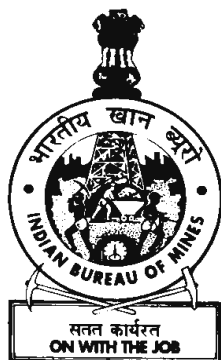


PETROLEUM AND NATURAL GAS



# Indian Minerals Yearbook 2012

(Part- III : Mineral Reviews)

51<sup>st</sup> Edition

**PETROLEUM AND NATURAL GAS**

**(FINAL RELEASE)**

**GOVERNMENT OF INDIA  
MINISTRY OF MINES  
INDIAN BUREAU OF MINES**

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**February, 2014**

## 39 Petroleum and Natural Gas

The domestic production of crude oil at 38.1 million tonnes in 2011-12 increased by 1.1% over 2010-11. The net production of natural gas (utilised) declined by 8.92% to 47,559 million cu metres in 2011-12. The refining capacity in the country at 213.07 million tonnes per annum as on 1.4.2012 was 19.68 million tonnes higher over preceding year and was 4.58% of the world refinery capacity.

### RESOURCES

As on 1.4.2012, total reserves of crude oil are estimated at 759.59 million tonnes (328.88 million tonnes in onshore and 430.71 million tonnes in offshore areas). Those of natural gas are placed at 1,330.26 billion cu m (337.93 billion cu m in onshore and 992.33 billion cu m in offshore areas) (Table - 1).

**Table – 1 : Reserves of Crude Oil and Natural Gas in India as on 1.4.2012 (P)**

(Crude oil in million tonnes; natural gas in billion cu m)		
Area	Crude oil	Natural gas
<b>India</b>	<b>759.59</b>	<b>1330.26</b>
<b>Onshore</b>	<b>328.88</b>	<b>337.93</b>
Andhra Pradesh	5.59	42.30
Assam*	178.71	178.14
Gujarat	135.72	78.19
Tamil Nadu	8.86	39.30
<b>Offshore</b>	<b>430.71</b>	<b>992.33</b>
Western offshore @	406.59	516.03
Eastern offshore#	24.12	476.30

**Source:** Indian Petroleum and Natural Gas Statistics, 2011-12, Ministry of Petroleum and Natural Gas, Govt. of India.

\* Includes reserve in Arunachal Pradesh, Nagaland and Tripura.

@ Includes Bombay High offshore, Rajasthan and JVC for crude oil. Also includes Bombay High offshore, Rajasthan and Madhya Pradesh & Jharkhand (Coal Bed Methane) in case of natural gas.

# Includes JVC/Private parties in case of crude oil and West Bengal (Coal Bed Methane) in case of natural gas.

### 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 including CBM in the country. As on 1.4.2012, there were in all 447 oil/gas fields under these companies including offshore areas.

In public sector, ONGC's jurisdiction extended to 372 fields – Cambay basin (Gujarat) – 87 oil/gas fields, Upper Assam – 35 fields and Assam & Assam Arakan – 7 fields Jodhpur (Rajasthan) – 7 fields, Krishna-Godavari basin (Andhra Pradesh) – 54 fields, Cauvery basin (Tamil Nadu) – 29 fields, Assam & Assam Arakan in Tripura - 11 fields and Assam & Assam Arakan in Nagaland – 3 fields, Mizoram - 1 field, Vindhyan basin (Madhya Pradesh) - 1 field, besides, 89 offshore fields in the Mumbai offshore, 6 in Kachchh, 3 in Cambay basin in West Coast and 39 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 venture companies were engaged in 56 oil/gas fields - Cambay basin (Gujarat) at 28 fields, Kharsang basin (Arunachal Pradesh) at 1 field, Amguri basin (Assam) at 1 field, Jharia & Bokaro (Jharkhand) at 1 field each, Shohagpur East & West (Madhya Pradesh) at 1 field each, Rajasthan at 7 fields and Raniganj East & West basin (West Bengal) at 1 field each in onshore areas. In offshore areas, these companies covered 2 fields in Cauvery basin and 4 fields in Krishna-Godavari basin on the East Coast and 4 fields in Mumbai basin and 3 fields in Cambay basin on the West Coast.

Highlights of exploration carried out by ONGC and OIL during 2011-12 are furnished below:

During 2011-12, ONGC carried out seismic surveys and generated a total of 2,534.76 GLK of 2D and 2,314.83 sq km of 3D seismic data acquired in the onland area and 11,071.00 LK of 2D and 7,505.60 sq km of 3D seismic data have been acquired in offshore area. A total of 135 exploratory wells with a meterage of 376,370 and 280 development wells with a meterage of 558,690 have been drilled. A total of 23 exploratory wells – 13 onland and 10 offshore areas – were successful with hydrocarbon finds. Exploratory efforts of ONGC during 2011-12 resulted in 23 new hydrocarbon finds: Patharia-5, G-354, KH-31 in Assam and Gojalia-13 in Tripura in Assam & Assam Arakan onland; Viraj-58, North kadi-461, East

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Linch, NK-472, UBER-2 in Western onshore (Gujarat); Nohta-2 in frontier basin (Madhya Pradesh) onland; Hortoki-1 in AAFB-Cachar onland (Mizoram); North Kovilkalappal - 3, Periyakudi-1 in Cauvery onland (Tamil Nadu); AN-DWN-2002/1-C in Andaman offshore, GS-70-1, Chandrika South-1, KGOSNO41NAAL-1 in KG offshore; MDW-13 in Mahanadi offshore; Aliabet-3 in Gulf of Cambay; GSSO4NAA-1 in Saurashtra offshore; GK-42-1 in Kachchh offshore and BT-127E-1, BH-67 in Mumbai offshore.

During 2011-12, ONGC as a consortium has been awarded 7 blocks (5 on land and 2 shallow water blocks) in the NELP-IX round. Out of these 7 blocks, ONGC is the operator in 5 blocks and OIL in 2 blocks.

The ultimate reserve accretion of oil-equivalent gas (O+OEG) in 2011-12 in domestic assets of ONGC was 84.13 million tonnes. The total ultimate reserves accretion of oil-equivalent gas (O+OEG) of ONGC as on 1.4.2012 was 2,679.04 million tonnes.

During 2011-12, OIL covered, under onshore seismic survey, 885.83 2D (GLKM) and 267.70 3D (SQKM) in Assam & Arunachal Pradesh; 72.76 3D (SQKM) in Andhra Pradesh; 43.35 2D (GLKM) in Mizoram; and under offshore seismic survey 511.00 2D (SQKM) and 1497.235 3D (SQKM) in Andhra Pradesh.

OIL carried out exploratory onshore drilling of 124,828 m in 36 wells in Assam and 3,166 m drilling in 2 wells in Rajasthan.

The details of discoveries of oil/gas made by OIL during 2011-12 are given below:

- i) The well Diroi 5, in the Moran extension area, district Dibrugarh, Assam, encountered a no. of prospective sand ranges within the Lakadong + Therria formation, showing evidence of oil (tested). The discovery has opened up a new area for exploration in the Diroi area, especially in the Paleocene-Lower Eocene formations.
- ii) The well Nahorkatiya 594, located in the Kharikatia structure in Chabua area, district Dibrugarh, Assam, encountered a no. of prospective sand ranges within the Lakadong+Therria formation and currently producing gas from one of the tested sands. The discovery of gas has opened up a new area for exploration in the Kharikatia area, especially in the Paleocene-Lower Eocene formations.
- iii) The well Nahorkatiya 595, located in Amgurigaon structure, district Dibrugarh, Assam, encountered oil bearing sand within

the barai formation. The discovery of oil within the Barai formation in this well has opened up a new area for exploration in Amgurigaon structure within the Nahorkatia extension ML area.

- iv) The well Makum 41, located in the North-West Makum structure of the Makum-North Hapjan oil field area in the Tinsukia district of Assam, was drilled to probe the hydrocarbon prospects within the Barail and Tipam formations. On testing the well produced oil from Barail formation. The discovery of oil in this well has opened up a new play for exploration/exploitation in the North-West Makum structure in the Hugrijan area.
- v) The well Makum 43, located in the West Makum structure in the Tinsukia district of Assam, encountered one gas bearing sand within the Barail formation (tested) and two possible hydrocarbon bearing sands within Tipam formations. The discovery of gas within the Barail formation in this well opened up a new play of exploration/exploitation in the West Makum structure in the Hugrijan area.
- vi) The well Balimara 1, located in the Balimara structure in the Dibrugarh district of Assam, was drilled to probe the hydrocarbon prospects within the Tipam and Barail formation and Kopili formation in the southern part of the Upper Assam Basin near the Belt of Schuppen. Presence of oil has opened up a new play for oil exploration/exploitation in the Balimara in the Dumduma area.
- vii) The well Nahorkatia 597, located in the East Zaloni structure in the Tinsukia district of Assam, encountered one gas bearing sand within the Girujan formation (tested) and Upper Tipam formation. The discovery of gas within the Girujan formation in this well has opened up new gas play for gas/oil exploration/exploitation in East Zaloni structure in the Hugrijan area.

The total reserves of crude oil and natural gas estimated by OIL at the end of 2011-12 (as on 31.3.2012) were 36.839 million cu m and 31.618 billion cu m, respectively.

In 2011-12, public sector companies drilled 453 wells (375 in onshore and 78 in offshore areas) with a meterage of 1,063 thousand (817 thousand in onshore and 246 thousand in offshore areas). The particulars of exploratory and development drilling carried out by public sector companies are given in Table-2.

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**Table – 2: Details of Drilling for Oil and Natural Gas\* 2011-12 (P)**

State/Area	Wells (No.)	Meterage ('000)
<b>ONSHORE</b>	<b>375</b>	<b>817</b>
Assam	78	264
Andhra Pradesh	20	68
Gujarat	235	381
Tamil Nadu	21	51
Tripura	12	30
Others	9	23
<b>OFFSHORE</b>	<b>78</b>	<b>246</b>
East Coast	17	78
West Coast	61	168
<b>Grand Total</b>	<b>453</b>	<b>1063</b>

\* Relates to Public Sector Companies.

## RELIANCE INDUSTRIES LIMITED

KG-D6 was the single largest source of domestic gas in the country in 2012 and accounted for almost 35% of the total gas consumption in India. The gas from KG-D6 catered to demand from 56 customers in critical sectors like fertilizer, power, CGD, steel, petrochemicals and refineries. The gas from KG-D6 accounted for about 44% of the total domestic gas production paving the way for increased energy independence for the country. An average daily gas production from KG-D6 block for the year was 42.65 MMSCMD. The cumulative gas production was 1,808 BCF since inception, of which 551.31 BCF was produced in FY 2011-12. An average oil and condensate production for the year from the block was 15,481 barrels per day. The cumulative production of oil and condensate was 19.44 MMBL since inception, of which 5.67 MMBL was produced in FY 2011-12.

In the D1-D3 gas fields, 22 wells have been drilled till date, of which 18 were producer wells. Of these, 2 wells were drilled during this year. Extensive reservoir studies are underway for augmenting additional production with the integrated (or combined or joint) efforts of RIL and BP's technical teams.

6 wells in the D26 field were producer wells. The well MA-2, which was earlier a gas injection well, was converted to a production well since

April 2010. Optimised Field Development Plan (OFDP) for the development of 4 satellite discoveries was approved by the Government of India in January 2012. Engineering activities, which are yet to commence will determine the future course of action. There have been re-estimation of reserves in these discoveries and RIL has restated the reserves downwards based on such results.

In addition, RIL has declared the commerciality of discovery D34 of KG-D6 and restated the Proved Reserves upwards based on re-estimation.

Revised plan of development for D26 field submitted to the DGH. Further, an integrated development plan for gas discoveries in the KG-D6 block is being conceptualised to maximise capital efficiency and accelerate monetisation.

The Company made a discovery in the first well drilled in CY-D6 block – Well SA1 – Discovery Dhirubhai 53. The appraisal work programme submitted which is under review with DGH.

The Company submitted a proposal for commerciality of 8 discoveries in CB-10 block and also notified declaration of commerciality for D32 and D40 in NEC-25 block.

During the year, as part of reassessment of its portfolio together with BP, RIL has considered 5 blocks as relinquished in its books and initiated the formal process of relinquishing these blocks. In addition to the above, RIL also relinquished 5 additional blocks from its portfolio. Consequently, RIL's domestic oil and gas portfolio consists of 17 exploration blocks excluding KG-D6, CBM, Panna-Mukta and Tapti.

The Panna-Mukta fields produced 10.06 MMBL of crude oil and 71.24 BCF of natural gas in FY 2011-12, growing 8% and 37%, respectively over the previous year, which was impacted due to a shutdown on account of a failure of sub-sea hose system and parting of anchor chains to the SBM.

Tapti fields produced 0.88 MMBL of condensate and 73.79 BCF of natural gas in FY 2011-12, a decline of 28% and 22%, respectively over the previous year. This decrease in production was due to a natural decline in the reserves.

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Reliance has 10 blocks in its international conventional portfolio, including 3 in Yemen (1 producing and 2 exploratory), 2 each in Kurdistan, Peru and Colombia and 1 in Australia amounting to a total acreage of over 51,000 sq km. During the year, the following activity was undertaken as part of the exploratory campaign: (i) 2D seismic data acquisition of 42 LKM in Yemen block 37 (ii) 3D seismic data acquisition of 500 sq km in Colombia blocks. (iii) Well testing in Sarta block in Kurdistan.

RIL holds 3 CBM blocks in Central India, which include Sohagpur (East), Sohagpur (West) and Sonhat (North) in the domestic unconventional portfolio. Exploration phases for Sohagpur East and West blocks were completed and these blocks entered their development phase. RIL has completed the following operations in these blocks: (i) Drilled, logged and tested over 45 core holes for gas content, permeability and coal properties (ii) Drilled over 85 production wells.

Further, RIL plans to achieve first gas production in FY 2015 subject to necessary approvals from regulatory authorities.

## PRODUCTION

### Petroleum (Crude)

Production of petroleum (crude) in the country at 38.1 million tonnes in 2011-12 registered an increase of 1.1% as compared to that in the previous year. Bulk of the total production (72.4%) was shared by the public sector companies. Private sector companies accounted for the remaining 27.6%.

Offshore areas continued to be the largest producer of petroleum (crude) in 2011-12 and had a share of 52.7% of the country's total output. Next in order were Rajasthan with a contribution of 17.2%, Gujarat with 15.2%, and Assam with 13.2%. The remaining 1.7% production was reported by Andhra Pradesh, Tamil Nadu and Arunachal Pradesh.

During 2011-12, the production of petroleum (crude) recorded increase in Rajasthan by 27.2%, Assam by 6.4%, Tamil Nadu by 6.0% and Arunachal Pradesh by 1.7%, whereas, there was a

decline in production in offshore areas by 5.6%, and Gujarat by 2.1% as compared to the previous year (Table - 3).

### Natural Gas (Utilised)

The production of natural gas (utilised) at 47,559 million cu metres was decreased by 8.9% in 2011-12 as compared to that in the previous year.

Offshore areas continued to be the largest producers of natural gas (utilised) with a share of 80.9%. Next in order were Assam with a share of 6.1%, Gujarat 4.6%, Andhra Pradesh 2.9%, Tamil Nadu 2.7%, Tripura (1.4%), and Rajasthan 1.2%. Arunachal Pradesh and West Bengal accounted for the remaining 0.2% of the total production.

Statewise analysis revealed that West Bengal, Rajasthan, Tamil Nadu, Assam, and Tripura recorded an increase in production, whereas, offshore areas, Arunachal Pradesh, Gujarat, and Andhra Pradesh recorded decrease in production of natural gas in 2011-12 as compared to that of previous year.

The production of natural gas increased in West Bengal by 104.9%, Rajasthan by 36.6%, Tamil Nadu by 14.8%, Assam by 8.4%, and Tripura by 5.6%. The decline in production was recorded in Offshore areas by 11.8%, Arunachal Pradesh by 9.1%, Gujarat by 3.9% and Andhra Pradesh by 1.7%.

As much as 54.6% of the total production came from the public sector companies, whereas, the remaining 45.4% was the share of the private sector companies during the year 2011-12 (Table - 4).

Domestic prices of petroleum (crude) in 2009-10 to 2011-12 are furnished in Table-5.

## INDUSTRY

The total refining capacity of 22 units in operation in the country was about 213.07 million tpy in April 2012, with a share of about 4.58% in the estimated world refinery capacity of 4,650 million tpy. In 2011-12, refinery crude throughput increased to 211.42 million tonnes from 206.00 million tonnes in 2010-11 (Table-6).

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**Table – 3 : Production of Petroleum (Crude), 2009-10 to 2011-12  
(By States)**

(Quantity in '000 tonnes; value in ₹'000)

State	2009-10		2010-11		2011-12(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
<b>India</b>	<b>33690</b>	<b>607894611</b>	<b>37684</b>	<b>688041255</b>	<b>38090</b>	<b>695454076</b>
Public sector	28427	512930250	28002	511265556	27563	503250215
Private sector	5263	94964361	9682	176775699	10527	192203861
Andhra Pradesh	304	5485306	305	5568745	305	5568745
Arunachal Pradesh	131	2363734	116	2117949	118	2154465
Assam	4740	85527470	4721	86196867	5025	91747355
Gujarat	5960	107540869	5905	107814553	5780	105532280
Rajasthan	447	8065565	5149	94011369	6552	119627595
Tamil Nadu	239	4312461	233	4254156	247	4509771
Offshore	21869	394599206	21255	388077616	20063	366313865

**Table – 4 : Production of Natural Gas (Utilised), 2009-10 to 2011-12  
(By States)**

(Quantity in million cu metres; value in ₹'000)

State	2009-10		2010-11		2011-12(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
<b>India</b>	<b>47496</b>	<b>177751215</b>	<b>52219</b>	<b>334253819</b>	<b>47559</b>	<b>304425159</b>
Public sector	25511	95473540	25445	162873445	25950	166105950
Private sector	21985	82277675	26774	171380374	21609	138319209
Andhra Pradesh	1479	5535078	1386	8871786	1363	8724563
Arunachal Pradesh	40	149698	44	281644	40	256040
Assam	2703	10115831	2680	17154680	2905	18594905
Gujarat	2444	9146538	2262	14479062	2173	13909373
Rajasthan	239	894445	432	2765232	590	3776590
Tamil Nadu	1178	4408601	1119	7162719	1285	8225285
Tripura	564	2110739	610	3904610	644	4122244
West Bengal	38	142213	41	262441	84	537684
Offshore	38811	145248072	43645	279371645	38475	246278475

**Table – 5 : Prices of Petroleum (Crude)  
2009-10 to 2011-12**

(In ₹ per tonne)

Grade	Market	2009-10	2010-11	2011-12
Indigenous*	Onshore	24233	28829	41143
Indigenous*	Offshore	26187	31525	42902
Indigenous*	Offshore & Onshore	25530	30614	42293
Imported	c.i.f. Indian Port (average)	23817	27535	-

*Source: Basic Statistics on Indian Petroleum & Natural Gas, 2011-12 for indigenous crude prices and DGCI&S, Kolkata for average imported crude prices.*

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

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**Table – 6 : Installed Capacity and Crude Throughput in Refineries**

(In '000 tonnes)

Refinery	Annual installed capacity (as on 1.4.2012)	Refinery Crude throughput		
		2009-10	2010-11(R)	2011-12(P)
<b>Total</b>	<b>213070</b>	<b>192768</b>	<b>206003</b>	<b>211424</b>
<b>Public/Joint Sector</b>	<b>120070</b>	<b>112117</b>	<b>115310</b>	<b>120906</b>
IOCL, Guwahati, Assam	1000	1078	1118	1058
IOCL, Barauni, Bihar	6000	6184	6207	5730
IOCL, Koyali, Gujarat	13700	13206	13561	14253
IOCL, Haldia, West Bengal	7500	5686	6878	8072
IOCL, Mathura, Uttar Pradesh	8000	8107	8880	8202
IOCL, Bongaigaon, Assam	2350	2220	2008	2188
IOCL, Digboi, Assam	650	600	651	622
IOCL, Panipat, Haryana	15000	13615	13660	15496
BPCL, Mumbai, Maharashtra	12000	12516	13020	13355
BPCL (formerly KRL), Kochi, Kerala	9500	7875	8699	9472
HPCL, Mumbai, Maharashtra	6500	6965	6638	7520
HPCL, Visakh, Andhra Pradesh	8300	8796	8200	8682
CPCL, Manali, Tamil Nadu	10500	9580	10104	9953
CPCL, Narimanam, Tamil Nadu	1000	517	703	611
MRPL, Mangalore, Karnataka	15000	12498	12662	12798
NRL, Numaligarh, Assam	3000	2619	2252	2825
ONGC, Tatipaka, Andhra Pradesh	70	55	69	69
<b>Joint Venture</b>	<b>15000</b>	-	-	-
Bharat Oman Refineries Ltd, Bina <sup>@</sup>	6000	-	-	-
HPCL, Bathinda <sup>#</sup>	9000	-	-	-
<b>Private Sector</b>	<b>78000</b>	<b>80651</b>	<b>90692</b>	<b>90515</b>
RIL, Jamnagar, Gujarat	33000	34415	34517	35423
RIL (SEZ), Jamnagar, Gujarat	27000	32735	41302	41449
Essar Oil Ltd, Vadinar, Gujarat	18000	13501	14873	13643

Figures rounded off.

**Source:** Indian Petroleum and Natural Gas Statistics, 2011-12, Ministry of Petroleum & Natural Gas, Government of India.

<sup>@</sup> Commissioned in May 2011, BORL is a joint venture company promoted by BPCL and Oman Oil Company Ltd (OOCL).

<sup>#</sup> HPCL & Mittal Energy Investment Pvt. Ltd, a Joint venture, Bathinda commissioned in April 2012.

**Note:** 1. CPCL and BRPL are subsidiaries of IOCL; NRL of BPCL and MRPL of ONGC.

2. RIL refineries crude throughput and petroleum includes during 2009-10, 2010-11 & 2011-12 which includes other inputs.

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In the next few years, the following additional refining capacities are reportedly expected to come on stream: (i) 15.0 million tonnes - IOCL, Paradeep, and (ii) 1.4 million tonnes - HPCL, Mumbai.

There are 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.

The capacity of Essar's 10.5 million tpy refinery at Vadinar in Gujarat is expected to rise to 12 million tpy after debottlenecking. CPCL's capacity augmentation at Manali in Tamil Nadu from 9.5 to 11.2 million tpy is underway.

Reliance Petroleum Limited, amalgamated with Reliance Industries Limited, has been formed to set up a greenfield petroleum refinery and polypropylene plant in SEZ in Jamnagar, Gujarat, adjacent to RIL's existing refinery and petrochemicals complex. The refinery has a total atmospheric distillation capacity

of about 580 kilo barrels per stream day (KBPSD), while the polypropylene plant has 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 during 2009-10 to 2011-12 is given in Table-7.

## CONSUMPTION

Total consumption of petroleum products (excluding Refinery Boiler Fuel) increased by 147.995 million tonnes in 2011-12 over the previous year. Consumption of some Light Distillates (LPG, motor spirit and naphtha) increased slightly in 2011-12. Consumption of Middle Distillates like HSDO, ATF also increased. However, consumption of Heavy Ends of furnace oil/LSHS recorded considerable decrease. The consumption of various petroleum products from 2009-10 to 2011-12 is given in Table-8.

**Table – 7: Production of Petroleum Products from Refineries, 2009-10 to 2011-12**

(In '000 tonnes)

Product	Production		
	2009-10	2010-11(R)	2011-12(P)
<b>A) FROM CRUDE OIL</b>	<b>179701</b>	<b>190316</b>	<b>196707</b>
<b>1. Light distillates</b>	<b>51197</b>	<b>55249</b>	<b>58004</b>
(a) LPG	8091	7541	7335
(b) Motor spirit	22537	26138	26890
(c) Naphtha	17105	17535	17176
(d) SBPS/Hexane	67	78	80
(e) Others	3397	3957	6523
<b>2. Middle distillates</b>	<b>93790</b>	<b>99771</b>	<b>103493</b>
(a) Kerosene	8545	7702	7475
(b) ATF	9296	9570	10057
(c) HSD	73281	78040	81901
(d) LDO	472	590	502
(e) Others	2196	3870	3558
<b>3. Heavy ends</b>	<b>34714</b>	<b>35296</b>	<b>35210</b>
(a) Furnace oil	15828	18659	17755
(b) Lube oils	950	884	994
(c) Bitumen	4889	4478	4610
(d) Petroleum coke	3709	2711	4480
(e) LSHS/HHS/RFO	2518	1860	1701
(f) Total Waxes	67	67	88
(g) Others	6753	6637	5582
<b>B) FROM NATURAL GAS</b>			
LPG	2243	2168	2213

*Source: Indian Petroleum & Natural Gas Statistics, 2011-12, Ministry of Petroleum & Natural Gas, Government of India.*  
*Note: Include production of RIL SEZ in the year 2009-10, 2010-11 & 2011-12 which includes other inputs.*



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**Table – 8 : Consumption of Petroleum Products  
2009-10 to 2011-12**

(In '000 tonnes)

Product	2009-10(R)	2010-11(R)*	2011-12*(P)
<b>Grand Total</b>	<b>152385</b>	<b>156912</b>	<b>163417</b>
<b>1. Light distillates</b>	<b>38995</b>	<b>41443</b>	<b>43657</b>
(a) LPG	13135	14331	15358
(b) Motor Spirit	12818	14194	14992
(c) Naphtha+NGL	10134	10676	11105
(d) Others	2908	2242	2202
<b>2. Middle distillates</b>	<b>71120</b>	<b>75029</b>	<b>79407</b>
(a) SKO	9304	8928	8229
(b) ATF	4627	5078	5536
(c) HSDO	56242	60071	64742
(d) LDO	457	455	415
(e) Others	490	497	485
<b>3. Heavy ends</b>	<b>27693</b>	<b>24568</b>	<b>24931</b>
(a) Furnace oil/ LSHS	11629	10789	9232
(b) Lubes & greases	2539	2429	2745
(c) Bitumen	4934	4536	4628
(d) Petroleum coke	6586	4982	6145
(e) Others	2005	1832	2181
<b>Total (1+2+3)</b>	<b>137808</b>	<b>141040</b>	<b>147995</b>
<b>4. Refinery Boiler fuel</b>	<b>14577</b>	<b>15872</b>	<b>15422</b>

*Source: Indian Petroleum & Natural Gas Statistics, 2011-12, Ministry of Petroleum & Natural Gas, Government of India.*

*\* Excludes data in respect of RIL SEZ Refinery as it is presumed that all products have been exported and not consumed domestically.*

## 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 development.

### Coal Bed Methane

Coal bed Methane (CBM), is an eco-friendly natural gas, stored in coal seams, generated during the process of the coalification. 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. CBM exploration and exploitation has an important bearing on reducing the green house effect and extraction of the CBM through degassing of the coal seams prior to mining of coal is a cost effective means of boosting coal production and maintaining safe methane level in working mines.

India, having the fourth largest proven coal reserves in the world, holds significant prospects for exploration and exploitation of CBM. The prognosticated CBM resources in the country are about 92 TCF (2608 BCM). In order to harness CBM potential in the country, the Government of India formulated CBM policy in 1997 to provide level playing platform for exploration and commercial exploitation of CBM by national and international entrepreneurs.

CBM blocks were carved out by DGH in close interaction with MOC & CMPDI. Till date, four rounds of CBM bidding rounds have been implemented by MOP&NG under the CBM policy resulting in award of 33 CBM blocks which covers 17,200 Sq km out of the total available coal bearing areas for CBM exploration of 26,000 sq km. Exploration under CBM policy has been undertaken by national and international companies. Total prognosticated CBM resource for awarded 33 CBM blocks, is about 63.85 TCF (1810 BCM), of which, so far, 8.92 TCF (252.8 BCM) has been established as Gas in Place (GIP).

Commercial CBM production has started from one block i.e. Raniganj (south) since 14th July 2007 which contributes about 0.25 MMSCMD of CBM production. In addition to this incidently produced CBM is also being sold in small quantities from Raniganj (East) and Jharia blocks to avoid wastage of gas through flaring. Four more CBM blocks are expected to start commercial production in near future. The total CBM production is expected to be around 4MMSCMD by end of 12th plan. 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. National Gas Hydrate Program (NGHP), steered by the Ministry of Petroleum and Natural Gas and technically coordinated by Directorate General of Hydrocarbons (DGH), 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. It is a consortium of National E & P companies, namely ONGC, GAIL, OIL and national research institutions NIO, NIOT and NGRI.

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.

Under NGHP-1 program through the ship Joides Resolution by Overseas Drilling Ltd USA Gas Hydrate layer was encountered at sites in the Krishna-Godavari Basin and in offshore of the Andaman Islands. Based on the findings of NGHP Expedition-01, the Krishna Godavari deepwater basin and the Mahanadi deep waters have been considered potential areas where large tracts of turbidity sand channel systems can be expected in the delta sequence accumulations. Three areas in KG offshore namely 'A' in Vizag offshore (Industrial well L1-1A area), Area 'B' in Krishna Offshore (South of KD Prospect) and Area 'C' (East of GD Prospect) have been identified.

The aims and objectives of the NGHP Expedition-02 are to identify gas hydrate bearing sands, identify the free gas below the gas hydrate stability zone and identify suitable location for carrying out pilot production testing in NGHP Expedition-03. 3D seismic data interpretation is in progress to identify potential sand channel systems. Based on the geophysical studies carried out so far in Area 'A' (320 sq km in Krishna Godavari Offshore Deepwater areas) 8 sites have been evaluated and prioritised for Leg-01 of the NGHP Expedition-02. These locations have been prioritised and extended in consultation with USGS scientists.

The NGHP technical committee agreed to test probable gas hydrate bearing sand in channel-leeve system by drilling of six out of eight proposed locations in area 'A' as top priority and two as alternate locations during NGHP-02 expedition. The paleogeographic reconstruction

of study area provided insight into sediment supply and the gas sourcing and charging reasonably fits into tectono-stratigraphic model and proven-petroleum system of KG Basin (offshore).

Earlier studies have prognosticated gas hydrate resources of 1894 TCM for India and 933 TCF (USDOE, Feb 2012) is the concentration of gas hydrate in sands within the gas hydrate stability zone. The estimated presence of sand is approximated based on gross geological depositional models. NGHP is carrying out resource estimation of the gas hydrates in offshore areas of East Coast.

NGHP has signed MoUs with USGS, USDOE, USMMS, JOGMEC and IFM-Geomar for collaborative research in gas hydrates. USGS scientists are in close consultation for prioritising locations. MoU was recently signed by DGH with the Leibniz Institute of Marine Sciences, Germany for methane production from gas hydrates by carbon dioxide sequestration.

### **Oil Shales**

Oil Shales are usually fine-grained sedimentary rocks containing relatively large amounts of organic matter from which significant quantities of shale oil and combustible gas can be extracted by destructive distillation. An oil shale, which has a very high proportion of organic matter in relation to mineral matter, is categorised as a coal. Oil shales range in age from Cambrian to Tertiary and occur in many parts of the world. Deposits range in size from small occurrences of little or no economic value to those of enormous size that occupy thousands of square miles and contain many billion barrels of potentially extractable shale oil.

Total world resources of oil shale are conservatively estimated at 2.6 trillion barrels. Because of higher costs, only a few deposits of oil shale are currently being exploited in China, Brazil,

and Estonia. However, with the continuing decline of petroleum supplies, accompanied by increasing costs of petroleum, oil shale presents opportunities for supplying some of the fossil energy needs of the world in the years ahead.

North-East India is endowed with rich deposits of coal, found in the Barail Formation of Tertiary age. Carbonaceous shale occurs interbedded with the coal. Studies have indicated that these coals and carbonaceous shale constitute the principal source rocks that have generated the hydrocarbons produced from the region.

A systematic approach has been initiated by Directorate General of Hydrocarbons (DGH) since 2010 to identify, characterise and prioritise the Indian sedimentary basins for focused shale oil / gas exploitation and also to assess and establish the potential of fields. Memorandum of understanding (MoU) has been signed between Department of State, USA and MOPNG, GOI on November 06, 2010 to cooperate in areas of assessment of Shale Gas Resources in India, Training, assistance in regulatory frameworks and Investment Promotion. DGH has taken necessary action to carry out the feasibility study and business model development for exploitation of oil shale. In order to assess the viability of syncrude generation from the Assam coal, OIL established a pilot plant for the extraction of oil from the coals of Assam with technology from the USA.

DGH has completed a project to identify and estimate oil shale resources and their syncrude potential in the Assam Arakan basin in north east parts of India. This project was carried out in association with BRGM, France and MECL, India. An estimate of syncrude resources has been made by BRGM in the 3 blocks at 400 MMT (approx.) of oil up to depth of 500 m.

## 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. The project on setting up of a Hydrogen Dispensing station at Dwarka, New Delhi by IOC (R&D) was completed. MoUs for the following 4 projects, approved by the Steering Committee of HCF, were signed and all the projects are in progress: (a) Design and construction of metal-organic framework materials with tuneable physical properties for storage of Hydrogen - HPCL/Gitam University (b) An integrated approach for Bio-hydrogen production through combined dark and photo fermentative process - HPCL/TERI (c) Hybrid-sorption enhanced steam reforming for the production of Hydrogen from Natural Gas - BPCL (d) Development of large scale photo-catalytic process using modular reactor for Hydrogen production by dissociation of water/H<sub>2</sub>S utilising solar energy - IOC (R&D)/IT-BHU.

A new project on Development of novel nano-composite Hydrogen storage materials by GAIL/IIT-Madras was approved by the steering committee of HCF in its meeting held in December 2011.

## 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 Jatropha. 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. In Uttar Pradesh, BPCL has launched a biodiesel project covering one million acres wasteland to produce one million tonnes bio-diesel by 2015. The current status of this project is: Wasteland identified for 130,143 acres, Jatropha/Pongamia plantation achieved in 7450 acres and pits ready for plantation in 8036 acres.

The oil marketing companies are experimenting with blending of bio-diesel in high speed diesel to the extent of 5%. BIS has already amended the specifications of diesel to permit blending of bio-diesel in diesel.

## 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. Due to shortfall in supply of ethanol the EBP programme was adversely affected.

Due to shortfall in procurement of ethanol for blending during 2006-09 against its requirement, EBP programme was adversely affected. To give

boost to EBP programme, the government issued a notification on 01.09.10 in pursuance of decision taken on 16.08.10 that OMCs would start procuring ethanol at an adhoc ex-factory price of Rs. 27/- per litre subject to adjustment with the fuel price arrived at, based on the recommendation of expert committee constituted for the purpose. Accordingly, procurement has started and supply of 5% EBP has commenced since 2010. For the year 2011-12, OMCs have contracted 46.97 crore litre of ethanol in 12 states against the requirement of 100.8 crore litre for the EBP programme in the entire notified area. The expert committee for pricing of ethanol has also submitted its final report containing its recommendations on pricing of ethanol. The same has been submitted to the National Bio Fuel Steering Committee (NBSC) for consideration.

## 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 60 MMSCMD 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 has become an official member of the Turkmenistan-Afghanistan-Pakistan-India (TAPI) Gas Pipeline Project in April 2008. The total capacity of the project is 90 MMSCMD and the length is about 1,680 km.

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 has decided to build a Strategic Crude Oil Reserve of 5 million tonnes through a special purpose vehicle (SPV) named Indian Strategic Petroleum Reserves Ltd (ISPRL) - a subsidiary company of OIDB. The locations selected are: (i) Visakhapatnam, Andhra Pradesh, (storage capacity 1.33 million tonnes), (ii) Mangalore, Karnataka (1.5 million tonnes), and (iii) Padur, Karnataka (2.5 million tonnes). The construction works are in progress at all these project. The project at Visakhapatnam, Mangalore and Padur are expected to be commissioned in 3rd quarter of 2013-14, 4th quarter of 2013-14 and 1st quarter of 2014-15, respectively.

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 249 blocks had been awarded in various rounds of NELP, spanning 2000-2012. Recently in March, 2012, 14 blocks covering area 14491 sq km were awarded under NELP - IX round.

The details of the exploration blocks awarded in NELP rounds are as below:

### Details of exploration block awarded

Round	Month, year	No. of blocks awarded	Awarded Area (sq km)	Present* Area (sq km)
NELP-I	Apr, 2000	24	230147	47774
NELP-II	July, 2001	23	267883	16154
NELP-III	Feb, 2003	23	204588	100674
NELP-IV	Feb, 2004	20	192810	112487
NELP-V	Dec, 2005	20	115180	58926
NELP-VI	Mar, 2007	52	306389	306227
NELP-VII	Dec, 2008	41	112955	112955
NELP-VIII	Jun, 2010	32	52573	52573
NELP-IX	Mar, 2012	14	14491	14491

\* Status of area as on 01.04.2012

## PETROLEUM AND NATURAL GAS

In order to explore and produce new sources of natural gas from coal-bearing areas, the Government had formulated a CBM Policy in 1997 and implemented in 2000 providing attractive fiscal and contractual framework for exploration and production of CBM which is an environment friendly clean gas fuel similar to conventional natural gas.

The Government of India has awarded 33 CBM blocks in Jharkhand (7), Madhya Pradesh (7), Chhattisgarh (3), Rajasthan (4), West Bengal (4), Andhra Pradesh (2), Odisha (2), Assam (1), Gujarat (1), Maharashtra (1) and Tamil Nadu (1) in different coalfields of India under CBM-I to IV. Out of 33 CBM awarded, total 3 CBM blocks have already been relinquished in Gujarat, Madhya Pradesh and Maharashtra (one CBM block in each). In CBM-IV, the Government of India awarded 7 CBM blocks in Assam, Chhattisgarh, Madhya Pradesh, Odisha and Tamil Nadu. 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 announced a Bio-diesel Purchase Policy effective from 1.1.2006. Under this scheme, Oil-marketing companies would purchase Bio-diesel for blending with High Speed Diesel to the extent of 5% at 20 purchase centres identified across the country. Since, no suppliers have come forward to offer Bio-diesel at these designated centres at the declared prices. As such, blending of Bio-diesel with HSD could not be set in motion.

The Government has notified the National Policy on Bio-fuels in December, 2009, which has laid down detailed guidelines for development of Bio-diesel. The National Bio-fuels Policy has superseded the Bio-diesel Policy.

### WORLD REVIEW

The world proved reserves of crude oil and natural gas at the end of 2011 were estimated at 234.3 billion tonnes and 208.4 trillion cu m, respectively (Tables - 9 and 10). The largest share of reserves of world crude oil is available in Middle East (46.2%) followed by South & Central America (21.6%), Europe & Eurasia (8.1%), Africa (7.5%), North America (14.3%) and Asia Pacific (2.3%).

Of the total world reserves of natural gas, Middle East possesses the largest share (38.4%) followed by Europe & Eurasia (37.8%), Asia Pacific

(8.1%), Africa (7.0%), North America (5.2%) and South & Central America (3.6%).

The world crude oil production in 2011 increased to 3980 million tonnes from 3923 million tonnes in 2010. OPEC countries, namely, Algeria, Angola, Ecuador, Gabon, Indonesia, Iran, Iraq, Kazakhstan, Kuwait, Libya, Nigeria, Saudi Arabia, UAE and Venezuela had a share of about 44% in the world crude oil production in 2011. Russia & Saudi Arabia (13% each), USA (9%), Iran & China (5% each), Canada, Kuwait, Mexico, UAE & Venezuela (4% each) and Brazil, Nigeria, & Norway (3% each) were the principal producers of crude petroleum.

The world production of natural gas also marginally increased to 3.4 trillion cu m in 2011 from 3.3 trillion cu m in 2010. OPEC countries had a share of 19% in the world natural gas production in 2011. Russia (20%), USA (19%), Canada, Iran & Qatar (4% each), China, Norway & Saudi Arabia (3% each) were the chief producers of natural gas in 2011 (Tables - 11 and 12).

The world consumption of oil in 2011 was estimated as 4,059.1 million tonnes, while that of natural gas was 2,905.6 million tonnes oil equivalent. Consumption of oil and natural gas in India in the same period was 162.3 million tonnes (with 4% share) and 55.0 million tonnes oil equivalent (with 1.9% share), respectively.

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

(In billion tonnes)

Country	Reserves
<b>World: Total</b>	<b>234.3</b>
Brazil	2.2
China	2.0
Canada	28.2
Iran	20.8
Iraq	19.3
Kazakhstan	3.9
Kuwait	14.0
Libya	6.1
Nigeria	5.0
Qatar	3.2
Russian Federation	12.1
Saudi Arabia	36.5
UAE	13.0
USA	3.7
Venezuela	46.3
Other countries	18.0

*Source: BP Statistical Review of World Energy, June, 2012.  
\* At 2011 end.*

PETROLEUM AND NATURAL GAS

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

(In trillion cu m)

Country	Reserves
<b>World : Total</b>	<b>208.4</b>
Algeria	4.5
Australia	3.8
Azerbaijan	1.3
Canada	2.0
China	3.1
Egypt	2.2
India	1.2
Indonesia	3.0
Iran	33.1
Iraq	3.6
Kazakhstan	1.9
Kuwait	1.8
Libya	1.5
Malaysia	2.4
Netherlands	1.1
Nigeria	5.1
Norway	2.1
Qatar	25.0
Russian Federation	44.6
Saudi Arabia	8.2
Turkmenistan	24.3
UAE	6.1
USA	8.5
Uzbekistan	1.6
Venezuela	5.5
Other countries	10.9

*Source: BP Statistical Review of World Energy, June, 2012.*  
\* At 2011 end.

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

(In '000 million cu m)

Country	2009	2010	2011
<b>World: Total</b>	<b>3101</b>	<b>3318</b>	<b>3403</b>
Algeria	80	80	78
Argentina	48	47	45
Australia	42	52	51
Canada	156	151	145
China	85	95	102
Egypt	63	61	61
India	48	51	46
Indonesia	77	86	75
Iran	131	146	152
Malaysia	60	61	61
Mexico	55	55	52
Netherlands	75	84	76
Norway	104	107	101
Pakistan	41	42	42
Qatar	89	117	147
Russia	584	649	669
Saudi Arabia	77	88	99
Turkmenistan	36	42	59
UAE	59	60	52
UK	63	60	48
USA #	583	604	651
Uzbekistan	60	60	57
Other countries	485	520	534

*Source: World Mineral Production, 2007-2011.*  
# Dry gas.

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

(In million tonnes)

Country	2009	2010	2011
<b>World : Total</b>	<b>3840</b>	<b>3923</b>	<b>3980</b>
Algeria	78	76	74
Angola	89	92	85
Brazil	105	111	113
Canada	134	141	145
China	189	203	204
Iran	202	207	206
Iraq	118	120	137
Kazakhstan	76	80	80
Kuwait	121	123	140
Libya	77	77	22
Mexico	154	153	152
Nigeria	101	117	117
Norway	115	105	100
Russia	494	505	509
Saudi Arabia @	459	467	526
UAE	126	131	150
UK	64	60	63
USA	335	346	360
Venezuela #	150	142	140
Other countries	653	667	657

*Source: World Mineral Production, 2007-2011*  
@ Including shares of production from the Neutral Zone.  
# Including oil from shale and coal.

## FOREIGN TRADE

### Exports

Exports of crude petroleum increased sharply to 21 thousand tonnes in 2011-12 as compared to that in the preceding year. Almost all the exports were to Singapore. Exports of natural gas in 2011-12 decreased considerably to 22,218 tonnes against 27,244 tonnes in 2010-11. Exports were almost entirely to Nepal (Tables - 13 and 14).

Exports of petroleum products (total-including light distillates, middle distillates and heavy ends) increased by 2.35% to 60.52 million tonnes in 2011-12 as compared to 59.13 million tonnes in the preceding year.

### Imports

Imports of crude petroleum increased considerably to 165.71 million tonnes in 2011-12, over the preceding year level of 153.12 million tonnes. Imports were mainly from Saudi Arabia (19%), Iraq (14%), Kuwait (11%), Nigeria, UAE & Iran (9% each), and Venezuela (6%). Imports of natural gas increased drastically to 13.20 million tonnes in 2011-12 from 9.77 million tonnes in 2010-11. Main suppliers were Qatar (76%), Nigeria (10%) and Egypt A. Rep (4 per cent each) (Tables - 15 and 16).

Imports of petroleum products (total) at 14.92 million tonnes in 2011-12 decreased by 13.96% as compared to 17.34 million tonnes in the preceding year. Besides, 9.70 million tonnes LNG was imported in 2011-12 as against 8.95 million tonnes in 2010-11.

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

Country	2010-11		2011-12	
	Qty (‘000 t)	Value (₹‘000)	Qty (‘000 t)	Value (₹‘000)
<b>All Countries</b>	<b>++</b>	<b>595</b>	<b>21</b>	<b>722969</b>
Singapore	-	-	21	703338
Bahrain	++	22	++	23
Mauritius	-	-	++	348
Nepal	-	-	++	19
Oman	++	23	++	23
Saudi Arabia	-	-	++	18784
Sri Lanka	++	23	++	434
Other countries	-	527	-	-

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

Country	2010-11		2011-12	
	Qty (t)	Value (₹‘000)	Qty (t)	Value (₹‘000)
<b>All Countries</b>	<b>27244</b>	<b>1191530</b>	<b>22218</b>	<b>1384872</b>
Nepal	26310	1161118	21572	1350388
Bangladesh	-	-	412	24096
Bhutan	191	6050	110	4040
Egypt	-	-	33	833
UAE	743	24358	71	4600
Other countries	++	4	20	915

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

Country	2010-11		2011-12	
	Qty (‘000 t)	Value (₹‘000)	Qty (‘000 t)	Value (₹‘000)
<b>All Countries</b>	<b>153120</b>	<b>4216162484</b>	<b>165712</b>	<b>6436885431</b>
Angola	8418	231685253	7976	314863396
Brazil	2966	77915794	3789	137018658
Iran	16083	419376295	14689	551088907
Iraq	14767	407338682	23778	901922110
Kuwait	14383	398933596	17918	687731836
Nigeria	16259	478602505	15386	650115715
Qatar	4836	140095419	6136	247494684
Saudi Arabia	26300	742434361	31415	1248931356
UAE	12657	358151739	14364	577637449
Venezuela	10147	237195738	9416	319877764
Other countries	26304	724433102	20845	800203556

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

Country	2010-11		2011-12	
	Qty (t)	Value (₹‘000)	Qty (t)	Value (₹‘000)
<b>All Countries</b>	<b>9765763</b>	<b>146481792</b>	<b>13199608</b>	<b>328736293</b>
Algeria	-	-	188814	6375849
Egypt	177724	4006308	522343	17125849
Japan	-	-	60437	2249884
Malaysia	68000	1469718	56009	2219885
Nigeria	292968	5644138	1356008	40468512
Oman	-	-	135613	3589883
Qatar	8053130	115831607	10000000	234002076
USA	184419	4304426	169733	4841742
Trinidad	263200	3576395	319526	9153104
Yemen Republic	137513	1694371	179526	3506142
Other countries	588809	9954829	211599	5203367



## FUTURE OUTLOOK

The country is deficient in oil resources and most of the domestic requirements are met through imports and this trend is likely to continue in future. 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.

Some of the recommendations of the Working Group on Petroleum & Natural Gas Sector for the 12th Five Year Plan (2012-17) are as follows:

### Exploration & Production Sector

- i. ONGC is to develop marginal fields located in west coast and other gas discoveries in east coast area during 12th Plan period. This will result in increase in natural gas production of ONGC by about 28 MMSCMD in 2016-17.
- ii. A National Data Repository (NDR) will comprise of reliable exploration and production data for India, with provisions for seamless access. Online data management would be drawn up which would be an essential part of an Open Acreage Licensing Policy (OALP).
- iii. Crude oil production is expected to increase by about 22% over the production in 11th Five Year Plan period. Natural gas production is expected to increase by about 57% during 12th Five Year Plan period.
- iv. OALP is expected to give further momentum to oil and gas exploration activities in the Indian sedimentary basins. An estimated area of about 3.96 lakh sq km is to be offered under NELP/OALP during 12th Plan.

### Acquisitions of Assets Abroad

- i. During the 12th Plan period, four oil PSUs together target to produce about 67 million tonnes of oil equivalent of oil and gas from overseas with an anticipated investment to the tune of ₹ 114,760 crore.

### Natural Gas

- i. With a targeted GDP growth rate of over 9%, India's energy demand is expected to grow at 5.2%.
- ii. GOI has adopted a multi-pronged strategy to enhance availability of natural gas in the country through (a) intensification of domestic E&P activities through NELP, (b) Coal Bed Methane Exploration & Production activities, (c) Developing underground Coal Gasification and (d) Target Unconventional sources like Shale Gas, Gas Hydrates, etc.
- iii. Price sensitivity is a major issue which is limiting LNG imports and hence, it is imperative to launch progressive reforms across the gas value chain. LNG imports into the country and development of downstream markets to ensure off take will remain at the core of the natural gas sector in the days to come.

### Refining

- i. Transformation in the Indian refining Sector to continue. Refinery capacity is expected to increase from 232.3 million tpy in 2011-12 to 310.9 million tpy by the end of 12th Plan.
- ii. Refinery configurations to undergo further change. Hydrogen production and management, sulphur removal and recovery, changing hydrocarbon species in product pool will continue to drive these changes. The emphasis on green technologies will add to these changes.
- iii. Refinery-Petrochemicals integration is an essential driver to economic growth as well as corporate profitability. Significant opportunity exists for refinery-petrochemical integration.
- iv. Dependence on crude oil imports is likely to go up from around 80% in 2011-12 to 86.7% in 2016-17.
- v. Existing port-infrastructure needs to be strengthened to handle additional Crude and POL imports/exports.
- vi. In order to ensure energy security in case of any emergency, strategic storage facilities are under construction at Visakhapatnam, Mangalore and Padur. A scheme for filling crude oil in the caverns has been proposed.