

62 Petroleum and Natural Gas

The domestic production of crude oil at 33.7 million tonnes in 2009-10 increased slightly by 0.6% over the year 2008-09. The net production of natural gas (utilised) rose by 44.6% to 47,510 mcm in 2009-10. The refining capacity in the country at 184 million tonnes per annum as on 1.4.2010 was 6 million tonnes higher over preceding year and was 4.07% of the world refinery capacity.

EXPLORATION & DEVELOPMENT

The ONGC and OIL, the two National Oil Companies (NOCs) and a few private and joint venture companies were engaged in exploration and production activities of oil and natural gas in the country. As on 1.4.2010, there were in all 443 oil/gas fields under these companies including offshore areas.

In public sector, ONGC's jurisdiction extended to 377 fields – Cambay basin (Gujarat) – 101 oil/gas fields, Upper Assam – 36 fields, Assam & Assam Arakan – 6 fields, Jodhpur (Rajasthan) – 7 fields, Krishna-Godavari basin (Andhra Pradesh) – 50 fields, Cauvery basin (Tamil Nadu) – 28 fields, Assam Arakan Fold Belt (AAFB) in Tripura - 11 fields and Assam & Assam Arakan in Nagaland – 3 fields, besides, 98 offshore fields in the Mumbai offshore, and 2 in Cambay basin in West Coast and 35 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 27 fields, AAFB basin (Arunachal Pradesh) at 1 field, Assam basin (Assam) at 1 field, Rajasthan at 7 fields and Raniganj (South) basin (West Bengal) at 1 field in onshore areas. In offshore areas, these companies covered 2 fields in Cauvery basin and 3 fields in Krishna-Godavari basin on the East Coast and 2 fields in Mumbai basin and 3 fields in Cambay basin on the West Coast.

Highlights of exploration carried out by ONGC and OIL during 2009-10 are furnished below:

During 2009-10, **ONGC** carried out seismic surveys and a total of 4,621 GLK of 2D and 4,133 sq km of 3D seismic data have been acquired in the onland part and 20,372 LK of 2D and 17,608 sq km of 3D seismic data have been acquired in offshore part. A total of 128 exploratory wells with a meterage of 368,669 and 249 development wells with a meterage of 509,078 have been drilled. A total of 21 exploratory wells – 13 onland and 8 offshore areas – were successful with hydrocarbon finds. Exploratory efforts of ONGC during 2009-10 resulted in 21 new hydrocarbon finds.

North Geleki - 1, Kasomarigaon - 2, Sundulbari - 4 in Assam & Assam Arakan basin; Penugonda - 1A, South Mahadevapatnam - 1, Kammapalem - 1, East Rangapuram - 3, Kesanapalli West - 30 in Krishna Godavari basin onland, Nannilam - 3 in Cauvery onland, North Kural - 1, Karvan - 1, Ahmedabad - 124, South Kadi - 155 in Cambay basin; GS - 69-1, GD -7-1, GS-KW-6 in Krishna-Godavari offshore, and SD -1-5, B-121-7, BF-1 and PER-1, in Western offshore. During 2009-10, ONGC as a consortium has been awarded 15 blocks (7 on land, 5 shallow water and 3 deep water blocks) in the NELP-VII round. Out of these 15 blocks, ONGC is the operator in 14 blocks while in one block, consortium partner GSPC is the operator.

The ultimate reserve accretion of oil-equivalent gas (O+OEG) in 2009-10 (as on 1.4.2010) in domestic assets of ONGC was 82.98 million tonnes. The total ultimate reserves of oil-equivalent gas (O+OEG) as on 1.4.2010 was 2,511.36 million tonnes.

During 2009-10, **OIL** covered, under onshore seismic survey, 905.01 2D(GLKM) and 743.76 3D (SQKM) in Assam & Arunachal Pradesh; 202.10 3D (SQKM) in Rajasthan; 402.85 2D (GLKM) in Mizoram; and 38.43 3D (SQM) in Andhra Pradesh.

OIL carried exploratory onshore drilling of 130,040 m in 43 wells in Assam, 5,016 m in 1 well in Arunachal Pradesh and 3331 m drilling in 2 wells in Rajasthan.

The details of discovery of oil/gas made by OIL during 2009-10 in Assam are given below:

- i) South Tinali - 2, in South Tinali structure, Assam, drilling revealed few hydrocarbon bearing sands in Tipam formation. On testing the well produced oil.
- ii) Disaijan - 1, in Tinsukia district Assam, encountered few prospective sands within Narpuh, Lakdong, Therria and Langpar formation. On testing the well produced oil mixed water with sluggish rate.
- iii) NHK - 583, North - West of Jaipur structure in Dibrugarh district, Assam, delineated few hydrocarbon bearing sands with lower Tipam and Barail formation. On testing the well produced gas.
- iv) Hapjan - 55, South of main Hapjan oilfield in Tinsukia district, Assam, encountered no. of hydrocarbon bearing sands within Tipam & Barail formation. On testing the well produced oil.
- v) Umatarata - 1, in Umatarata structure, in Dibrugarh district, Assam, encountered few hydrocarbon bearing sands within Barail formation. On testing the well produced oil.
- vi) NHK - 581, in Dhulijan structure, Tinsukia district, Assam, encountered a gas bearing sand within Tipam formation.

The total recoverable reserves of crude oil and oil-equivalent natural gas estimated by OIL at the end of 2009-10 (as on 31.3.2010) were 38.34 million KL and 37.98 million KL, respectively.

In 2009-10, public sector companies drilled 428 wells (346 in onshore and 82 in offshore areas) with a meterage of 1019 thousand (768 thousand in onshore and 251 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* 2009-10 (p)

State/Area	Wells (No.)	Meterage ('000)
ONSHORE	346	768
Assam	63	259
Gujarat	199	335
Others	64	174
OFFSHORE	82	251
Bombay High	82	251
Grand Total	428	1019

* Relates to Public Sector Companies.

Source: Basic Statistics on Indian Petroleum and Natural Gas, 2009-10.

RELIANCE INDUSTRIES LIMITED

The company has submitted a proposal for commerciality of the discoveries made in KG-III-5, CY-D5, NEC-25, and KG-D6 blocks.

Reliance Industries Limited (RIL) has successfully drilled 4 appraisal wells in the southern and deeper parts of the NEC-25 block. Results of these are being incorporated to generate an integrated development plan for all discoveries to maximise capital efficiency. Appraisal activities area currently underway in KG-D4, CY-D5, KG-III-5, KG-III-6, KG-V-D3 and GS-01 blocks.

During the year 2009-10, two deepwater blocks of NELP-V round namely KK-V-D1 and KK-V-D2 were relinquished due to their poor prospectivity. Currently, RIL's portfolio consists of 29 exploration blocks.

The development of the Panna-K (PK) area has been completed. Current production from PK wells is around 5,000 Barrels of Oil Per Day (BOPD) and around 10 Million Metric Standard Cubic Feet Per Day (MMSCFD) gas.

The South West Panna (SWP) development project was approved in February 2008 with projected 2P reserves of around 4.7 Million Barrels of Oil (MMBO) from about 42 MMBO in-place reserve. New 3D survey indicated a significant reduction in 2P reserves at 1.76 MMBO from about 11 MMBO in place. The Government has approved abandoning the project. Separately, it has approved installing the SWP jacket and deck with minor modifications at Panna L (PL) to advance production by around 12 months and improve the final hydrocarbon recovery from PL.

The development plan of the PL area has been approved by the Director General of Hydrocarbons India (DGH) in June 2009 for completion in 2011. However, with the Government approving the installation of SWP facilities at PL, the project was now expected to be completed in 2010. Initial anticipated total production from PL is approximately 4,000 BOPD from 6 wells.

PETROLEUM AND NATURAL GAS

To arrest the declining gas production in Tapti, 3 infill wells (2 in South Tapti and 1 in Mid Tapti) have been approved for drilling in Q3/Q4 2009-10 by the Management Committee. MTA-6 well has been already drilled and is currently producing around 35-40 MMSCFD gas. STA-7 well has also been drilled and is currently producing 35 MMSCFD of gas. The STC well is currently being drilled and after the drilling of this well, gas production from Tapti is expected to be ramped up from the current level of around 315 MMSCFD to around 330 MMSCFD. A development plan for Mukta (MB area) is being planned to be submitted to the Government of India for approval after the results of a pre-drilled well to be drilled in 2010-11 are reviewed.

Panna-Mukta fields produced 1.8 million tonnes of crude oil and 1,965 MMSCM of natural gas in FY 2009-10, registering a growth of 9% and 18% respectively over the previous year. Higher volumes in the first half are due to full production as compared to lower production registered in the same period last year on account of downtime due to repairs (PPA Hot Oil Heater).

Tapti fields produced 187,000 tonnes of condensate and 3,102 MMSCM of natural gas for FY 2009-10, a decrease of 31% and 26% respectively as compared to the previous year. The decrease in production was due to a natural decline in the reserves.

The development plan for Sohagpur Coal Bed Methane (CBM) blocks has been approved by the Government and development activities have been planned to commence in FY 2010-11 by drilling and completion of additional wells. Prolonged production testing was undertaken in the wells drilled in Sohagpur CBM blocks with favourable results.

During the year two CBM blocks BS-1 and BS-2 were relinquished. With this RIL currently holds a total of 3 CBM blocks.

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-India (TAPI) Gas Pipeline Project, as per the Cabinet's decision on 18.5.2006, after suitable amendments to inter-governmental and Gas Pipeline Framework Agreements (GPFA). A draft framework agreement was under consideration and heads for agreements for the proposed Gas Sales Purchase Agreement (GSPA).

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 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.

RESOURCES

State/Regionwise reserves of crude oil and natural gas as on 1.4.2009 are given in Table - 2. As on 1.4.2009, total reserves of crude oil are estimated at 773 million tonnes (321 million tonnes in onshore and 452 million tonnes in offshore areas). Those of natural gas are placed at 1,115 billion cu m (275 billion cu m in onshore and 840 billion cu m in offshore areas) as per the Basic Statistics on Indian Petroleum and Natural Gas, 2008-09.

PRODUCTION

Petroleum (Crude)

Production of petroleum (crude) in the country was 33.7 million tonnes in 2009-10 and registered a marginal increase of 0.6% as compared to that in the previous year. Bulk of the total production (84.4%) was shared by the public sector companies. Private sector companies accounted for the remaining 15.6%.

Off-shore areas continued to be the largest producer of petroleum (crude) in 2009-10 and had a share of 64.9% in the country's output. Next in order were Gujarat with a contribution of 17.7% and Assam with 14.1%. The remaining 3.3% production was reported by Andhra Pradesh, Tamil Nadu and Arunachal Pradesh.

During 2009-10 the production of petroleum (crude) recorded increase in Arunachal Pradesh by 27.2%, Andhra Pradesh by 5.2%, Assam by 1.4% and Gujarat by 0.3%. Whereas, there was a decline in production in Tamil Nadu by 10.2% and Off-shore areas by 1.6% as compared to the previous year (Table - 3).

Table – 2 : Reserves* of Crude Oil and Natural Gas in India as on 1.4.2009(P)

Area	(Crude oil in million tonnes; natural gas in billion cu m)	
	Crude oil	Natural gas
India	773.30	1115.27
Onshore	320.84	275.17
Andhra Pradesh	4.21	39.55
Assam	173.74	131.45
Gujarat	134.97	77.22
Tamil Nadu	7.92	26.95
Offshore	452.46	840.09
Western offshore	429.96	414.65
Eastern offshore	22.50	425.44

* *Proved and indicated balance recoverable reserves.*

Note: Reserves of crude oil and natural 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, 2008-09, Ministry of Petroleum and Natural Gas, Govt. of India.

PETROLEUM AND NATURAL GAS

**Table – 3 : Production of Petroleum (Crude), 2007-08 to 2009-10
(By States)**

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

State	2007-08		2008-09		2009-10(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	34118	496938100	33506	533819700	33691	607912600
Public sector	29041	422990192	28832	459353238	28428	512948247
Private sector	5077	73947908	4674	74466462	5263	94964353
Andhra Pradesh	279	4063712	289	4604366	304	5485306
Arunachal Pradesh	102	1485658	103	1641002	131	2363734
Assam	4357	63460909	4673	74450530	4738	85491375
Gujarat	6177	89969712	5944	94700182	5960	107540859
Rajasthan	–	–	–	–	447	8065564
Tamil Nadu	298	4340452	265	4221997	239	4312461
Offshore	22905	333617657	22232	354201623	21872	394653301

Domestic prices of petroleum (crude) in 2008-09 to 2009-10 are furnished in Table-4.

**Table – 4 : Prices of Petroleum (Crude)
2007-08 to 2009-10**

(In Rs. per tonne)

Grade	Market	2007-08	2008-09	2009-10
Indigenous*	Onshore	24433	28354	24233
Indigenous*	Offshore	26668	30507	26187
Indigenous*	Offshore & Onshore	25913	29796	25530
Imported	c.i.f. Indian Port (average)	22322	26672	23817

* Relates to basic prices of petroleum crude is all inclusive Gross (pre-discount) price.

Source: Basic Statistics on Indian Petroleum & Natural Gas, 2009-10 for indigenous crude prices and DGCI&S, Kolkata for average imported crude prices.

Natural Gas (Utilised)

The production of natural gas (utilised) at 47,510 mcm recorded an increase of 44.6% in 2009-10 as compared to that in the previous year. Offshore areas were continued to be the largest producer of natural gas (utilised) with a share of (81.7%). Next in order were Assam (5.7%), Gujarat (5.1%), Andhra Pradesh (3.1%), Tamil Nadu (2.5%),

Tripura (1.2%), Rajasthan (0.5%), Arunachal Pradesh and West Bengal accounted for the remaining 0.1% each of the total production.

Statewise analysis revealed that West Bengal, off-shore areas, Arunachal Pradesh, Rajasthan, Assam and Tripura recorded an increase in production, whereas, Gujarat, Tamil Nadu and Andhra Pradesh recorded decrease in production of natural gas in 2009-10 as compared to that of previous year. The production of natural gas increased in West Bengal by 90%, Off-shore areas by 61.2%, Rajasthan by 10.6%, Assam 5.1% and Tripura by 1.6%. The decline in production recorded in Gujarat by 6.2%, Tamil Nadu by 5.2% and Andhra Pradesh by 2.9%.

As much as 53.7% of the total production came from the public sector companies, whereas, the remaining 46.3% was the share of the private sector companies during the year 2009-10.

Employment

A total of 129,988 persons was employed in the petroleum industry as on 01.4.2010, as compared to 138,973 persons in the preceding year. Out of these, 33,351 persons were employed in exploration and production, 34,036 in refining, and the balance 62,601 in marketing, pipelines, R & D and others.

PETROLEUM AND NATURAL GAS

**Table – 5 : Production of Natural Gas (Utilised), 2007-08 to 2009-10
(By States)**

(Quantity in million cu metres; value in Rs.'000)

State	2007-08		2008-09		2009-10(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	32417	109995500	32849	121088500	47510	177803600
Public sector	24690	83776688	24759	91267015	25525	95525929
Private sector	7727	26218812	8090	29821485	21985	82277671
Andhra Pradesh	1567	5317054	1524	5617793	1479	5535077
Arunachal pradesh	30	101794	30	110586	40	149698
Assam	2597	8811991	2573	9484633	2704	10119573
Gujarat	2932	9948694	2605	9602592	2444	9146538
Rajasthan	255	865251	216	796223	239	894445
Tamil Nadu	1169	3966584	1242	4578280	1178	4408601
Tripura	534	1811938	553	2038477	562	2103255
West Bengal	15	50897	20	73724	38	142213
Off-shore	23318	79121297	24086	88786192	38826	145304200

CONSUMPTION

Total consumption of petroleum products (excluding Refinery Boiler Fuel) increased by 4.49 million tonnes in 2009-10 over the previous year. Consumption of some Light Distillates (Mogas and naphtha) increased slightly in 2009-10. Consumption of Middle Distillates like HSD also increased. However, consumption of Heavy Ends recorded decrease of furnace oil/LSHS. The consumption of various petroleum products from 2007-08 to 2009-10 is given in Table-6.

INDUSTRY

The total refining capacity of 20 units in operation in the country was about 184 million tpy in April 2010, with a share of about 4.07% in the estimated world refinery capacity of 4,512 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,

**Table – 6 : Consumption of Petroleum Products
2007-08 to 2009-10**

(In '000 tonnes)

Product	2007-08	2008-09	2009-10(P)
Grand Total	140697	145312	149803
1. Light distillates	38556	39908	39086
(a) L. P. gas	12165	12193	13121
(b) Mogas	10332	11257	12818
(c) Naphtha	13294	13875	10239
(d) Others	2776	2583	2908
2. Middle distillates	62823	66364	71198
(a) SKO	9365	9303	9304
(b) ATF	4543	4455	4627
(c) HSD	47669	51668	56320
(d) LDO	667	552	457
(e) Others	579	386	490
3. Heavy ends	27567	27128	27911
(a) Furnace oil/LSHS	12717	12437	11589
(b) Lubes & greases	2290	2149	2657
(c) Bitumen/Asphalt	4506	4705	4919
(d) Petroleum coke	5950	5870	6750
(e) Others	2105	1967	1996
Total (1+2+3)	128946	133400	138196
4. Refinery fuel	11751	11912	11607

Source: Basic Statistics on Indian Petroleum & Natural Gas 2009-10, Ministry of Petroleum & Natural Gas, Government of India.

Note: Consumption data includes private sales as well as private imports.

PETROLEUM AND NATURAL GAS

- (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) 23.5 million tonnes - Essar, Vadinar and
- (xiii) 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 2009-10, refinery crude throughput increased to 192.77 million tonnes from 160.77 million tonnes in 2008-09 (Table-7).

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.

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 were commissioned in December 2008 and production started from January 2009.

Production of various petrochemicals from these refineries from 2008-09 to 2009-10 is given in Table-8.

**Table – 8 : Production from Refineries
2007-08 to 2009-10**

(In '000 tonnes)

Product	Production		
	2007-08	2008-09	2009-10
A) FROM CRUDE OIL	144930	150516	179769
1. Light distillates	40111	40222	51197
(a) LPG	6732	6996	8091
(b) Mogas	14167	16020	22537
(c) Naphtha	16440	14826	17105
(d) Others	2772	2380	3464
2. Middle distillates	76649	80309	93790
(a) Kerosene	7794	8223	8545
(b) ATF/RTF/Jet A-1	9107	8071	9296
(c) HSD	58361	62889	73281
(d) LDO	671	606	472
(e) Others	716	520	2196
3. Heavy ends	28170	29985	34782
(a) Furnace oil	12638	14749	15828
(b) Lube oils	881	874	950
(c) Bitumen	4507	4713	4889
(d) Petroleum coke	4129	4241	3709
(e) LSHS/HHS/RFO	3166	2935	2518
(f) Others	2849	2473	6888
B) FROM NATURAL GAS			
LPG	2060	2162	2243

Source: Basic Statistics on Indian Petroleum & Natural Gas, 2010-11, 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.

PETROLEUM AND NATURAL GAS

Table – 7 : Installed Capacity and Crude Throughputs in Refineries

(In '000 tonnes)

Refinery	Annual installed capacity (as on 1.4.2010)	Refinery Crude throughput		
		2007-08	2008-09	2009-10
Total	182386	156103	160772	192768
Public/Joint Sector	111886	112541	112223	112117
IOCL, Guwahati, Assam	1000	920	1076	1078
IOCL, Barauni, Bihar	6000	5634	5940	6184
IOCL, Koyali, Gujarat	13700	13714	13852	13206
IOCL, Haldia, West Bengal	7500	5715	6042	5686
IOCL, Mathura, Uttar Pradesh	8000	8033	8601	8107
IOCL, Digboi, Assam	650	564	623	600
IOCL, Panipat, Haryana [@]	12000	12821	13070	13615
BPCL, Mumbai, Maharashtra	12000	12746	12262	12516
BPCL (formerly KRL), Kochi, Kerala	9500	8134	7739	7875
HPCL, Mumbai, Maharashtra	5500	7409	6652	6965
HPCL, Vizag, Andhra Pradesh	8300	9409	9155	8796
CPCL, Manali, Tamil Nadu	9500	9802	9718	9580
CPCL, Narimanam, Tamil Nadu	1000	464	418	517
BRPL, Bongaigaon, Assam	2350	2020	2163	2220
MRPL, Mangalore, Karnataka	11820	12525	12577	12498
NRL, Numaligarh, Assam	3000	2568	2251	2619
ONGC, Tatipaka, Andhra Pradesh	66	63	84	55
Private Sector	72500	43562	48549	80651
RPL, Jamnagar, Gujarat	33000	36931	35636	34415
RPL (SEZ), Jamnagar, Gujarat*	27000	–	–	32735
Essar Oil Ltd** Vadinar, Gujarat.	10500	6631	12913	13501

Source: Basic Statistics on Indian Petroleum and Natural Gas, Statistics 2010-11, Ministry of Petroleum & Natural Gas, Government of India.

* Commissioned on 25.12.2008; production started from January, 2009.

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

Note: CPCL and BRPL are subsidiaries of IOCL; NRL of BPCL and MRPL of ONGC. KRL is merged with BPCL w.e.f. 21st August 2006.

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.

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, Jojoba, 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 notified on

20.9.2006, 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 been applicable to the entire country (except NE States, Jammu & Kashmir, Andaman & Nicobar Islands and Lakshadweep) with effect from 1.11.2006. The requirement of ethanol for 5% EBP programme in whole country is about 0.56 million KL per annum whereas the supply during 2009 was 15% of the requirement.

WORLD REVIEW

The world proved reserves of crude oil and natural gas at the end of 2008 were estimated at 170.8 billion tonnes and 185.0 trillion cu m, respectively (Tables - 9 and 10). The reserves of crude oil and natural gas at the end of 2009 are placed at 181.7 billion tonnes and 187.5 trillion cu m, respectively.

The rise in crude oil prices continued in 2008 mainly due to continuing growth in demand, uncertainties of supply, constraints of world refining capacity, as also because of project delays, calamities, etc.

The world crude oil production in 2009 declined to 3.78 billion tonnes from 3.91 billion tonnes in 2008. OPEC countries, namely, Algeria, Angola, Ecuador, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, UAE and Venezuela, had a share of about 35% in the world crude oil production in 2009. Russia (13%), Saudi Arabia (12%), USA (9%), Iran & China (5% each), Canada & Mexico (4% each) and Iraq, Kuwait, Norway, UAE & Venezuela (3% each) were the principal producers of crude petroleum.

The world production of natural gas also marginally declined to 3.09 trillion cu m in 2009 from 3.15 trillion cu m in 2008. OPEC countries had a share of 15% in the world natural gas production in 2009. Russia & USA (19% each), Canada (5%), Iran (4%), Algeria & China (3% each) and Norway & Saudi Arabia (2.5% each) were the chief producers of natural gas in 2009 (Tables - 11 and 12).

The world consumption of oil in 2008 was estimated as 3,927.9 million tonnes, while that of natural gas was 2,726.1 million tonnes oil equivalent. Consumption of oil and natural gas in India in the same period was 135 million tonnes (with 3.4% share) and 37.2 million tonnes oil equivalent (with 1.4% share), respectively.

PETROLEUM AND NATURAL GAS

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

(In billion tonnes)	
Country	Reserves
World: Total	170.8
China	2.1
Canada	4.4
India	0.8
Iran	18.9
Iraq	15.5
Kazakhstan	5.3
Kuwait	14.0
Libya	5.7
Nigeria	4.9
Russian Federation	10.8
Saudi Arabia	36.3
UAE	13.0
USA	3.7
Venezuela	14.3
Other countries	21.1

* At 2008 end.

Source: Indian Petroleum and Natural Gas Statistics, 2008-09.

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

(In trillion cu m)	
Country	Reserves
World : Total	185.00
Australia	2.51
Algeria	4.50
Bangladesh	0.37
China	2.46
India	1.09
Indonesia	3.18
Iran	29.61
Iraq	3.17
Kazakhstan	1.82
Malaysia	2.39
Myanmar	0.49
Nigeria	5.22
Norway	2.91
Pakistan	0.85
Qatar	25.46
Russian Federation	43.30
Saudi Arabia	7.57
Turkmenistan	7.94
UAE	6.43
USA	6.73
Uzbekistan	1.58
Venezuela	4.84
Other countries	20.58

* At 2008-end.

Source: Indian Petroleum and Natural Gas Statistics, 2008-09.

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

(In million tonnes)			
Country	2007	2008	2009
World : Total	3884	3906	3776
Brazil	95	98	105
Canada	136	136	134
China #	187	190	189
Iran	210	210	202
Iraq	105	119	122
Kuwait @	130	137	121
Mexico	179	163	136
Nigeria	114	103	99
Norway	126	121	115
Russia	491	488	494
Saudi Arabia @	494	515	459
UAE	136	139	121
UK	70	65	63
USA	315	309	334
Venezuela	134	132	125
Other countries	962	980	957

Source: World Mineral Production, 2005-2009.

@ 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	2007	2008	2009
World: Total	3045	3157	3093
Algeria	85 ^(e)	86 ^(e)	81 ^(e)
Canada	174	167	156
China	69	80	85
Indonesia	77	74	82
Iran	112	116	131
Malaysia	61	61	58
Netherlands	72	79	75
Norway	90	99	103
Qatar	63	77	89
Russia	653	664	584
Saudi Arabia	74	80	77
Turkmenistan	65	66	36
United Kingdom	77	75	63
USA #	540	574	593
Uzbekistan	59	64	61
Other countries	774	795	819

Dry gas.

Source: World Mineral Production, 2005-2009.

PETROLEUM AND NATURAL GAS

FOREIGN TRADE

Exports

Exports of crude petroleum decreased to 34 thousand tonnes in 2009-10 as compared to 56 thousand tonnes in the preceding year. Main destination was China (50%). Exports of natural gas in 2009-10 declined considerably to 9,293 tonnes against 38,074 tonnes in 2008-09. Exports were entirely to Nepal (Tables - 13 and 14).

Exports of petroleum products (total - including light distillates, middle distillates and heavy ends) increased by 32% to 51 million tonnes in 2009-10 as compared to 30.6 million tonnes in the preceding year.

Imports

Imports of crude petroleum reached 153.63 million tonnes in 2009-10, a rise of 18% over the preceding year level of 130.04 million tonnes. Imports were mainly from Saudi Arabia (17%), Iran (14%), Kuwait (10%) Iraq (9%) Nigeria (8%) and UAE (7%). Imports of natural gas rose by 9.7% to 9.11 million tonnes in 2009-10 from 8.3 million tonnes in 2008-09. Main suppliers were Qatar (75%), Australia (7%), Russia (6%), Austria, Oman and Egypt (2% each) and Algeria & Nigeria (1% each) (Tables - 15 and 16).

Imports of petroleum products (total) were 14.7 million tonnes in 2009-10 declining 28% compared to 20.3 million tonnes in the preceding year.

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

Country	2008-09		2009-10	
	Qty (’000 t)	Value (Rs.’000)	Qty (’000 t)	Value (Rs.’000)
All Countries	56	1397827	34	888968
China	–	–	17	461122
Egypt	–	–	++	2767
Hong Kong	–	–	++	1954
Nepal	++	7482	++	140
Guinea	++	2856	++	1
Bhutan	1	18139	–	–
Netherlands	50	1269258	–	–
Singapore	5	97948	–	–
Yemen Republic	++	1976	–	–
Unspecified	–	–	17	422159
Other countries	++	168	++	825

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.’000)	Qty (t)	Value (Rs.’000)
All Countries	38074	1518657	9293	379069
Nepal	38074	1518657	9103	370624
Bhutan	–	–	190	8440
Singapore	–	–	++	4
Netherlands	–	–	++	1

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

Country	2008-09		2009-10	
	Qty (’000 t)	Value (Rs.’000)	Qty (’000 t)	Value (Rs.’000)
All Countries	130042	3468454807	153629	3659009475
Saudi Arabia	25915	710961848	26883	662926267
Iran	21590	498334917	22086	482632149
Kuwait	14081	356850005	14612	345518335
Nigeria	11736	385750403	13020	338025741
Iraq	12222	340404143	13883	330483468
UAE	14210	411099133	10433	257204535
Angola	2932	64988437	8039	199866389
Venezuela	8161	184472556	6238	133174667
Qatar	2496	63925866	4615	113525153
Malaysia	3708	124937432	2526	62904820
Other countries	12991	326730067	31294	732747951

PETROLEUM AND NATURAL GAS

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

Country	2008-09		2009-10	
	Qty (t)	Value (Rs.'000)	Qty (t)	Value (Rs.'000)
All Countries	8306769	128867509	9110571	110672243
Qatar	6480480	64525741	6795541	75656047
Australia	66373	2669393	638768	9788727
Russia	–	–	551046	7506046
Egypt	124670	5348493	177547	3388279
Austria	63880	1455568	185930	3119942
Trinidad	178277	4503407	162035	2292702
Oman	186442	5147825	65910	1738820
Nigeria	285133	10530453	118292	1620901
Algeria	240835	8334832	118478	1453019
Belgium	169687	8197128	–	–
Other countries	510992	18154669	297024	4107760

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 184.38 million tonnes per annum as on 1.4.2010 from 51.78 million tonnes in 1990-91. The refining capacity is likely to reach 240.96 million tpy by the end of XI Plan. 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 39 oil and gas projects in 15 countries – Vietnam (3 projects), Russia (2 projects), Sudan (3 projects), Iran (1 project), Iraq (1 project), Libya (3 projects), Myanmar (5 projects), Syria (2 projects), Egypt (2 projects), Cuba (2 projects), Nigeria Sao Tome Principe JDZ (1 project), Brazil (5 projects), Nigeria (2 projects), Colombia (6 projects) and Venezuela (1 project). Oil & Natural gas production by OVL comes from 9 projects in seven countries namely Russia, Sudan, Vietnam, Syria, Colombia, Venezuela and Brazil. OVL started production of oil and gas in 2003.

PETROLEUM AND NATURAL GAS

In private sector, RIL's overseas interests comprise 13 blocks with acreage of about 93,500 sq km – 3 in Yemen, 2 each in Peru, Oman, Kurdistan and Colombia and one each in East Timor and Australia.

Under New Exploration Policy (NELP), 203 exploration blocks have been awarded to both foreign and Indian entrepreneurs on sharing basis. A total of 77 oil and gas discoveries in 23 blocks have already been made. The largest natural gas discovery in the country has been made in Krishna Godavari (KG) deep water, from where production has started in April 2009. During 2009-10, natural gas production was expected to be around 50.237 billion cu m, i.e. 53% higher than the preceding year, mainly owing to production from Krishna Godavari deep water basin. 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.