pounds per Square Inch
PSUs	Public Sector Undertaking
PVT	Pressure Volume Temperature
RCA	Reservoir Connectivity Analysis
RDG	Raageshwari Deep Gas
RIL	Reliance Industry Limited
RRR	Reserve-Replacement Ratio
SACEP	South Asia Co-operative Environment Program
SBM	Synthetic Oil Based Mud
SCAL	Special Core Analysis
SCMD	Standard Cubic Meter per Day
SKM	Square Kilometer
SOBM	Synthetic Oil Based Mud
SRFS	Site Restoration Fund Scheme
STOIIP	Stock Tank Original Oil-Place
TCF	Trillion Cubic Feet
TMT	Thousand Metric Tonnes
TPD	Tonnes Per Day
TVDSS	True Vertical Depth Sub Sea
UAT	User Acceptance Test
US DOE	United States Department of Energy
USGS	United States Geological Survey
VSP	Vertical Seismic Profiling
WAG	Water Alternating Gas
WARP	Weighting Agent Reduction Particle
WP&B	Work Program and Budget
WSO	Water Shut off

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Shri Narendra Modi
Prime Minister of India

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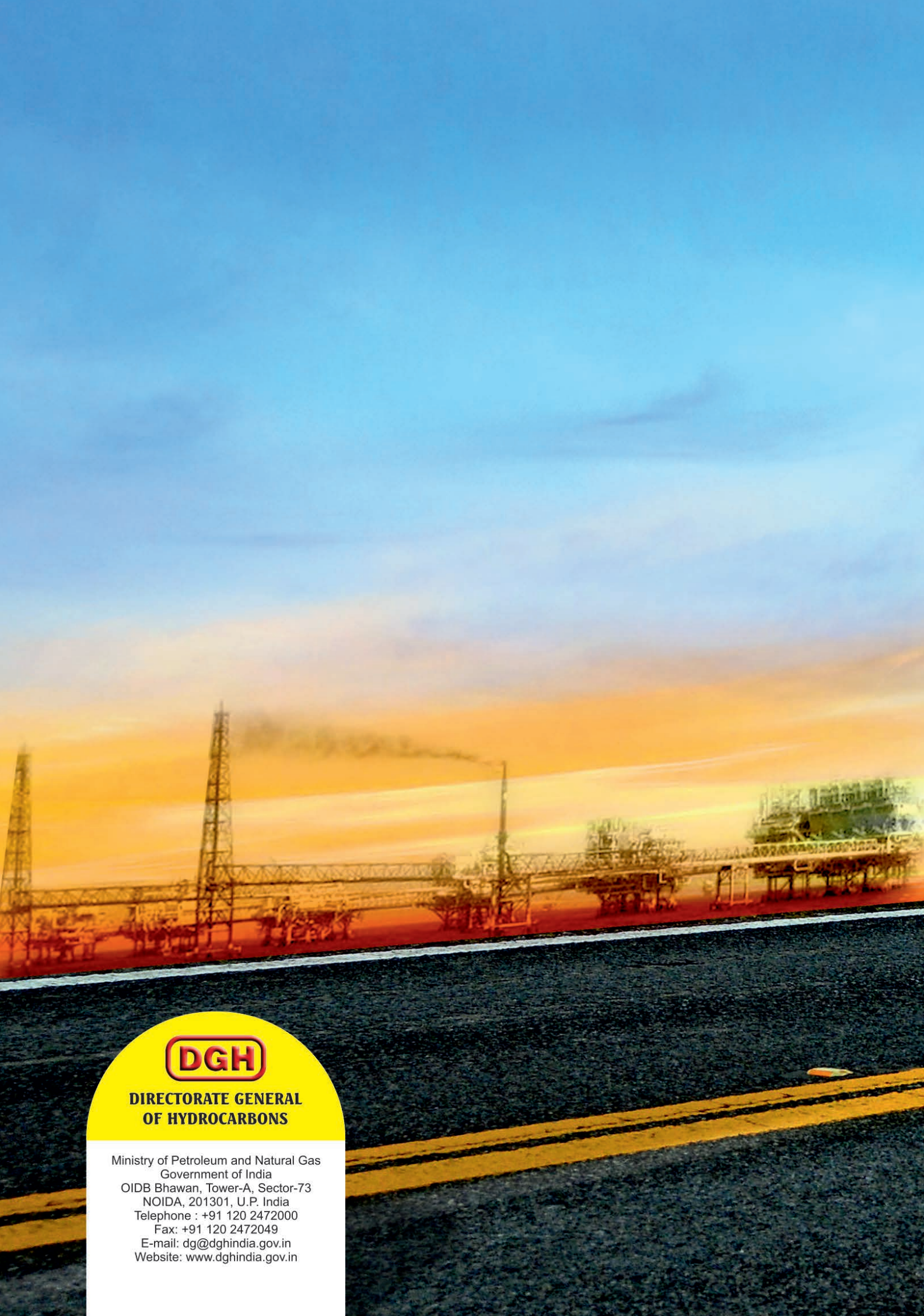

DGH

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