# Brief Note on Exploration & Production

## 1. Preamble

Oil and gas exploration has been carried out by Oil and Natural Gas Corporation Limited (ONGC), Oil India Limited (OIL) and Private/JV companies in 26 sedimentary basins of India covering an area of 3.14 million Sq. Km. including deepwater areas. Total prognosticated resources of the country have been estimated at about 28-32 billion tonnes, out of which, about 8.6 billion tonnes of inplace oil and gas reserves have been established. About 1.4 billion tonnes of oil and gas have been produced till 1.4.2006.

As on 1.4.2006, the balance recoverable reserve position of O+OEG is about 1,856 million tonnes, which has increased from 1,485 million tonnes in 2002-03 mainly due to major discoveries by Private/JV companies.

## 2. Crude Oil and Natural Gas production in 2005-06:

In 2005-06 crude oil and natural gas production was 32.191 MMT and 32.206 BCM respectively. The main reason for shortfall in crude oil production was Mumbai High Fire incident resulting in a loss of about 1.5 MMT.

3. **Discoveries made by ONGC, OIL and Private/JV companies in 2005-06** :

In 2005-06, ONGC, OIL and Private/Jv companies made 10, 5 and 15 oil and gas discoveries respectively.

## 4. Initiatives by upstream oil companies and the Ministry to enhance oil & gas production

Several important steps have been taken to increase oil and gas production, which include the following:

(i) Improvement in the recovery factor from existing major fields by implementing Enhanced Oil Recovery (EOR)/Improved Oil Recovery (IOR) schemes. Oil and Natural Gas Corporation Limited (ONGC) has taken up 15 major fields for this purpose at an estimated investment of about Rs. 12,000 crore, which would also help in accelerating oil production from these fields.

(ii) Under the five rounds of New Exploration Licensing Policy (NELP), Production Sharing Contracts (PSCs) have been signed for 110 blocks and 30 discoveries have already been made. The award of 52 blocks under Sixth round of NELP is under progress.

(iii) Exploration in new areas, especially in deep water and difficult frontier areas, as also exploration in the deeper layers of the producing fields.

(iv) Faster development of the newly discovered fields and to step up the use of new technologies for seismic surveys, work over, stimulation operations, drilling of wells etc. in producing areas.

(v) Tapping of alternate sources of energy.

The brief status of IOR/EOR efforts, NELP, CBM, UCG and Gas hydrates are given in the following paragraphs.

## 4.1 Implementation of IOR/EOR Projects

18 schemes of IOR/EOR have been approved to increase recovery factor from ageing oil & gas fields of ONGC. The IOR/EOR schemes under implementation include 5 offshore, 10 onshore Improved Oil Recovery and 3 Enhanced Oil Recovery schemes as given below:

i) **5 Offshore IOR Projects** are : Mumbai High North Redevelopment, Mumbai High South Redevelopment, Neelam (completed in July, 2005), Additional Development Heera Pt-I (completed in December, 2005) and Additional Development Heera Pt.-II.

ii) **3 EOR Projects in Gujarat** are : Insitu Combustion Balol (completed in November, 2001), Insitu Combustion Santhal (completed in December, 2001) and Extended Polymer Sanand (completed in September, 2002).

iii) **7 IOR Projects in Gujarat** are : Santhal Infill (completed in November, 2003), Gandhar (completed in July, 2005), Kalol, North Kadi Phase-I, Sobhasan, Jotana (completed) and North Kadi Phase-II.

iv) **3 IOR Projects in Assam** are : Lakwa Lakhmani, Rudrasagar and Geleki.

The estimated cost of 18 schemes is about Rs. 11,649 crore and expected oil gain 120 MMT by 2030. One scheme, namely, Lanwa is yet to be approved by ONGC. 8 schemes namely in-situ Combustion Balol, in-situ Combustion Santhal, Extended Polymer Sanand, Additional Development Heera Pt-I, Santhal Infill, Jotana, Gandhar and Neelam have been implemented by ONGC. As on 1.4.2006, the actual cumulative incremental oil production from IOR/EOR projects was about 22.65 MMT as compared to expected oil production of 31.4 MMT, which is about 72% of the planned cumulative incremental crude oil production. The actual investment by ONGC on these IOR/EOR projects was of the order of Rs. 9,518 crore (89%) as against the plan expenditure of Rs. 10,684 crore till March, 2006.

## 4.2 New Exploration Licensing Policy (NELP)

Government of India approved the NELP 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 Licences (PELs)**. Five rounds of bids have so far been invited under NELP, in which, Production Sharing Contracts (PSCs) for 110 exploration blocks have been signed. In addition, 28 exploration blocks were signed prior to NELP. Under NELP, 37 discoveries have already been made in Cambay onland, North East Coast and Krishna-Godaveri deepwater areas, for which, development plans by the operators, viz., Cairn, RIL and Niko are in progress.

Government made the highest ever offering of 55 Exploration blocks under sixth round of New Exploration Licensing Policy (NELP-VI) in February, 2006 for bidding. The aggressive and effective projection of these investment opportunities resulted in best ever response from both Indian (public & private) and foreign companies with a total of 165 bids for NELP-VI blocks. In all 68 companies including 36 foreign companies made bids under NELP-VI. These bids are at present under process of being awarded to the successful bidders shortly.

With Exploration and development efforts made under NELP, Natural Gas production in the country is likely to be doubled from the present level of gas production of about 90 million standard cubic metres per day (MMSCMD) by end of $11^{th}$ Five Year Plan.

## 4.3 Coal Bed Methane Policy (CBM)

Coal Bed Methane is a natural gas (Methane) adsorbed in coal and lignite seams and is an eco-friendly source of energy. Coal is both the source and reservoir rock for CBM. CBM production is done by simple depressurization and dewatering process. To harness this new source of energy in the country, the Government approved a comprehensive CBM policy in July, 1997 for exploration and production of CBM gas.

As of now, 23 CBM Blocks were awarded through competitive international bidding under first three rounds of CBM policy, under which blocks are being operated by technically competent companies. 2 blocks were awarded on nomination basis and one block through FIPB route. 16 CBM exploration blocks are under operation and contracts for 10 Blocks under CBM-III have been signed recently in November, 2006 (against which 54 bids had been received). Thus, Government has signed contracts for 26 blocks covering an area of 13,600 Sq. Km. The total committed investment in these blocks is of the order of Rs 675 crore. As on 1.4.2006, Rs.170 crores was already invested by the operating companies in CBM blocks. In just 4 blocks, over 6 TCF of gas reserves have been established. In 2007-08, India may join the rank of the few countries that commercially produce CBM. During XI Five Year Plan, CBM gas production is envisaged as 3.78 billion cubic metres.

## 4.4 Underground Coal Gasification (UCG)

UCG is a potential economic means for extracting gas from deep seated and/or isolated coal deposits/ lignite resources, which may not be amenable to conventional physical extraction economically. As per the estimates of ONGC, the recoverable energy from Mehsana-Ahmedabad block with coal reserves of 63 billion tonnes in the form of gas is estimated to be equivalent to 15, 000 Billion Cubic Meters (BCM) of natural gas (which is many times the conventional gas resources of the country at present). Even if a fraction of this is realized, it will go a long way to meet our energy needs. That is why UCG needs more attention as it has tremendous potential and high rewards.

The extraction of gas through UCG process involves drilling of wells and injection of air/oxygen with water or steam in the coal seam. The companies working under MOP&NG are well versed with the drilling technology and water/steam injection process.

ONGC has signed an MOU with Skochinsky Institute of Mining (SIM), Russia having expertise in the field of UCG. GAIL (India) Ltd. has also signed an MOU with Ergo (a Canada based company) for exploitation of UCG potential.

## 4.5 Equity oil & Gas from Abroad

In view of unfavorable demand – supply balance of hydrocarbons in the country, acquiring equity oil and gas assets overseas is one of the important components of enhancing energy security. The Government is encouraging Oil PSUs to aggressively pursue equity oil and gas opportunities overseas. OVL has made an investment commitment of over US$ 5 Billion and has an oil and gas production of 6.6 MMT (Oil and oil equivalent gas) in the year 2005-06.

In 2006, ONGC Videsh Ltd (OVL) acquired blocks/participating interest in Vietnam, Cuba, Nigeria, Brazil and Libya. Besides, ONGC - Mittal joint venture acquired interest in a block in Syria. Oil India Ltd. - Indian Oil Corporation consortium obtained interests in blocks in Libya, Gabon and Nigeria. GAIL consortium including BPCL, HPCL and Videocon acquired an exploration block in Oman. HPCL, BPCL and GSPC consortium acquired participating interest in an exploration block in Australia and the consortium of BPCL, Videocon and GSPC have acquired participating interest in an exploration block jointly awarded by Timor and Australia. In addition, private Indian companies like RIL and Essar are also pursuing E&P opportunities abroad.

In a significant development this year, ONGC brought home first consignment of crude oil from Sakhalin-1 oil field in Russia, which not only marked arrival of crude oil from the major equity oil investment in Russia but also opened up a new source/route for crude oil. The shipment of about 90,000 tonnes was ceremonially received by the Petroleum Minister Shri Murli Deora on 2$^{nd}$ December, 2006 at Mangalore. OVL has a 20% stake in the Sakhalin-I oil field.

During XI Five year period, Overseas Crude oil and natural gas production is likely to be of the order of 7 MMT par annum and 2 BCM par annum respectively.

## 4.6 Gas Hydrates

Exploration of Gas hydrates is at R&D stage world over. India is participating in the Gas Hydrates Programmes carried out by other countries. A road map was prepared for National Gas Hydrates Programme(NGHP). As per the road map, detailed geoscientific investigations were carried out in the KG Basin and Kerala-Konkan basin by NGHP through National Institute of Oceanography (NIO). Based on the results of seismic data studies and geoscientific investigations, ten sites in Mahanadi, KG & Kerala-Konkan basins and Andaman sea have been short listed for drilling/ coring of gas hydrates in the deepwaters. The drilling/ coring for gas hydrates is a very specialized activity and **India is only the third country in the world to do so, after USA and Japan.** The services for such specialized activity are not available commercially in the world. With sustained efforts by DGH, with IODP & USA, the drillship JOIDES Resolution along with all the scientific equipment and scientists onboard collected samples in Indian offshore from April, 2006 to August, 2006, under an agreement between DGH and a “US Consortium” of companies.

After obtaining the gas hydrates cores, several scientific studies are being carried out onboard the ship and will also be carried out in several laboratories in India, USA and Canada, for which separate agreements have been signed by DGH and corresponding agencies.

The studies will lead to understand gas hydrates characterization in Indian offshore areas and also in carrying out resource estimates, as well as R&D in this field. During drilling/coring by drillship, presence of huge quantities of Gas Hydrates has been detected in one of the wells in KG Basin. A specialized core repository is also being constructed in Panvel, Mumbai for storing all the valuable gas hydrates cores for future studies. Overall, good progress has been made in exploration for gas hydrates in the country, under NGHP.

The production of gas from gas hydrates itself is the biggest challenge faced by the world scientific community. The basic challenge is to find out a suitable technology to first dissociate the gas hydrates present in the solid form below the seabed in deep-sea conditions, as well as the permafrost regions of the world. Another challenge is to produce the dissociate gas from gas hydrates at a commercial rate.

## Allocation of Ravva Crude to North-East

In view of limited availability of about 5 MMT Crude Oil Produced in Assam to the four North-East refineries, they have been unable to operate to the level of their rated capacities. IOC's Guwahati Refinery (1.00 MMT) and Digboi Refinery (0.65 MMT), its subsidiary Bongaigaon Refinery (2.35 MMT) and Numaligarh Refinery (3.00 MMT) have a combined capacity of 7.00 MMTPA. Therefore, an allocation of 1.5 MMTPA of Ravva crude oil has been made to Bongaigaon Refinery & Petrochemicals Ltd. (BRPL) effective 1.4.2003. This enhances the total crude oil availability to all the four North-East refineries and has resulted in improved profitability and performance of these important industrial installations in the North-Eastern Region.

An allocation of 1.5 MMTPA of Ravva crude oil to Bongaigaon Refinery & Petrochemicals Ltd. (BRPL) continued during the year 2006 also.

## Developments in the Downstream Sector

## Pricing

With the declared intention of moving towards market-determined pricing for petroleum products, Government announced the dismantling of the Administered Pricing Mechanism (APM), effective, 1.4.2002. However, there has been an unprecedented, sharp and spiraling increase in international oil prices, particularly since late 2003, combined with considerable week-to-week and even day-to-day volatility. Therefore, Government, in June 2004, elucidated the principles which would govern its policy of containing the burden of increase in international prices on consumers of sensitive petroleum products. It was decided that the burden should be equitably shared by consumers, the Government and the oil companies. Therefore, the full impact of the international

# OR.I SECTION.

## REFINING CAPACITY

At present, there are 19 refineries operating in the country , out of which 17 are in public sector and two in private sector. Out of the 17 Public Sector refineries 7 are owned by Indian Oil Corporation Limited ( IOCL), 2 each by Chennai Petroleum Corporation Limited ( a subsidiary of IOCL), Hindustan Petroleum Corporation Limited (HPCL), Bharat Petroleum Corporation Limited ( BPCL) ( Kochi Refinery merged with BPCL on 21-08-2006) and Oil and Natural Gas Corporation Limited, 1 each by Numaligarh Refinery Limited (a subsidiary of BPCL) and Bangaigaon Refinery and Petrochemicals Limited ( a subsidiary of IOCL). The private sector refineries belong to Reliance Industries Limited and Essar Oil Limited.

*The domestic refining capacity as on 1.4.2006 was 132.47 Million Metric Tonnes Per Annum (MMTPA).* The present refining capacity is 148.97 MMTPA comprising of 105.47 MMTPA by PSUs and 43.50 MMTPA by private sector. The location and capacities of these refineries are given Annexure-I.

## ***National Auto Fuel Policy***

In line with the road map laid in the Auto fuel Policy approved by the Government in October 2003, the following quality of fuel has been introduced all over the country:-

| **Fuel quality** | **States/cities** | **Date of introduction** |
|---|---|---|
| Euro-III Petrol and Diesel | 13 cities (Delhi/National Capital Region, Mumbai, Kolkata, Chennai, Bangalore, Hyderabad, Ahmedabad, Pune, Surat, Kanpur, Agra, Solapur and Lucknow) | 1.04.2005 |
| Bharat Stage-II Petrol | All over country | 1.04.2005 |
| Bharat Stage-II Diesel | All States except Rajasthan, West U.P, Uttranchal, M.P, Punjab, H.P and Jammu & Kashmir | 1.04.2005 |
| | Rajasthan | 1.06.2005 |
| | West UP and Uttaranchal | 1.07.2005 |
| | Madhya Pradesh, Himachal Pradesh and Chandigarh | 1.09.2005 |
| | Punjab and Jammu & Kashmir | 1.10.2005 |

As per the road map provided in the Auto Fuel Policy, Introduction of Euro IV equivalent norms in identified cities and Euro-III equivalent norms in the entire country is from 1-4-2010. It is subject to review based on the assessment of the impact of Bharat Stage-II norms in the entire country and Euro-III equivalent norms in identified cities. Ministry of Environment & Forests have initiated these studies in coordination with Central Pollution Control Board. It is expected that the final report based on data for three seasons would be compiled by October, 2007. The oil industry is planning for introduction of Euro-IV norms in the year 2010 in line with the Auto Fuel Policy.

## AUTO FUEL POLICY

In line with the road map laid down in the Auto Fuel Policy, Euro-III Petrol & Diesel has been introduced in 43 cities including the most polluted cities viz. Delhi/National Capital Region, Mumbai, Kolkata, Chennai, Hyderabad, Bangalore, Ahmedabad, Pune, Agra, Kanpur, Lucknow, Nasik, As on 1.1.2007, Public Sector Oil Marketing Companies have set up 178 Auto LPG Dispensing Stations (ALDS) at existing retail outlets across the country for dispensing Auto LPG to vehicles. As per the road map for vehicular exhaust emission norms, all the Metros/Most polluted cities would have vehicles with exhaust emissions conforming to Euro-III or equivalent norms by Apirl, 2005 and Euro IV or equivalent norms by the year 2010. For the rest of the country, vehicles exhaust emissions should conform to Euro III or equivalent norms by the year 2010.

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