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The domestic production of crude oil at 33.99 million tonnes in 2006-07 rose slightly to 34.12 million tonnes in 2007-08. The net production of natural gas (utilised) also rose by 1.7% from 31.7 billion cu m in 2006-07 to 32.3 billion cu m in 2007-08. The refining capacity in the country at 148.97 million tonnes per year as on 1.4.2008 was unchanged over preceding year and was 3.4% of the world refinery capacity. On 9 April 2009, the Government of India invited bids for 70 exploration blocks on offer under the NELP-VIII programme by 10 August 2009.

EXPLORATION & DEVELOPMENT

The ONGC and OIL, the two National Oil Companies (NOCs) and a few private & joint venture companies were engaged in exploration and production activities of oil and natural gas in the country. As on 1.4.2008, there were in all 402 oil/gas fields under these companies including offshore areas.

In public sector, ONGC's jurisdiction extended to 352 fields – Cambay basin (Gujarat) – 96 oil/gasfields, Upper Assam – 31 fields, Assam & Assam Arakan – 6 fields, Jodhpur (Rajasthan) – 7 fields, Krishna-Godavari basin (Andhra Pradesh) – 45 fields, Cauvery basin (Tamil Nadu) – 26 fields, Assam Arakan Fold Belt (AAFB) in Tripura - 9 fields and Assam & Assam Arakan in Nagaland – 3 fields, besides, 91 offshore fields in the Mumbai offshore, 5 in Kachchh and 2 in Cambay basins in West Coast and 31 offshore fields in Cauvery, Mahanadi, Andaman and Krishna-Godavari basins (shallow and deep) in East Coast. OIL, a public sector company was engaged in 19 fields – Upper Assam basin in Assam (14 fields) and Arunachal Pradesh (1 field), Jaisalmer basin (Rajasthan) (3 fields) and Bikaner-Nagaur basin (Rajasthan) - 1 field. Private/Joint sector companies were engaged in Cambay basin (Gujarat) at 22 fields, AAFB basin (Arunachal Pradesh) at 1 field and Assam basin (Assam) at 1 field in onshore areas. In offshore areas, these companies covered 1 field in Cauvery basin and 1 field in Krishna-Godavari basin on the East Coast and 3 fields in Bombay basin and one field in Cambay basin on the West Coast.

Highlights of exploration carried out by ONGC and OIL during 2006-07 and 2007-08 are furnished below :

2006-07

During 2006-07, **ONGC** continued its onland seismic survey. Besides, offshore seismic surveys were carried out on East Coast offshore. In 2006-07, a total of 1,238 GLK of 2D and 3,398 sq km of 3D seismic data have been acquired in the onland part and 8,513 LK of 2D and 20,775 sq km of 3D seismic data have been acquired in offshore part. A total of 87 exploratory wells with a meterage of 225,616 and 178 development wells with a meterage of 401,874 have been drilled. A total of 32 exploratory wells – 25 onland and 7 offshore areas – was successful with hydrocarbon finds. Exploratory efforts of ONGC during 2006-07 resulted in 22 new hydrocarbon finds: SB-14 in Western offshore, UD-1 (KG-DWN-98/2) and KG-DW-S-1 in Krishna-Godavari offshore (deep water), Kalyanpur, Laiplingaon-6 and Mekeypore-4 in A&AA Basin, Deloli, Mehraj, Wadsar in Western onland, Gujarat, BV-10, Adichapuram, Kaveri onland, Tamil Nadu; MDW2, Mahanadi offshore; Linch-59, Linch-60, NK-435, Kosamba-40, Mewad-20, Sobhasan-250, Cambay, Gujarat; Mori-15, GS-49-4, Suryaraopeta-4, KG onland, Andhra Pradesh; and SB-13, Mumbai offshore.

Reserve accretion of in situ oil and oil-equivalent gas (O+OEG) in 2006-07 in domestic assets of ONGC was 169.52 million tonnes and 65.56 million tonnes ultimate reserves.

During 2006-07, **OIL** covered, under onshore seismic survey, 357.25 2D (GLKM), 250.62 3D (SQKM) and 672.77 3D (SQKM) contractual survey in Assam and Arunachal Pradesh; and 57.28 2D (GLKM) contractual survey in North East Frontier Project (NEF). Exploratory onshore drilling of 34,326 m and development onshore drilling of 71,539 m were carried out in Assam, while in Rajasthan, exploratory and development drilling carried out was 7,740 m and 1,014 m, respectively.

The details of discovery of oil/gas made by OIL during 2006-07 are given below :

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- i) NHK-556 in Santi Structure within Lakadong-Therria formation, Tinsukia district, Assam.
- ii) Baghjan-4 and Baghjan-5 in Baghjan Structure, Tinsukia district, Assam.
- iii) Berekuri-6 in the Berekuri structure, Tinsukia district, Assam.

Total recoverable reserves of crude oil and natural gas estimated by OIL at the end of 2006-07 were 36.24 million KL and 34.81 million KL (oil-equivalent), respectively.

2007-08

During 2007-08, ONGC carried out seismic surveys and a total of 996 GLK of 2D and 4,489 sq km of 3D seismic data have been acquired in the onland part and 7,161 LK of 2D and 14,870 sq km of 3D seismic data have been acquired in offshore part. A total of 99 exploratory wells with a meterage of 251,580 and 224 development wells with a meterage of 482,227 have been drilled. A total of 50 exploratory wells – 37 onland and 13 offshore areas – were successful with hydrocarbon finds. Exploratory efforts of ONGC during 2007-08 resulted in 14 new hydrocarbon finds: Disangmukh-3, Babejia-1, Kunjaban-2, Sundalbari-2 in Assam & Assam Arakan basin; Karjan-9 in western onshore; B-12-11, B-55-5, BNP-2 and B-7-2 in Western offshore, GS-48-1 in Krishna-Godavari offshore; MN-DWN-98/3-A1 (MDW-4A) and MN-DWN-98/3-B(MDW-5) in Mahanadi offshore; and Upiddi-1 and East Rangapuram-1 in Krishna-Godavari onshore. In addition, 24 new pool discoveries were also made during the year.

Reserve accretion of in situ oil and oil-equivalent gas (O+OEG) in 2007-08 in domestic assets of ONGC was 182.23 million tonnes and 63.82 million tonnes ultimate reserves.

During 2007-08, OIL covered, under onshore seismic survey, 143.34 2D (GLKM), 171.05 3D (SQKM) and 746.90 3D (SQKM) contractual survey and 227.50 (SQKM) contractual survey in Assam and Arunachal Pradesh; and 11.0 2D (GLKM) contractual survey and 227.50 (SQKM) contractual survey in North East Frontier Project (NEF). Exploratory onshore drilling of 39,930 m and development onshore drilling of 85,748 m were carried out in Assam, while in Rajasthan, exploratory and development drilling carried out was 1,650 m and 10,522 m, respectively.

The details of discovery of oil/gas made by OIL during 2007-08 in Assam and Rajasthan are given below:

- i) South Chandmari-2, Tinsukia district.
- ii) Sapkaint-1, Dibrugarh district.
- iii) Moran-112, Sivsagar district.
- iv) Hapjan-48, Tinsukia district.
- v) Makum-25, Tinsukia district.
- vi) Kathaloni-42, Dibrugarh district.
- vii) Makum-28, Tinsukia district.
- viii) Baghjan-7, Tinsukia district.
- ix) Dandiwalla-17, Khuiala formation, Rajasthan.

The total recoverable reserves of crude oil and oil-equivalent natural gas estimated by OIL at the end of 2007-08 were 37.23 million KL and 25.46 million KL, respectively.

In 2007-08, public sector companies drilled 359 wells (271 in onshore and 88 in offshore areas) with a meterage of 872 thousand (614 thousand in onshore and 258 thousand in offshore areas). The particulars of exploratory and development drilling carried out by public sector companies are given in Table-1.

Table - 1: Details of Drilling for Oil and Natural Gas in India* 2007-08 (p)

State/Area	Wells (No.)	Meterage ('000)
ONSHORE	271	614
Assam	67	227
Gujarat	156	255
Others	48	132
OFFSHORE	88	258
Bombay High	88	258
Others	-	-
Grand Total	359	872

* Relates to Public Sector Companies.

Source : Basic Statistics on Indian Petroleum and Natural Gas, 2007-08.

In private sector, Reliance Industries Ltd (RIL) made 9 offshore discoveries (7-gas, 1-oil and 1-oil & gas) in 2007-08, across four offshore basins, viz Mahanadi, Krishna, Cauvery and Gujarat-Saurashtra. With these, the number of discovered blocks held by RIL is 37. The recent discoveries are:

- i) KG-D6-R1, KG-V-D3-A1 & B1 (Gas, KG basin, deep water).
- ii) KG-III-05-P1 & J1 (Gas, KG basin, shallow water)
- iii) CY-D5-A1 (Oil & gas, Cauvery basin, deep water).
- iv) KG-D4-MD1 (Oil, KG basin, deep water).

- v) GS-01-B1 (Gas, Gujarat-Saurashtra basin, shallow water).
- vi) NEC-25-J1 (Gas, Mahanadi basin, shallow water).

The development of discoveries Dhirubhai-1 and Dhirubhai-3 in KG-D6 blocks were on schedule for production of gas during the second half of 2008-09. RIL's proved reserves of oil at the beginning of 2006-07 and 2007-08 were 6.71 million tonnes and 12.47 million tonnes, respectively, with addition of 6.33 million tonnes reserves in 2006-07. Similarly, the proved natural gas reserves at the beginning of 2006-07 and 2007-08 stood at 178.67 billion cu m and 222.15 billion cu m, respectively, with addition of 44.68 billion cu m and 1.71 billion cu m, respectively, of proved reserves in the two years. The oil and gas proved reserves at the end of 2007-08 were 11.64 million tonnes and 222.19 billion cu m, respectively.

In the CBM fields, RIL's development plan for Sohagpur coal bed methane blocks (East and West) was approved by DGH. Gas-In-Place (GIP) estimates of 3.65 TCF has been concurred by DGH for Sohagpur East and West blocks. Commercial production of CBM is likely to start by 2009.

POLICIES AND CONTRACTS

On 9.2.2005, the Government had approved a proposal of Ministry of Petroleum & Natural Gas to pursue natural gas imports from Iran, Myanmar and Central Asian Countries through onland transnational pipelines. In pursuance of the Cabinet decision, the Government is discussing the Iran-Pakistan-India (IPI) project with the Governments of Iran and Pakistan particularly relating to transportation tariff and transit fee for passage of pipeline through Pakistan. India will also join the Turkmenistan-Afghanistan-Pakistan (TAP) Gas Pipeline Project, as per the Cabinet's decision on 18.5.2006, after suitable amendments to inter-governmental and framework agreements. A draft framework agreement was under consideration.

One of the landmarks in Liberalisation Policy in petroleum sector is encouragement to participation of foreign and other Indian companies in exploration and development activities. A number of contracts have been signed with both foreign and Indian companies to undertake exploration activities and development of fields on production-sharing basis. Similarly, the Government is encouraging National

Oil Companies to aggressively pursue equity oil and gas opportunities overseas.

The Government had initiated bids under the New Exploration Licensing Policy (NELP) in 2000 to accelerate and expand exploration of oil and gas in the country. A total of 162 blocks had been awarded in various rounds of NELP, spanning 2000-2006. The investment for exploration in the three phases for 162 blocks is about Rs.45,000 crore which is expected to increase substantially with discoveries of hydrocarbons. Exploration under NELP has shown positive results with discoveries made in Krishna-Godavari deep water and in Cambay onland. NELP-VI launched in February 2006 offered 55 exploration blocks (24 deep water, 6 shallow water and 25 onland) covering 352,191 sq km area. A total of 52 exploration blocks were awarded in February 2007 after Cabinet approval. In December 2007, 57 blocks were put on offer by the Government under NELP-VII inviting bids by 11 April 2008. The blocks include 29 onland ones. Of the 28 offshore blocks, 19 are in deep water and 9 in shallow water.

Subsequently, the Government invited offers on 9 April 2009 for exploration of oil and natural gas under NELP-VIII by 10 August 2009. A total of 70 blocks were on offer comprising 8 onland, 10 onland type S, 28 shallow water and 24 deep water blocks.

In order to explore and produce new sources of natural gas from coal-bearing areas, the Government had formulated a Coal Bed Methane (CBM) Policy providing attractive fiscal and contractual framework for exploration and production of CBM which is an environmentally friendly clean gas fuel similar to conventional natural gas. Ten new blocks were offered by the Government for exploration & production of coal bed methane under CBM-IV on 9 April 2009.

The Government of India has awarded 26 CBM blocks in Jharkhand (6), Madhya Pradesh (5), Andhra Pradesh (2), Chhattisgarh (3), Maharashtra (1), Rajasthan (4), Gujarat (1) and West Bengal (4) in different coalfields of India under CBM-I to III. Exploration activities have established significant finds in eastern and central India. Commercial production of CBM has commenced from July 2007.

The Ministry of Petroleum & Natural Gas has formulated a Bio-diesel Purchase Policy which came into force on 1.1.2006. The Policy is a statement of intent towards purchase of bio-diesel by the oil-marketing companies. The policy, inter alia, identifies 20 purchase centres to be set up by public sector.

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RESOURCES

State/Regionwise reserves of crude oil and natural gas as on 1.4.2007 are given in Table - 2. As on 1.4.2008, total reserves of crude oil are estimated at 726 million tonnes (357 million tonnes

in onshore and 369 million tonnes in offshore areas). Those of natural gas are placed at 1,055 billion cu m (270 billion cu m in onshore and 785 billion in offshore areas) as per the Basic Statistics on Indian Petroleum and Natural Gas, 2007-08.

Table - 2 : Reserves* of Crude Oil and Natural Gas in India as on 1.4.2007(p)

(Crude oil in million tonnes;
natural gas in billion cu m)

Area	Crude oil	Natural gas
India	725.38	1054.58
Onshore	277.87	266.10
Andhra Pradesh	4.40	40.92
Assam	133.76	119.74
Gujarat	131.62	76.72
Tamil Nadu	8.09	28.72
Offshore	447.51	788.48
Western offshore	420.65	369.36
Eastern offshore	26.86	419.12

* *Proved and indicated balance recoverable reserves.*

Note: *Reserves of crude oil and gas are included in Assam in respect of Nagaland, Tripura and Arunachal Pradesh. Reserves in respect of Bombay High, Rajasthan and Joint Venture Companies are included in Western Offshore while those of Joint Venture Companies and private parties are included in Eastern Offshore.*

Source: *Indian Petroleum and Natural Gas Statistics, 2006-07, Ministry of Petroleum and Natural Gas, Govt. of India.*

PRODUCTION

Petroleum (Crude)

Provisional total production of petroleum (crude) was at 34.1 million tonnes in 2007-08 which was nearly at the previous year's level.

Offshore areas remained the largest producer of petroleum (crude) with a share of 67.1% of the national output in 2007-08. Next in order were Gujarat with a contribution of 18.1% and Assam with 12.8%. The remaining 2.0% production was reported by Tamil Nadu, Andhra Pradesh and Arunachal Pradesh.

Production of petroleum (crude) was higher in Andhra Pradesh by 10.7% and Offshore by 1.1%. There was a decline in production in Tamil Nadu by 15.6% in Arunachal Pradesh by 5.6%, in Assam by 1.0% and in Gujarat by 0.6% as compared to previous year.

About 85% of the petroleum (crude) production was reported from public sector and the remaining 15% from private sector in 2007-08 (Table-3).

Table - 3 : Production of Petroleum (Crude), 2005-06 to 2007-08 (By States)

(Quantity in '000 tonnes; value in Rs. '000)

State	2005-06		2006-07		2007-08 (p)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	32190	179298300	33988	189313160	34117	190031690
Public sector	27638	153943660	29158	162410060	29040	161752800
Private sector	4552	25354640	4830	26903100	5077	28278890
Andhra Pradesh	216	1203120	252	1403640	279	1554030
Arunachal Pradesh	104	579280	108	601560	102	568140
Assam	4474	24920180	4401	24513570	4357	24268490
Gujarat	6251	34818070	6213	34606410	6177	34405890
Tamil Nadu	385	2144450	353	1966210	298	1659860
Offshore	20760	115633200	22661	126221770	22904	127575280

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Domestic prices of petroleum (crude) in 2005-06 to 2007-08 are furnished in Table-4.

**Table - 4 : Prices of Petroleum (Crude)
2005-06 to 2007-08**

		(In Rs. per tonne)		
Grade	Market	2005-06	2006-07	2007-08(p)
Indigenous*	Onshore	7372	14504	24433
Indigenous*	Offshore	11811	17856	26668
Indigenous*	Offshore & Onshore	10174	16725	25913
Imported	c.i.f. Indian Port (average)	17359	19947	22322

* *Relates to provisional weighted average basic prices of petroleum crude of ONGC, excluding royalty, cess, sales tax and other charges.*

Source: Basic Statistics on Indian Petroleum & Natural Gas, 2008-09.

Natural Gas (Utilised)

The production of natural gas (utilised) at 32,274 million cu m recorded an increase of 1.7% in 2007-08 as compared to that in the previous year. Offshore areas continued to be the largest producer of natural gas (utilised) with a share of 71.9%. Next in the order were Gujarat with a share

of 9.1%, Assam (including Arunachal Pradesh) (8.1%), Andhra Pradesh (4.9%), Tamil Nadu (3.6%) and Tripura (1.7%). Rajasthan accounted for the remaining 0.7% of the production.

Statewise analysis revealed that most of the states recorded an increase in production of natural gas in 2007-08 as compared to that of the previous year. The production increased in Rajasthan by 6.7%, in Tamil Nadu by 3.5%, offshore by 3.2%, Tripura by 2.7%, Andhra Pradesh by 2.6% and Assam by 2.5%. The only state that recorded a decline in production was Gujarat 11.0%.

As much as 76% of the total production came from the public sector in 2007-08. The remaining 24% was the share of the private sector companies (Table-5).

Employment

A total of 139,823 persons was employed in the petroleum industry as on 1.4.2008, as compared to 135,315 persons employed in the preceding year. Out of these, 33,935 persons were employed in exploration and production, 30,128 in refining, and the balance 75,760 in marketing, pipelines, R & D, etc.

**Table - 5 : Production of Natural Gas (Utilised), 2005-06 to 2007-08
(By States)**

State	(Quantity in million cu m; value in Rs.'000)					
	2005-06		2006-07		2007-08 (p)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	32202	93082800	31747	97641600	32274	99229440
Public sector	24844	71813834	24708	75992335	24547	75472054
Private sector	7358	21268966	7039	21649265	7727	23757386
Andhra Pradesh	1663	4989000	1527	4886400	1567	5014400
Assam @	2456	4420800	2565	4924800	2628	5045760
Gujarat	3831	11493000	3294	10540800	2931	9379200
Rajasthan	242	726000	239	764800	255	816000
Tamil Nadu	906	2718000	1129	3612800	1169	3740800
Tripura	480	864000	520	998400	534	1025280
Offshore	22624	67872000	22473	71913600	23190	74208000

@ *Includes production of natural gas (utilised) for non-captive use in public sector in Arunachal Pradesh.*

CONSUMPTION

Total consumption of petroleum products (excluding Refinery Boiler Fuel) decreased marginally in 2007-08 over the previous year. Consumption of some Light Distillates (naphtha and others) and Middle Distillates like SKO decreased slightly in 2007-08. Consumption of Heavy Ends like furnace oil, lubes & greases, petroleum coke, etc. also decreased. LPG, Mogas, ATF and bitumen recorded an increase in consumption. The consumption of various petroleum products from 2005-06 to 2007-08 is given in Table-6.

INDUSTRY

The total refining capacity of 19 units in operation in the country was about 149 million tpy in April 2008, with a share of about 3.4% in the world refinery capacity of 4,378 million tpy.

In the next five years, the following additional refining capacities totalling about 112 million tpy are reportedly expected to come on stream: (i) 1.5 million tonnes - IOCL, Haldia, (ii) 3.0 million tonnes - IOCL, Panipat, (iii) 15.0 million tonnes - IOCL, Paradeep, (iv) 2.4 million tonnes - HPCL, Mumbai, (v) 7.5 million tonnes - HPCL, Vizag, (vi) 9.0 million tonnes - Mittal, Bhatinda, (vii) 6.0 million tonnes - BPCL, Bina, (viii) 2.0 million tonnes - BPCL, Kochi, (ix) 1.7 million tonnes - CPCL, Chennai, (x) 5.31 million tonnes - MRPL, Mangalore, (xi) 0.08 million tonnes - ONGC, Tatipaka, (xii) 29.0 million tonnes - RIL, Jamnagar, (xiii) 23.5 million tonnes - Essar, Vadinar and (xiv) 6.0 million tonnes - Nagarjuna, Cuddalore.

A joint venture has been established for setting up the greenfield Guru Gobind Singh Refinery Project at Bhatinda with Mittal Energy Pvt. Ltd. The project has an initial capacity of 9 million tpy and is expected to be completed by 2011. There are also reports of the LN Mittal Group signing an MoU with HPCL, Total (of France), GAIL and OIL for jointly developing a 15 million tpy refinery cum petrochemicals complex in Visakhapatnam at a cost of \$ 6 billion.

In 2007-08, refinery crude throughput has risen to 156.1 million tonnes from 146.6 million tonnes in 2006-07 (Table-7).

Table - 6 : Consumption of Petroleum Products 2005-06 to 2007-08

(In '000 tonnes)			
Product	2005-06	2006-07	2007-08(p)
Grand Total	122353	131669	131014
1. Light distillates	33660	37076	33190
(a) L. P. gas	10456	10849	11324
(b) Mogas	8647	9286	10327
(c) Naphtha	12194	13886	8890
(d) Others	2363	3055	2649
2. Middle distillates	54423	57595	62766
(a) SKO	9541	9505	9352
(b) ATF	3296	3983	4556
(c) HSD	40191	42896	42847
(d) LDO	883	720	720
(e) Others	512	491	5291
3. Heavy ends	25129	26078	22871
(a) Furnace oil/LSHS	12825	12618	11750
(b) Lubes & greases	2081	1900	1132
(c) Bitumen/Asphalt	3508	3832	4471
(d) Petroleum coke	4928	5440	433*
(e) Others	1787	2288	1181
Total	113212	120749	118827
4. Refinery fuel	9141	10920	12187

Source: Basic Statistics on Indian Petroleum & Natural Gas, 2007-08, Ministry of Petroleum & Natural Gas, Government of India.

* *Relates to sales of petroleum products excluding Refinery Boiler Fuel.*

The capacity of Essar's 10.5 million tpy refinery at Vadinar in Gujarat is expected to rise to 12 million tpy after debottlenecking. It is understood that Essar has plans to raise the capacity to 34 million tpy by 2010. CPCL has undertaken capacity augmentation at Manali in Tamil Nadu from 9.5 to 11.2 million tpy that is scheduled for completion by early 2009.

Reliance Petroleum Ltd (RPL), promoted by RIL and Chevron India Holdings Pte. Ltd, Singapore, has been formed to set up a greenfield petroleum refinery and polypropylene plant to be located in a SEZ in Jamnagar, Gujarat, adjacent to RIL's existing refinery and petrochemicals complex. The refinery will have a total atmospheric distillation capacity of about 580 kilo barrels per stream day (KBPSD), while the polypropylene plant will have a production capacity of 0.9 million tpy. The refinery and plant are expected to be commissioned by December 2008.

Production of various petrochemicals from these refineries from 2005-06 to 2007-08 is given in Table- 8.

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Table - 7 : Installed Capacity and Crude Throughputs in Refineries

(In '000 tonnes)

Refinery	Annual installed capacity (as on 1.4.2007 and 1.4.2008)	Refinery Crude throughput		
		2005-06	2006-07	2007-08 (p)
Total	148968	130109	146551	156103
Public/Joint Sector	105468	96946	108172	112541
IOCL, Guwahati, Assam	1000	864	839	920
IOCL, Barauni, Bihar	6000	5553	5469	5634
IOCL, Koyali, Gujarat	13700	11543	12953	13714
IOCL, Haldia, West Bengal	6000	5502	5836	5715
IOCL, Mathura, Uttar Pradesh	8000	7938	8883	8033
IOCL, Digboi, Assam	650	615	586	564
IOCL, Panipat, Haryana [@]	12000	6507	9435	121821
BPCL, Mumbai, Maharashtra	12000	10298	12030	12746
HPCL, Mumbai, Maharashtra	5500	6249	7419	7409
HPCL, Vizag, Andhra Pradesh	7500	7980	9377	9409
KRL, Kochi, Kerala	7500	6939	7742	8134
CPCL, Manali, Tamil Nadu	9500	9680	9784	9802
CPCL, Narimanam, Tamil Nadu	1000	682	618	464
BRPL, Bongaigaon, Assam	2350	2356	2067	2020
MRPL, Mangalore, Karnataka	9690	12014	12536	12525
NRL, Numaligarh, Assam	3000	2133	2504	2568
ONGC, Tatipaka, Andhra Pradesh	78	93	94	63
Private Sector	43500	33163	38379	43562
RPL, Jamnagar, Gujarat	33000	33163	36616	36931
Essar Oil Ltd.*, Vadinar, Gujarat.	10500	-	1763	6631

Source: Basic Statistics on Indian Petroleum and Natural Gas, 2007-08, Ministry of Petroleum & Natural Gas, Government of India.

** Commissioned on 24.11.2006; production started from December, 2006.*

@ Increased installed capacity on 12.01.2007.

Note: CPCL and BRPL are subsidiaries of IOCL; KRL and NRL of BPCL and MRPL of ONGC.

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**Table - 8 : Production from Refineries
2005-06 to 2007-08**

(In '000 tonnes)

Product	Production		
	2005-06	2006-07	2007-08(p)
A) FROM CRUDE OIL	119750	135260	144930
1. Light distillates	32427	38104	40111
(a) LPG	5525	6315	6732
(b) Mogas	10502	12539	14167
(c) Naphtha	14509	16660	16440
(d) Others	1891	2590	2772
2. Middle distillates	64432	71225	76649
(a) Kerosene	9078	8491	7794
(b) ATF/RTF/Jet A-1	6196	7805	9107
(c) HSD	47572	53465	58361
(d) LDO	923	803	671
(e) Others	663	661	716
3. Heavy ends	22891	25931	28170
(a) Furnace oil	10320	12325	12638
(b) Lube oils	677	825	881
(c) Bitumen	3576	3891	4507
(d) Petroleum coke	3182	3779	4129
(e) LSHS/HHS/RFO	3985	3372	3167
(f) Others	1151	1739	2848
B) FROM NATURAL GAS			
LPG	2185	2093	2060

Source : Basic Statistics on Indian Petroleum & Natural Gas, 2007-08, Ministry of Petroleum & Natural Gas, Government of India.

ALTERNATIVE SOURCES

With the ever-increasing dependence on petroleum imports due to stagnant domestic production and spiralling growth in demand, the Government is encouraging the development of alternative sources of hydrocarbons. With this view, the Government has identified coal bed methane, gas hydrates, hydrogen, bio-diesel and ethanol for vigorous exploration and development.

Coal Bed Methane

The coal and lignite seams contain varying amounts of methane depending on the rank of the carbonaceous matter, the depth of burial and the geotectonic setting of basins. The commercial production of such methane, better known as coal bed methane (CBM), is a proven technology and has added to the natural gas production of USA (the major producer), Australia and China.

Within the next few years, CBM is expected to emerge as a new source of natural gas production in the country. India has emerged as the fourth country in the world capable of producing CBM on commercial scale with the commencement of commercial production from July 2007.

Gas Hydrates

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

There are numerous potential offshore areas of gas hydrates accumulation within India's Exclusive Economic Zone. A National Gas Hydrate Programme (NGHP) is in place and various R&D studies are in progress to develop vast resources of gas hydrates in western and eastern offshore and Andaman offshore areas. Based on the detailed geoscientific studies carried out by NGHP through NIO, 10 sites in Mahanadi, Krishna-Godavari and Kerala-Konkan Basins and Andaman Sea have been short-listed for drilling/coring of gas hydrates in deep waters.

India is the third country after USA and Japan, where R&D work on gas hydrates has started. The sustained efforts carried out by the Directorate General of Hydrocarbons (DGH) with IODP & USA, the drillship JOIDES Resolution collected samples from Indian offshore in April-August 2006 period under agreement between DGH and a US consortium of companies. During drilling/coring by the drillship, huge quantities of gas hydrates have been detected in one of the wells in KG basin.

National Institute of Ocean Technology (NIOT), Chennai, has developed a Remotely Operated Vessel (ROV) which can go down to ocean bed and remain there to map the gas hydrates and collect samples. An Indo-Russia Gas Hydrate Centre is also set up at NIOT in 2004 to support the Integral Long Term Programme (ILTP) of Russia.

The DGH convened an International Conference on Gas Hydrates in February 2008 to deliberate on scientific results and the outcome of the Expedition-I gas hydrate coring/drilling programme and status of similar programmes in other countries. There are recent reports of a large find of methane hydrate deposit in the KG basin. A German research project is understood to be making large investments for the exploration of the deposit and working along with the DGH, National Institute of Oceanography (NIO) and others.

Oil Shales

Resource assessment of oil shale deposits in Assam and Arunachal Pradesh was in progress with the expertise of an international company. Field work in respect of data collection was initiated.

Hydrogen

Hydrogen is receiving worldwide attention as a clean fuel and efficient energy storage medium for automobiles. Hydrogen can replace or supplement oil used in road transportation. Hydrogen production technologies can be both fossil fuel based and renewable resource based. However, substantial research and development is needed to establish use of hydrogen as an alternative fuel in a cost-effective manner. For development of hydrogen as a fuel, the Ministry of Petroleum & Natural Gas has set up a Hydrogen Corpus Fund with contribution from five major Oil Companies and Oil Industry Development Board (OIDB). A road map has been set up by Indian Oil Corp. (R&D), the nodal agency for the hydrogen research project, for hydrogen production, dispensing, storage and application. Demonstration projects in pipeline include using 10% hydrogen in CNG at IOC R&D centre at Faridabad and a similar demonstration project later in Delhi. Another such mixture dispensing station is planned to be set up as demonstration project by IOC with funding from Ministry of New & Renewable Energy (MNRE) and Hydrogen Corpus Fund. The station was expected to be set up by March 2008.

Presently, in India, hydrogen is being produced mainly from steam reforming of naphtha and natural gas in fertilizer and petroleum refining

industries. Hydrogen as a by-product is also being produced in the chemical industry. Hydrogen is expensive for energy applications in comparison to the existing hydrocarbon fuels. Further, there is no infrastructure available in the country for regular use of hydrogen as an energy carrier.

Introduction of hydrogen energy applications in the market would require an integrated system development approach. This will include all aspects of hydrogen energy technologies such as production, storage, transportation, delivery and end use applications and associated devices. Codes and standards are also required to address safety concerns and speedy commercialisation of hydrogen as a fuel. There are several scientific, technical and engineering challenges, which need to be resolved. Apart from R&D efforts, technology demonstration projects, precommercial pilot plants, manpower development etc. are required. Therefore, the MNRE has initiated the process of preparing a National Hydrogen Energy Road Map.

Bio-diesel

Bio-diesel is chemically treated vegetable oil/ animal fat which can be mixed with conventional diesel to be used as transport fuel. It is extracted from the seeds of the trees like Mahua, Karanja, Kusum, Dhupa, Undi, Simarouba, Sal, Pilu, Jajoba, Tumba, Nahor, Kokum, Rubber-seed, Cheura, Wild-Apricot, Tung, Neem, Mango, Kernel and Jatropa. Many of these plants can be grown in waste and degraded lands. The R&D studies indicated that a bio-diesel/diesel blend results in a fuel that is non-toxic, biodegradable and nonflammable with a very high flash point. It enhances the life of the engine and results in less pollution.

The oil marketing companies are experimenting with blending of bio-diesel in diesel in collaboration with State Governments in the transport sector and the automobile industry. BIS has already amended the specifications of diesel to permit blending of bio-diesel in it.

Ethanol

To reduce dependence on imported oil by way of encouraging use of indigenous sources of energy, Ministry of Petroleum & Natural Gas had

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notified vide GSR 705(E), dated 27.10.2004, the scheme of 5% ethanol-blended petrol (EBP), in accordance with BIS specifications, to be sold in notified areas subject to condition. The EBP has now been extended to the entire country (except NE States, Jammu & Kashmir, Andaman & Nicobar Islands and Lakshadweep) with effect from 1.1.2006. The requirement of ethanol for 5% EBP programme in whole country is about 0.56 million KL per annum.

WORLD REVIEW

The world proved reserves of crude oil and natural gas at the end of 2006 were estimated at 164.5 billion tonnes and 181.46 trillion cu m, respectively (Tables - 9 and 10).

The rise in crude oil prices continued in 2006 mainly due to continuing growth in demand, uncertainties of supply, constrains of world refining capacity, as also because of project delays, calamities, etc.

The world crude oil production in 2007 remained stable at 3.89 billion tonnes. OPEC countries, namely, Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, UAE and Venezuela, had a share of about 43% in the world crude oil production in 2007. Saudi Arabia & Russia (13% each), USA (8%), Iran (6%), China & Mexico (5% each), Canada & UAE (4% each) and Iraq, Kuwait, Nigeria & Norway (3% each) were the principal producers of crude petroleum.

The world production of natural gas rose to 3.03 trillion cu m in 2007 from 2.97 trillion cu m in 2006. OPEC countries had a share of 18.5% in the world natural gas production in 2007. Russia (21%), USA (18%), Canada (6%) Iran (4%) and Algeria, Saudi Arabia, Indonesia, Norway & UK (3% each) were the chief producers of natural gas in 2007 (Tables -11 and 12).

The world consumption of oil in 2006 was estimated as 3,889.8 million tonnes, while that of natural gas was 2,574.9 million tonnes oil equivalent. Consumption of oil and natural gas in India in the same period was 120.3 million tonnes (with 3.1% share) and 35.8 million tonnes oil equivalent (with 1.4% share), respectively.

**Table - 9 : World Proved Reserves of Crude Oil*
(By Principal Countries)**

(In billion tonnes)

Country	Reserves
World : Total	164.5
China	2.2
Canada	2.4
India	0.8
Iran	18.9
Iraq	15.5
Kazakhstan	5.5
Kuwait	14.0
Libya	5.4
Nigeria	4.9
Russian Federation	10.9
Saudi Arabia	36.3
UAE	13.0
USA	3.7
Venezuela	11.5
Other countries	19.5

* At 2006 end.

Source: Indian Petroleum and Natural Gas Statistics, 2006-07.

**Table - 10 : World Proved Reserves of Natural Gas*
(By Principal Countries)**

(In trillion cu m)

Country	Reserves
World : Total	181.46
Australia	2.61
Algeria	4.50
Bangladesh	0.44
China	2.45
India	1.08
Indonesia	2.63
Iran	28.13
Iraq	3.17
Kazakhstan	3.00
Malaysia	2.48
Myanmar	0.54
Nigeria	5.21
Norway	2.89
Pakistan	0.80
Qatar	25.36
Russian Federation	47.65
Saudi Arabia	7.07
Turkmenistan	2.86
UAE	6.06
USA	5.93
Uzbekistan	1.87
Venezuela	4.32
Other countries	20.41

* At 2006-end.

Source: Indian Petroleum and Natural Gas Statistics, 2006-07

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**Table - 11 : World Production of Crude Petroleum
(By Principal Countries)**

(In million tonnes)

Country	2005	2006	2007
World Total	3878	3899	3885
Brazil	89	94	95
Canada	127	132	137
China #	181	185	187
Iran	210	211	212
Iraq	90	98	105
Kuwait @	129	132	130
Mexico	194	190	180
Nigeria	125	120	114
Norway	140	137	126
Russia	470	481	491
Saudi Arabia @	527	514	493
UAE	129	139	136
UK	79	71	71
USA	319	316	317
Venezuelav ^(e)	151	144	134
Other countries	918	935	957

Source: World Mineral Production, 2003-2007.

@ Including shares of production from the Neutral Zone.
Including oil from shale and coal.

**Table - 12 : World Production of Natural Gas
(By Principal Countries)**

(In billion cu m)

Country	2005	2006	2007
World Total	2884	2972	3033
Algeria	89	88	84e
Canada	177	177	174
Indonesia	85	81	77
Iran	103	109	112
Malaysia	60	60	61
Netherlands	74	73	72
Norway	85	88	90
Russia	641	656	651
Saudi Arabia	71	73	74
Turkmenistan	63	62	67
UK	94	84	77
USA#	511	523	546
Uzbekistan	60	55	59
Other countries	771	843	889

Dry gas

Source: World Mineral Production, 2003-2007.

FOREIGN TRADE

Exports

Exports of crude petroleum declined sharply to 26 thousand tonnes in 2007-08 as compared to 106 thousand tonnes in the preceding year. Main destinations were Turkey (19%), Tanzania (12%) and Indonesia, Australia, Thailand &

Ethiopia (8% each). Exports of natural gas in 2007-08 rose sharply by more than three times to 49,812 tonnes against 15,408 tonnes in 2006-07. Exports were mostly to Nepal (Tables - 13 and 14).

Exports of petroleum products (total - including light distillates, middle distillates and heavy end) rose by 17% to 39.3 million tonnes in 2007-08 compared to 33.6 million tonnes in the preceding year.

Imports

Imports of crude petroleum reached 115.3 million tonnes in 2007-08, a rise of 8% over the preceding year level of 106.8 million tonnes. Imports were mainly from Saudi Arabia (24%), Iran (17%), Nigeria and Iraq (11% each), UAE and Kuwait (10% each). Imports of natural gas rose by 15% to 8.1 million tonnes in 2007-08 from 7.0 million tonnes in 2006-07. Main suppliers were Qatar (80%), Algeria, Nigeria (5% each) and Oman (4%) (Tables - 15 and 16).

Imports of petroleum products (total) were 22.7 million tonnes in 2007-08 rising 29% compared to 17.7 million tonnes in the preceding year.

**Table - 13 : Export of Petroleum (Crude)
(By Countries)**

Country	2006-07		2007-08	
	Qty (‘000 t)	Value (Rs.‘000)	Qty (‘000 t)	Value (Rs.‘000)
All Countries	106	3250961	26	1085521
Turkey	3	112260	5	198039
Tanzania	++	4531	3	101128
Indonesia	7	216201	2	76906
Australia	1	21881	2	65488
Thailand	1	44588	2	65105
Ethiopia	++	19609	2	61592
UAE	30	969385	1	43356
Singapore	1	38134	1	35831
Japan	30	794580	++	206
Korea, Rep. of	30	832963	-	-
Other countries	3	196829	8	437870

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**Table - 14 : Export of Natural Gas
(By Countries)**

Country	2006-07		2007-08	
	Qty (t)	Value (Rs. '000)	Qty (t)	Value (Rs. '000)
All Countries	15408	531472	49812	1854344
Nepal	15387	531096	49754	1852484
Bangladesh	-	-	58	1860
Bhutan	21	376	-	-

**Table - 15 : Import of Petroleum (Crude)
(By Countries)**

Country	2006-07		2007-08	
	Qty ('000 t)	Value (Rs. '000)	Qty ('000 t)	Value (Rs. '000)
All Countries	106827	2130878538	115339	2574617041
Saudi Arabia	24795	494420268	27272	607574996
Iran	16501	295403249	19050	391879751
Nigeria	13694	312979020	12298	293066750
Iraq	12832	249412673	12636	274815782
UAE	7398	156842597	11179	259482880
Kuwait	11496	224537285	11003	246961087
Malaysia	4387	104076819	3679	93405488
Yemen Republic	4037	84938930	2323	51993518
Mexico	2048	29385124	1669	33050626
Egypt	1932	29391048	1804	31589728
Other countries	7167	149491525	12426	290796435

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**Table - 16 : Import of Natural Gas
(By Countries)**

Country	2006-07		2007-08	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	7044454	67157470	8086104	92554485
Qatar	5471813	41706331	6476691	53973803
Nigeria	64458	1391512	434317	9198610
Oman	623803	6258881	329509	9124227
Algeria	131255	2587849	372912	7686821
Trinidad	106176	2256026	291550	6944960
Guinea	-	-	59326	2024524
Australia	123008	2279537	60039	1807003
Egypt	228314	4850661	61760	1794537
Malaysia	122321	2371731	-	-
UAE	111786	2242850	-	-
Other countries	61520	1212092	-	-

FUTURE OUTLOOK

The country is deficient in oil resources and most of the domestic requirements are met through imports. This trend is likely to continue in future till the crude oil production in the country increases. Several measures were taken by the Government to intensify exploration and enhance hydrocarbon reserves. These included development of new as well as existing fields, implementation of Enhanced Oil Recovery Schemes, recourse to specialised technology, enlisting the services of international experts and encouraging participation of private and joint-venture companies in the exploration programme. The installed refining capacity in the country has increased to 148.97 million tonnes per annum as on 1.4.2008 from 51.78 million tonnes in 1990-91. The refining capacity is likely to grow by 111.99

million tpy by 2012 as per the reported plans of various public/private sector companies available. India has a near self-sufficiency in the refining sector. ONGC, OIL and a few private companies & joint ventures engaged in the exploration and exploitation of oil and natural gas have intensified the exploration activities.

ONGC Videsh Limited (OVL), a wholly owned subsidiary of ONGC, is pursuing to acquire exploration and production opportunities in Africa, Middle East, Central Asia, Latin America and Southeast Asia. OVL has participation in 37 oil and gas projects in 17 countries – Vietnam, Sudan, Russia, Iraq, Iran, Myanmar, Libya, Syria, Cuba, Nigeria, Qatar, Egypt, Brazil and Colombia. OVL started production of oil and gas in 2003 achieving production of 7.952 million tonnes in 2006-07 of oil and oil equivalent gas (O+OEG).

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In private sector, RIL's overseas interests comprise 11 blocks with acreage of about 80,000 sq km – 3 in Yemen, 2 each in Oman, Kurdistan and Colombia and one each in East Timor and Australia.

A number of contracts have been awarded to both foreign and Indian entrepreneurs to undertake exploration activities and development of fields on production-sharing basis. About 30 oil and gas discoveries have been made out of which gas discoveries in Krishna Godavari (KG) basin are the most significant. About 40 MMSCMD natural gas production was likely to be achieved from KG Basin by 2008-09. It is expected that these measures and developments may help in reducing the imports and increasing the output of crude oil in the country from the current production level of around 34 million tonnes per annum.

The liberalisation of the petroleum industry will result in globalisation in the near future with the entry of multinational oil companies.

It will accentuate the competitive pressure on Indian refineries. To meet the international standards, Indian refineries are improving the product qualities. New refineries are being built and existing ones are undergoing modification and expansion.

The unprecedented high levels of oil price is expected to result in inflationary pressures and slow down of economic growth, thus lowering the demand of oil. Some policy measures have been undertaken in many countries to reduce use of oil. On the other hand, high prices encourage oil companies to undertake more risky and high-cost exploration and field operations. High prices of oil also encourage conservation and improved efficiency by consuming industries and also help in increasing the supplies of other forms of energy. It is clear that presently there is a mismatch between demand and supply. It is believed that in time the position would settle to rational levels.