

PETROLEUM AND NATURAL GAS



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PETROLEUM AND NATURAL GAS

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

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39 Petroleum and Natural Gas

The domestic production of crude oil stood at 37.8 million tonnes in 2013-14 which decreased by 0.3% compared to the output in the corresponding period of last year. Whereas, the net production of natural gas (utilised) decreased to 35,407 million cu metres in 2013-14 which is 13% less as against the production in 2012-13. As on 01.04.2014, the refining capacity in the country was up by 2.0 million tonnes year-over-year (YoY) basis to touch 215.066 million tonnes. With this jump, India's share in total refinery capacity in the world has increased to 4.56 percent.

RESOURCES

As on 1.4.2014, total reserves of crude oil were estimated at 762.74 million tonnes (379.37 million tonnes in onshore and 383.37 million tonnes in offshore areas). Those of natural gas are placed at 1,427.15 billion cu m (464.99 billion cu m in onshore and 962.16 billion cu m in offshore areas) (Table - 1).

Table – 1 : Reserves of Crude Oil and Natural Gas in India as on 1.4.2014 (P)

Area	(Crude oil in million tonnes; natural gas in billion cu m)	
	Crude oil	Natural gas
India	762.74	1427.15
Onshore	379.37	364.41
Andhra Pradesh	11.45	48.20
Assam*	178.79	184.31
Gujarat	135.01	72.96
Rajasthan	45.00	14.02
Tamil Nadu	9.12	44.92
Offshore	383.37	1076.76
Western offshore @	327.28	505.67
Eastern offshore#	56.09	571.09

Source: Indian Petroleum and Natural Gas Statistics, 2013-14, 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 Oil and Natural Gas Corporation (ONGC) and Oil India Limited (OIL), the two National Oil Companies (NOC) and a few private and joint venture companies were engaged in exploration and production activities of oil and natural gas, including Coal Bed Methane in the country. As on 1.4.2014, there were in all 449 oil/gas fields under these companies including offshore areas.

In public sector, ONGC's jurisdiction extended to 374 fields – Cambay basin (Gujarat) – 92 oil/gas fields, Upper Assam – 34 fields and Assam & Assam Arakan – 8 fields, Jodhpur (Rajasthan) – 8 fields, Krishna-Godavari basin (Andhra Pradesh) – 61 fields, Cauvery basin (Tamil Nadu) – 31 fields, Assam & Assam Arakan in Tripura - 11 fields and Assam & Assam Arakan in Nagaland – 2 fields, Mizoram - 1 field, besides, 76 offshore fields in the Mumbai offshore, eight in Kachchh, two in Cambay basin in West Coast and 40 offshore fields in Cauvery, Mahanadi 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 30 fields, Kharsang basin (Arunachal Pradesh) at 1 field, Amguri basin (Assam) at 1 field, Jharia & Bokaro (Jharkhand) at 1 field (CBM) each, Sohagpur (Madhya Pradesh) at 2 field (CBM), Rajasthan at 7 fields and Raniganj East basin (West Bengal) at 2 field 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 3 fields in Mumbai basin and 2 fields in Cambay basin on the West Coast.

Highlights of exploration carried out by ONGC and OIL during 2013-14 are furnished below:

During 2013-14, ONGC carried out seismic surveys and acquired 475.03 GLKM of 2D and 1173.52 SKM of 3D seismic data in the onland area. A total of 106 exploratory wells with a meterage of 320,765 and 283 development wells with a meterage of 596,794 have been drilled.

Exploratory efforts of ONGC during 2013-14 resulted in 14 oil and gas discoveries (7 onland and 7 offshore areas) in domestic fields. Out of these, 6 discoveries were made in the new prospects, whereas 8 were new pool discoveries. A total of five discoveries were made in New Exploration Licencing Policy blocks and nine in the nomination blocks. The new discoveries made during the year were: Seripalem, Gedanapalli and Mendapata south Godavari district (east & west) in KG basin onland Andhra Pradesh, Gandhar, Sobhasan, Nandasan in Bharuch & Mehsana in Gujarat on western onshore, one Khubal in North Tripura, KGOSNO41 NANL 1&2 and Padmavati in east coast offshore area, GK28 & 42 in western offshore areas.

ONGC as a consortium has been awarded seven blocks (five on land and two shallow water blocks) in the NELP-IX round and PSC was signed in March 2012. Out of 7 blocks, ONGC is the operator in 5 blocks and OIL in 2 blocks.

The ultimate reserve accretion of oil and oil equivalent gas (O+OEG) in 2013-14 in domestic assets of ONGC was 84.99 million tonnes. The total ultimate reserves of oil and oil equivalent gas (O+OEG) of ONGC as on 1.4.2014 was 2,849.04 million tonnes.

During 2013-14, OIL covered, under onshore seismic survey, 232.92 (GLKM) of 2D and 189.73 (SQKM) of 3D in Assam & Arunachal Pradesh and 108.00 (SQKM) of 3D in Rajasthan. Also, 266.32 (GLKM) of 2D and 131.37 (SQKM) of 3D in Andhra Pradesh, 183.00 (SQKM) of 3D in Offshore in Maharashtra. OIL carried out exploratory and development onshore drilling of 105,111 m in 34 wells in Assam.

The details of discoveries of oil/gas made by OIL during 2013-14 are given below:

Sologuri-1(Loc-DIBC)

The well, located in West Sologuri Structure (onshore) within Dibrugarh PEL was drilled down to a depth of 3,962 m within basement to probe the hydrocarbon prospects within Paleocene-Eocene formations. The well has encountered a few prospective sand ranges within Lakadong + Therria formation and is currently

producing oil from one of the tested sands. The discovery of oil in this well has opened up new avenues for exploration and exploitation of hydrocarbon in Paleocene-Eocene-Formations in Sologuri area.

South Kathaloni-3 (Loc.HVX)

The well, located in South Kathaloni structure (onshore) within Hugrijan M/L was drilled down to 3710 m within basement to probe the hydrocarbon prospects within Paleocene-Eocene formations. The well has encountered a few prospective sand ranges within Lakadong + Therria formation and is currently producing oil from one of the tested sands. The discovery of oil in this well has opened up new avenues for exploration and exploitation of hydrocarbon in Paleocene-Eocene-Formation in South Kathaloni area.

Baruanagar-3(Loc.BE)

The well, located in Baruanagar structure (onshore) within Borhat PEL (now converted to Borhat ML) was drilled down to 4,375 m to probe the hydrocarbon prospects within Lakadong + Therria formations. The well has encountered a few prospective sand ranges within Lakadong + Therria formation. The discovery of oil in this well has opened up a new area for exploration and exploitation of oil in Baruanagar area.

Nahorkatiya-610 (Loc-HVJ)

The well, located in East Deohal structure (onshore) within Hugrijan ML was drilled down to 2,984 m to probe the hydrocarbon prospects within Barail formations. The well has encountered prospective sand range within Barail formation and is currently producing gas from the tested sands. The discovery of gas in this well has opened up new areas for exploration and exploitation of hydrocarbon in Barail Formation in East Deohal structure.

Nahorkatiya-614 (Loc NLE)

The well, located in the Central Part of Jaipur Structure (onshore) within Nahorkatiya Extension ML was drilled down to a depth of 3,233 m to probe the hydrocarbon prospects within Barail and Tipam formations. The well has encountered a few prospective sand ranges within

Tipam formation and is currently producing oil from one of the tested sands. The discovery of oil in the Middle Tipam Formation has opened up a new reservoir for exploration and exploitation of oil in Jaipur area.

Nahorkatiya-405(Loc HDL-II)

The well lies in the South Nagajan area of Greater Jorajan oilfield(onshore) within Hugrijan ML and has discovered gas on testing the new/unappraised Upper Tipam sand during workover operations. The discovery of gas in this well has opened up a new reservoir for exploration and exploitation of gas in South Nagajan area.

Lassa-1(South Africa) (Loc SC)

The well Lassa-1 located in Lassa structure of Shakhi Bloc, Gabon, South Africa was drilled to a depth of 2141 m within basement to probe the hydrocarbon prospects within N'Dombo Formation. The well has encountered two hydrocarbon prospective sand ranges within the targeted formation and on testing produced oil along with some amount of gas. The oil discovery in the Shakhil Block, Gabon, within the N'Dombo Formation in well Lassa-1 marks Oil India Limited (OIL) maiden success in overseas exploration venture as operator and open up areas for future exploration and exploitation within the block.

RIL's Performance

There are 4 blocks which are under development and production including KG-D6 in Krishna Godavari offshore basin, Panna-Mukta and Tapti in Mumbai offshore basin and NEC-25 in the Mahanadi basin.

KG-D6 Block: The KG-D6 fields produced 178.3 BCF of natural gas and 3.3 million barrels (MMBBL) of crude oil and condensate in 2013-14, reduction of 30% in case of liquid portion and 47% in case of natural gas on a YoY basis. The fall in production is mainly attributed to geological complexity, natural decline in the fields and higher than envisaged water ingress.

To augment production from the current fields (D1-D3 and MA), various Base Management actions have been planned for maximising value from these fields. These include to maximise the recovery from the field, well intervention jobs were planned for execution in phases, reservoir top set drilling of a substitute well has been completed, and further drilling, completion and connections are planned to be undertaken during 2015-16. Besides side tract activities are planned and well options have been prioritised.

In D 26 field, well MA 6H and MA 5H side track have been completed successfully and put on production.

Additionally, potential upside through resource accretion is being targeted by undertaking exploration drilling in the existing production area with the approval of Government of India. MJ1 exploratory well in D1-D3 ML area is under drilling, targeting the Mesozoic synrift clastic petroleum system, similar to the MA oil and gas field.

Panna-Mukta and Tapti (PMT) Block: During 2013-14, PMT JV achieved the significant milestone of 500 million barrels of oil equivalent (MMBOE) of oil and gas production. Panna-Mukta fields produced 7.4 MMBBL of crude oil and 65.4 BCF (billion cubic feet) of natural gas in 2013-14, a reduction of 9% in case of crude oil and in case of natural gas 8% on YoY basis. The decrease was due to underperformance of new wells as well as the natural decline in reserves.

Tapti produced 0.3 MMBBL (million barrel) of condensate and 27.3 BCF of natural gas in 2013-14, a decline of 48% and 38% respectively, on YoY basis. The decrease was due to the underperformance of new wells, as well as natural decline in reserves.

Additionally, Mukta-B development project is at an advanced stage of completion. Drilling of six development wells is scheduled to commence during 2015-16.

Domestic Exploration Blocks

Apart from KG-D6, Panna-Mukta & Tapti and NEC-25 blocks, RIL along with JV partners made two significant hydrocarbon discoveries during 2013-14 i.e. Discovery (D-55) in well MJ1 drilled in KG D-6 block situated in Krishna Godavari basin and Discovery (D-56) in exploration block CY D5 situated in Cauvery basin.

D-55: The KG D6-MJ1 well was drilled in a water depth of 1,024 metres and to a total depth of 4,509 metres to explore the prospects of a Mesozoic Synrift Clastic reservoir, lying over 2,000 metres below the already producing reservoirs in the D1-D3 gas field.

D-56: As part of the minimum work programme in this block, exploratory well CY-III D5S1 which was drilled in water depth of 1,743 metres, to a total depth of 5,731 metres, with the primary objective of exploring Mesozoic aged reservoirs has resulted in gas condensate discovery.

Coal Bed Methane (CBM)

Development activities are progressing in RIL's two CBM blocks (Sohagpur East and West) with first gas being targeted in the mid of 2015-16.

The development phase for these blocks are under progress. Govt. of India on 18/10/2014 notified New 'Domestic' Natural Gas Price Guideline 2014.

Reliance Gas Pipe line Ltd, a subsidiary of RIL is building a natural gas pipeline from Shahdol in M.P. to Phulpur in Uttar Pradesh to transport gas from its CBM blocks.

The pipeline work will be completed by second half of 2015-16.

PRODUCTION

Petroleum (Crude)

Production of petroleum (crude) in the country stood at 37.8 million tonnes in 2013-14 registered a nominal decrease of 0.2% as compared to that in the previous year. Bulk of the total production (68%) was shared by the public sector companies. Private sector companies accounted for the remaining 32% (Table-2).

Offshore areas continued to be the largest producer of petroleum (crude) in 2013-14 with a share of 48.2% of the country's output. Next in order were Rajasthan with a contribution of (24.3)%, Gujarat with (13.4)%, and Assam with (12.4) percent. The remaining (1.7%) production was reported by Andhra Pradesh, Tamil Nadu and Arunachal Pradesh.

During 2013-14, the production of petroleum (crude) recorded increase in Rajasthan by (6.8)%, and Arunachal Pradesh by 0.7%, whereas, there was a decline in production in Arunachal Pradesh by (8.3)%, Gujarat by (5.1)%, Tamil Nadu (5%), Assam (3.1%) and Offshore areas (1.2) percent as compared to the previous year.

Natural Gas (Utilised)

The production of natural gas (utilised) at 35,407 mcm registered a decrease of 13% in 2013-14 as compared to that in the previous year

Offshore areas continued to be the largest producers of natural gas (utilised) with a share of 74.5%. Next in the order were Assam with a share of (8.1%), Gujarat (4.7%), Tamil Nadu (3.7%), Andhra Pradesh (3.3%), Rajasthan (2.8%), Tripura (2.3%). West Bengal and Arunachal Pradesh accounted for the remaining 0.6% of the total production.

Statewise analysis revealed that Rajasthan, Tripura, Tamil Nadu, West Bengal recorded an increase in production, whereas, offshore areas, Gujarat, Andhra Pradesh and Assam recorded decrease in production of natural gas in 2013-14 as compared to the previous year.

The production of natural gas increased in West Bengal by (55.1%), Rajasthan by (43.4%), Tripura by (27%), Tamil Nadu by (8.1) percent. The decline in production was recorded in Gujarat by (18.5%), offshore areas by (17%), Andhra Pradesh by (6.2%) and Assam by (1.4) percent.

As much as 73.2% of the total production resulted from the public sector companies, whereas, the remaining 26.8% was accounted to the private sector companies during the year 2013-14 (Table - 3).

Domestic prices of petroleum (crude) in 2011-12 to 2013-14 are furnished in Table-4.

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Table – 2 : Production of Petroleum (Crude), 2011-12 to 2013-14(P)
(By States)

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

State	2011-12		2012-13		2013-14(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	38090	692017330	37862	688171117	37788	686826110
Public sector	27563	500763289	26222	476605119	25711	467317300
Private sector	10527	191254041	11640	211565998	12077	219508810
Andhra Pradesh	305	5541226	295	5361853	297	5398204
Arunachal Pradesh	118	2143819	121	2199269	111	2017511
Assam	5025	91293964	4863	88388784	4710	85607891
Gujarat	5780	105010768	5331	96895046	5061	91987587
Rajasthan	6552	119036428	8593	156184417	9180	166853596
Tamil Nadu	247	4487484	238	4325834	226	4107725
Offshore	20063	364503641	18421	334815914	18203	330853596

Table – 3 : Production of Natural Gas (Utilised), 2011-12 to 2013-14(P)
(By States)

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

State	2011-12		2012-13		2013-14(P)	
	Quantity	Value	Quantity	Value	Quantity	Value
India	47559	342107011	40679	336420537	35407	292820422
Public sector	25950	186666602	26188	216578112	25910	214279016
Private sector	21609	155440409	14491	119842425	9497	78541406
Andhra Pradesh	1363	9804492	1249	10329390	1171	9684320
Arunachal Pradesh	40	287733	41	339075	41	339075
Assam	2905	20896589	2910	24066072	2868	23718727
Gujarat	2173	15631080	2032	16804900	1657	13703602
Rajasthan	590	4244057	685	5665038	982	8121266
Tamil Nadu	1285	9243414	1206	9973774	1304	10784247
Tripura	644	4632497	647	5350773	822	6798045
West Bengal (CBM)#	84	604239	107	884904	166	1372841
Offshore	38475	276762910	31802	263006611	26396	218298299

Includes Jharkhand and Madhya Pradesh

CBM: Coal Bed Methane

Source: Ministry of Petroleum & Natural Gas

Table – 4 : Prices of Petroleum (Crude), 2011-12 to 2013-14(P)

(In ₹ per tonne)

Grade	Market	2011-12	2012-13	2013-14(P)
Indigenous*	Onshore	41143	43656	45600
Indigenous*	Offshore	42902	46134	49911
Indigenous*	Offshore & Onshore	42293	45295	48504
Imported	c.i.f. Indian Port (average)	38444	42389**	

Source: Indian Petroleum & Natural Gas Statistics, 2013-14 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 and linked to international crude prices.

** M&MS Division, IBM.

INDUSTRY

The total refining capacity of 22 units in operation in the country was about 215.066 million tpy in 2013-14, with a share of about 4.56% in the estimated world refinery capacity of 4,712.3 million tpy during year 2013. In 2013-14, refinery crude throughput increased to 222.50 million tonnes from 219.21 million tonnes in 2012-13 (Table-5).

In the next few years, about 30.0 million tonnes of additional refining capacities in both brownfield and greenfield expansion are reportedly expected to come on stream. The new refineries that are under implementation and coming up in the near future are Indian Oil Corporation Ltd, Paradeep, Odisha (15.0 million tonnes), Nagarjuna Oil Corporation Ltd, Cuddalore, Tamil Nadu (6.0 million tonnes), and Hindustan Petro Chemical Ltd, Barmer, Rajasthan (9.0 million tonnes).

During the 12th five year plan period, capacity augmentation to the tune of 53.1 million tonnes are planned as per annual report of Ministry of Petroleum & Natural Gas. Out of these, 32.1 million tonnes of capacity expansion is planned by PSU refineries. The capacity expansion by JV and private refineries during the same period are planned for three million tonnes and 18 million tonnes, respectively. The capacity of Essar refinery, Vadinar, Gujarat is expected to rise by 18 million tpy after brownfield expansion. The capacity augmentation at Bharat Oman Refinery Ltd, Bina, M.P. plans to achieve 9.0 million tpy in near future.

Production of various petrochemicals from these refineries during 2011-12 to 2013-14 is given in Table-6.

CONSUMPTION

Total consumption of petroleum products (excluding Refinery Boiler Fuel) increased to 158.20 million tonnes in 2013-14 from 157.06 million tonnes in 2012-13.

Consumption of Petroleum Coke increased by 14.96%, LPG by 4.7%, Motor spirit by 8.79% and ATF by 4.44% during 2013-14 as compared to that of during 2012-13, whereas the consumption of Naptha declined by 6.79%, Kerosene by 4.49%, HSDO by 1.03%, Fuel oil by 19.11% and Lube 9.55% during 2013-14 as compared to 2012-13.

The consumption of various petroleum products from 2011-12 to 2013-14 is given in Table-7.

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. To give a fillip, the Government has initiated vigorous exploration & development for coal bed methane, gas hydrates, hydrogen, bio-diesel and ethanol.

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 greenhouse 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 has the fourth largest proven coal reserves in the world and therefore, holds significant prospects for exploration and exploitation of CBM. 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 offered through international competitive bidding for exploration and production of CBM in the country for the first time in May 2001. So far, under CBM policy, the Government has awarded 30 CBM blocks in four rounds of bidding to National, Private & Joint Venture Companies. In addition, 2 CBM blocks were awarded on nomination basis and one block through Foreign Investment Promotion Board (FIPB) route. These CBM blocks are in the states of Andhra Pradesh, Assam, Chhattisgarh, Gujarat, Jharkhand, Madhya Pradesh, Maharashtra, Odisha, Rajasthan, Tamil Nadu and West Bengal.

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Table – 5 : Installed Capacity and Crude Throughput in Refineries

(In '000 tonnes)

Refinery	Annual installed capacity (as on 1.4.2014)	Refinery Crude throughput		
		2011-12	2012-13	2013-14(P)
Total	215066	204119	219211	222498
Public/Joint Sector	120066	120892	120301	119548
IOCL, Guwahati, Assam	1000	1058	956	1019
IOCL, Barauni, Bihar	6000	5730	6344	6478
IOCL, Koyali, Gujarat	13700	14253	13155	12960
IOCL, Haldia, West Bengal	7500	8072	7490	7952
IOCL, Mathura, Uttar Pradesh	8000	8202	8561	6641
IOCL, Bongaigaon, Assam	2350	2188	2356	2328
IOCL, Digboi, Assam	650	622	660	651
IOCL, Panipat, Haryana	15000	15496	15126	15098
BPCL, Mumbai, Maharashtra	12000	13355	13077	12684
BPCL (formerly KRL), Kochi, Kerala	9500	9472	10105	10285
HPCL, Mumbai, Maharashtra	6500	7506	7748	7785
HPCL, Visakh, Andhra Pradesh	8300	8682	8028	7776
CPCL, Manali, Tamil Nadu	10500	9953	9105	10065
CPCL, Nagapattinam, Tamil Nadu	1000	611	640	559
MRPL, Mangalore, Karnataka	15000	12798	14415	14589
NRL, Numaligarh, Assam	3000	2825	2478	2613
ONGC, Tatipaka, Andhra Pradesh	66	69	57	65
Joint Venture	15000	2048	10636	14721
Bharat Oman Refineries Ltd, Bina [@]	6000	2048	5732	5450
HPCL, Bathinda [#]	9000	-	4904	9271
Private Sector	80000	81179	88274	88229
RIL, Jamnagar, Gujarat	33000	32497	32613	30307
RIL (SEZ), Jamnagar, Gujarat	27000	35186	35892	37720
Essar Oil Ltd, Vadinar, Gujarat	20000	13496	19769	20202

Figures rounded off.

Source: Indian Petroleum and Natural Gas Statistics, 2013-14, Ministry of Petroleum & Natural Gas, Government of India.

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

[#] 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. Excludes other inputs from RIL refineries crude throughput during 2010-11, 2011-12 & 2012-13 .

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Table – 6: Production of Petroleum Products from Refineries, 2011-12 to 2013-14(P)

(In '000 tonnes)

Product	Production		
	2011-12(R)	2012-13	2013-14(P)
A) FROM CRUDE OIL	198562	213219	216455
(a) LPG	7333	7694	7890
(b) Mogas	27186	30118	30275
(c) Naphtha	17135	17354	17038
(d) Kerosene	7789	7868	7338
(e) ATF/RTF/Jet A-1	10051	10077	11210
(f) HSD	82864	91085	93742
(g) LDO	502	400	423
(h) Furnace oil	16732	13690	12920
(i) LSHS/HHS/RFO	1701	1364	485
(j) Fuel Oils*	18433	15054	13405
(k) Lube oils	1028	896	941
(l) Bitumen	4610	4670	4785
(m) Petroleum coke	7837	10943	12068
(n) Total Waxes	54	57	56
(o) Others	13740	17003	17284
B) FROM NATURAL GAS			
LPG	2214	2130	2140

Source: Indian Petroleum & Natural Gas Statistics, 2012-13, Ministry of Petroleum & Natural Gas, Government of India.
Note: Include production of RIL SEZ in the year 2011-12, 2012-13 & 2013-14 which includes other inputs.

* Fuel Oil figures not included in total.

The estimated CBM resources are of the order of 2600 Billion Cubic Metres (BCM) or 91.8 Trillion cubic feet spread across 11 states in the country. Out of these, about 280.3 BCM (9.90 TCF) of CBM reserves have been established as recoverable by different operators as on 31.03.2014.

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 in Raniganj (South) block in West Bengal operated by Great Eastern Energy Corporation Limited (GEECL). Current production in the block is about 0.32 MMSCMD (million metric standard cubic metre per day). Additionally, two blocks, Raniganj (East) block operated by Essar Oil Limited is producing @ 0.14 MMSCMD and Jharia operated by ONGC is producing @ 10,000 standard cubic metre per day (SCMD). Therefore, the total CBM production during the year 2013-14 was around 0.6 MMSCMD from 3 CBM blocks. Some more CBM blocks are expected to start commercial production in near future. The total CBM production is expected to be around 4 MMSCMD by the end of the 12th plan.

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 permafrost region 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.

World over gas hydrate production is in research & development stage. India is the third country after USA and Japan, where R&D work on gas hydrates has commenced. National Gas Hydrate Programme (NGHP), steered by the Ministry of Petroleum & 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.

**Table – 7 : Consumption of Petroleum Products
2011-12 to 2013-14* (P)**

(In '000 tonnes)			
Product	2011-12	2012-13	2013-14(P)
1. Light distillates of which	43870	46272	47748
(a) LPG	15350	15600	16336
(b) Motor Spirit	14992	15744	17127
(c) Naphtha+NGL	11222	12289	11454
(d) Others	2306	2639	2831
2. Middle distillates of which	79415	82702	81839
(a) SKO	8229	7502	7165
(b) ATF	5536	5271	5505
(c) HSDO	64750	69080	68369
(d) LDO	415	399	386
(e) Others	485	450	414
3. Heavy ends of which	24848	28084	28610
(a) Furnace oil/ LSHS	9307	7656	6193
(b) Lubes Greases	2633	3196	2891
(c) Bitumen	4638	4676	4938
(d) Petroleum coke	6138	10135	11651
(e) Others	2132	2421	2937
Total (1+2+3)	148133	157058	158197

Source: Indian Petroleum & Natural Gas Statistics, 2013-14, 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.*

Notes: Consumption data includes private sales & private imports too.

There are numerous potential offshore areas of gas hydrates accumulation within India's Exclusive Economic Zone. The NGHP expedition 01,02 &03 programmes has established the presence of gas hydrate in KG, Mahanadi and Andaman deepwaters. Various geoscientific studies have been carried out and these are at different stages of completion. During NGHP expeditions programmes, total six prospective sites have identified in KG offshore areas. Total 43 sites were proposed by ONGC to NGHP technical committee and the same were reviewed by international expert committee. The NGHP steering committee has approved 20 sites in Indian offshore for coring/drilling 40 wells in these sites. In addition a regional gas hydrate prospect map was generated for KG and Mahanadi basins of the identified prospective sites.

Shale Oil/Shale Gas

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 occur in many parts of the world ranging 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.

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.

Shale Gas can emerge as an important new source of energy in the country. India has several Shale formations which seem to hold Shale Gas. The Shale Gas formations are spread over several sedimentary basins such as Gangetic plain, Gujarat, Rajasthan, Andhra Pradesh and other coastal areas in the country including hydrocarbons bearing ones-Cambay, Assam-Arkan & damodar basins have large shale deposits. The details of estimations of shale gas/oil resource potential made by various agencies in selected sedimentary basins/sub-basins are stated below:

(i) M/s Schlember: 300 to 2100 TCF of shale gas resources for the country.

(ii) Energy Information Administration (EIA), USA in 2011: 290 TCF of shale gas in Cambay onland, Damodar-Krishna, Godavari onland and Cauvery onland.

(iii) EIA in 2013: 584 TCF of shale gas and 87 billion barrels of shale oil in above stated four basins.

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(iv) ONGC: 187.5 TCF of shale gas in 5 basins, these are Assam-Arkan and four other mentioned above.

(v) CMPDI: 45 TCF of shale gas in 6 sub basins viz. Jharia, Bokaro, North Karanpura, South Karnapura, Raniganj and Sohagpur.

(vi) USGS has also estimated recoverable shale gas resources of 6.1 TCF in three basins viz. Cambay onland, KG onland and Cauvery onland. Further, it is indicated that these basins have potential for shale oil too.

After the notification of New Shale Gas Policy in October, 2013, ONGC has recently completed drilling of first pilot shale gas well in Jambusar area in Cambay basin. It has also identified and submitted 50 nomination blocks to Ministry of Petroleum & Natural Gas. Of these, 28 blocks are in Cambay basin, 10 in KG basin, 9 in Cauvery basin and 3 in Assam Shelf. Process of nominations of these blocks has been completed and work is in progress.

Shale gas exploration and its production is one of the key elements of ONGC's Perspective Plan (PP-2030) wherein an accretion potential of 850 to 1150 MMtoe and production potential of 80 to 140 MMtoe have been envisaged by the year 2030. ONGC plans to take up shale gas activities proactively in different Indian basins. About 20 pilot wells are planned to be drilled in KG, Cauvery and A & AA basins in 2014-15, besides continuation of the pilot programme in Cambay basin where in one more location, GNSG-1 has been released in the Bharuch depression which will be taken up for drilling shortly. Success in these envisaged shale gas pilot programme will help in unlocking the unconventional shale gas and oil reserves in different basins.

ONGC was entrusted with the task of preparing the Information Docket (ID) for the identified basins by DGH along with generation of prospective area maps and estimation of resource potential for shale gas of these basins. ONGC has prepared and submitted shale gas information dockets of Cambay, KG, Cauvery, A & AA, Ganga, Jaisalmer basin in Rajasthan, Kutch and Vindhyan basins to DGH.

OIL has identified five blocks, of these, four blocks in Uppar Assam areas viz. Jairampur Extension, Chabua, Dum Duma & Dibrugarh and Jaisalmer in Rajasthan area in its nominated Petroleum Exploration Licence / Petroleum Mining Lease areas for exploration of shale gas/oil based on the available geoscientific data.

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. A number of 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/H₂S utilising solar energy - IOC (R&D)/IT-BHU.

Hydrogen upto 20% (by volume) can be blended with Compressed natural Gas (CNG) for use as an automobile fuel.

Bio-diesel

Bio-diesel is a fatty acid having properties similar to diesel derived from crude oil by distillation process which can be a substitute of High Speed Diesel (HSD). The properties of bio-diesel are such that it can be mixed with any diesel fuel. It is extracted from the seeds of the trees like Mahua, Karanja, Kusum, Dhupa, Undi, Simarouba, Sal, Pilu, Jojoba, Tumba, Nahor, Kokum, Rubberseed, Cheura, Wild-Apricot, Tung, Neem, Mango, Kernel and Jatropha. Of these, Jatropha curcas has been found most suitable for the purpose. It can be planted on under-stocked forest lands, field boundaries to provide protective hedge, fallow lands, as agro forestry on farmlands along with agricultural crops, public lands along railway tracks, highways, canals and community and government lands in villages. The R&D studies indicated that a bio-diesel/diesel blend results in a fuel that is non-toxic, biodegradable and non-flammable with a very high flash point. It enhances the life of the engine and results in less pollution.

To encourage production of bio-diesel in the country, the Ministry of Petroleum and Natural Gas announced a Bio-diesel Purchase Policy, in October 2005, which became effective from 01.01.2006. Under this scheme, Oil Marketing Companies (OMCs) are to purchase Bio-diesel, meeting the fuel quality standard prescribed by BIS for blending with High Speed Diesel to the extent of 5% at identified purchase centres across the country. The Policy has identified 20 purchase Centres of the public sector OMCs all over the country. The OMCs would purchase bio-diesel from those bio-diesel manufacturers who register with them after satisfying the technical specifications, at a specified delivered price.

Ministry of New and Renewable Energy, Government of India has promulgated the National Policy on Bio-fuels, in December 2009. As per the policy, the responsibility of storage, distribution & marketing of Biofuels rests with OMCs. The minimum purchase price for bio-diesel will be determined by the National Biofuel Steering Committee and decided by National Biofuel Coordination Committee taking into account the entire value chain comprising production of oil seeds, extraction of bio-oil, its processing blending, distribution and marketing. The Minimum Purchase Price (MPP) for bio-diesel by

the OMCs will be linked to the prevailing retail diesel price.

OMCs have reviewed the procurement price of bio-diesel at the various purchase centres accordingly and presently the declared price of Bio-diesel is 42.50 per litre w.e.f. 26.10.2013. However, the Bio-diesel manufacturers have not come forward to sell their Bio-diesel produce to OMCs at this declared price.

Ethanol

To reduce dependence on imported oil by way of encouraging use of indigenous sources of energy, Ministry of Petroleum & Natural Gas (MoPNG) 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. In a series of steps aimed to boost the EBP Programme, the Government decided on 22.11.2012 that 5% mandatory ethanol blending with Petrol should be implemented across the country. The 5% mandatory blending is to be reckoned for the country as a whole and was to be achieved by 30.06.2013. Procurement price of ethanol was to be decided between Oil Marketing Companies (OMCs) and suppliers of ethanol and in case of any shortfall in domestic supply, the OMCs and Chemical Companies would be free to import ethanol. Accordingly, a Gazette Notification was issued by MoPNG on 02.01.2013 directing OMCs to implement the Government decisions of 22.11.2012.

Subsequently, Cabinet Committee on Economic Affairs decided on 03.07.2013 that sugarcane or sugarcane juice may not be used for production of ethanol and it be produced only from molasses and that OMCs will procure ethanol only from domestic sources to achieve the mandatory requirement of 5% ethanol blending with Petrol by October 2013 in areas/parts of the country where sufficient quantity of ethanol is available. In other parts of the country, blending of ethanol may be increased progressively depending upon the availability of ethanol to reach the 5% mandatory level. OMCs and Sugar Industry Associations may interact with each other on a regular basis to achieve the target.

Pursuant to the above mentioned decisions, OMCs are implementing the Programme in the notified 20 States and 4 UTs as per the availability of Ethanol by procurement of ethanol through a tender process.

POLICIES AND CONTRACTS

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. Similarly, the Government is encouraging National Oil Companies to aggressively pursue oil and gas opportunities overseas.

Taking into account the oil security concerns of India, the Government has also decided to build a Strategic Crude Oil Reserve of 5 million tonnes at three locations in the country viz. Visakhapatnam, Andhra Pradesh (1.0 million tonnes), Mangalore, Karnataka (1.5 million tonnes), and (iii) Padur, Karnataka (2.5 million tonnes) through a special purpose vehicle (SPV) named Indian Strategic Petroleum Reserves Ltd (ISPRL), a subsidiary company of OIIB. The capacity of Visakhapatnam site was subsequently enhanced to 1.33 MMT (million metric tonnes). Thus, storage capacity has been enhanced to 5.33 MMT. The construction works are in progress at all these project. Commissioning of the Visakhapatnam facility is expected by September 2014. Commissioning of Mangalore and Padur projects is expected by October 2015.

The need for additional crude oil storage is being felt in the light of increasing requirement of crude oil in the country. ISPRL was entrusted with the responsibility of preparation of Detailed Feasibility Reports (DFRs) for 12.5 MMT of Strategic Storage of Crude oil in Phase-II in four States, namely, Rajasthan, Odisha, Gujarat and Karnataka. The DFR's have been prepared by EIL with capacities proposed as Chandikhol 3.75 MMT, Rajkot 2.5 MMT, Bikaner 3.75 MMT and Padur 2.5 MMT.

The New Exploration Licensing Policy (NELP) for exploration & production (E&P) of oil & natural gas (excluding Coal Bed Methane), and the Coal Bed Methane (CBM) Policy were formulated by the Government of India, with Directorate General of Hydrocarbons (DGH) as the nodal agency, during 1997-98 to provide a level playing field to both the Public and Private sector companies in exploration and production of hydrocarbons. NELP has steered steadily towards a healthy spirit of competition between National Oil Companies and private companies.

The Government had initiated bids under the New Exploration Licensing Policy in February 1999 to accelerate and expand exploration of oil and gas in the country. Under NELP, acreages are offered to the participating companies through the process of open international competitive bidding. The first round of offer of blocks was launched in 1999 and most of the ninth round awards were concluded in 2012. A total of 388 exploration blocks have been offered so far and 282 blocks have been awarded for which PSC signed under various rounds of NELP, spanning 1999-2012. As on 01.04.2014, total 152 blocks are active and 130 have already been relinquished.

The details of the exploration blocks awarded in NELP rounds are given in Table -8.

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

Table 8: Details of exploration block awarded

Round	Month/year award of block or PSC signed	No. of blocks awarded	Awarded Area (sq km)	Present* Area (sq km)
NELP-I	Apr, 2000	24	231527	17221
NELP-II	July, 2001	23	267883	5086
NELP-III	Feb, 2003	23	204608	15586
NELP-IV	Feb, 2004	20	192810	15197
NELP-V	Dec, 2005	20	115180	21560
NELP-VI	Mar, 2007	52	306389	95438
NELP-VII	Dec, 2008	41	112988	81471
NELP-VIII	Jun, 2010	32	52573	52573
NELP-IX	Mar, 2012	19	26428	26027

* Status of area as on 01.04.2014.

Source: Hydrocarbon exploration and production activities India 2013-14.

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 (GOI) has awarded total 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 these, three CBM blocks have already been relinquished in Gujarat, Madhya Pradesh and Maharashtra (one in each). Exploration activities have established significant finds in eastern and central India. Commercial CBM production has started since July 2007 in Raniganj (South) block in West Bengal which contributes about 0.32 MMSCMD (million metric standard cubic metre per day) of CBM production. Additionally, two blocks, Raniganj (East) block operated by Essar Oil Limited is producing @ 0.14 MMSCMD and Jharia operated by ONGC is producing @ 10,000 SCMD. Some more CBM blocks are expected to start commercial production in near future.

The energy demand is on rise with social and economic development in the country. Current hydrocarbon demand is much more than the domestic crude oil and natural gas production. In order to bridge the gap between energy supply and demand, it is imperative to accelerate the exploration and production (E&P) activities in the country. Therefore, GOI has adopted multi-pronged strategy for giving momentum to exploration and production in the country. The major steps taken in this regard includes offering of exploration blocks in Indian sedimentary basins through NELP, development of alternate sources of hydrocarbon such as CBM and Shale Gas, Research & Development for new sources such as Gas Hydrate, and carrying out E&P operations in safe and environment friendly manner.

The GOI has been reviewing the policies from time to time for encouraging exploration activity and investments. At present, oil & gas and CBM are under two different contract regimes. These two contractual regimes for allocation of acreages for E&P operations of hydrocarbons have different fiscal terms and conditions. The contracts under the New Exploration and Licencing Policy (NELP) for oil and gas are based on production sharing contract (PSC) where Government stake depends on biddable sharing of profit petroleum after allowing for cost recovery, while the contracts under CBM Policy provide for biddable revenue sharing based on production linked payment (PLP).

Considering the constraints experienced in the present PSC format and differences in fiscal and contractual regime for oil & gas and CBM, it is now proposed that the award of acreages for hydrocarbon exploration & production in future will be under a uniform licencing policy covering all types of hydrocarbons, with new fiscal terms ensuring ease of operation for E&P companies.

Under the revised policy, total 46 blocks (17 onland, 15 shallow water and 14 deep water blocks) are being offered under tenth round of New Exploration Licencing Policy (NELP-X) in 13 prospective sedimentary basins of India for exploration of oil and natural gas, covering an area of 166,053 sq km. These 46 blocks are falling in basin of Gujarat-Kachchh, Gujarat-Saurashtra, Mumbai, Kerala-Konkan, Cauvery, Krishna-Godavari, Mahanadi-NEC, Andaman, Bengal, Punjab plain, Rajasthan, Cambay & Deccan Synclise.

The Government has issued "Policy Guidelines for Exploration and Exploitation of Shale Gas and Oil on 14th October, 2013. Under this Policy, the right to exploration and exploitation of Shale Gas & Oil will lie with the National Oil Companies (NOCs) holding Petroleum Exploration Licence (PEL)/Petroleum Mining Lease (PML) granted under the nomination regime.

WORLD REVIEW

The world proved reserves of crude oil and natural gas at the end of 2013 were estimated at 238.2 billion tonnes and 187.7 trillion cu m, respectively (Tables - 9 and 10). The largest share of reserves of world crude oil is available in Middle East (45.92%) followed by South & Central America (21.45%), Europe & Eurasia (8.35%), Africa (7.26%), North America (14.69%) and Asia Pacific (2.3%).

Of the total world reserves of natural gas, Middle East possesses the largest share (43.24%) followed by Europe & Eurasia (30.48%), Asia Pacific (8.18%), Africa (7.65%), North America (6.30%) and South & Central America (4.15%).

The world crude petroleum production in 2013 increased to 4,425 million tonnes from 4,095 million tonnes in 2012. OPEC countries, namely, Algeria, Angola, Ecuador, Gabon, Indonesia, Iran, Iraq, Kazakhstan, Kuwait, Libya, Nigeria, Saudi Arabia, UAE and Venezuela had a share of about 45.4% in the world crude oil production in 2013. Saudi Arabia & Russia (12% each), UAE (11%), USA (10%), China (5%), Canada & Iran (4% each), Iraq, Kuwait, Mexico & Venezuela (3% each) were the principal producers of crude petroleum.

The world production of natural gas also marginally increased to 3.51 trillion cu m in 2013 from 3.47 trillion cu m in 2012. OPEC countries had a share of 15% in the world natural gas production in 2013. USA (20%), Russia (19%), Iran & Qatar (5% each), Canada (4%), and China, Norway & Saudi Arabia (3% each) were the major producers of natural gas in 2013 (Tables - 11 & 12).

The world consumption of oil in 2013 was estimated as 4185.0 million tonnes, while that of natural gas was 3020.9 million tonnes oil equivalent. Consumption of oil and natural gas in India in the same period was 175.2 million tonnes (with 4.19% share) and 46.3 million tonnes oil equivalent (with 1.53% share), respectively.

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

(In billion tonnes)	
Country	Reserves
World: Total	238.2
Brazil	2.3
China	2.5
Canada	28.1
Iran	21.6
Iraq	20.2
Kazakhstan	3.9
Kuwait	14.0
Libya	6.3
Nigeria	5.0
Qatar	2.6
Russian Federation	12.7
Saudi Arabia	36.5
UAE	13.0
USA	5.4
Venezuela	46.6
Other countries	17.5

*Source: BP Statistical Review of World Energy, 2014.
* At 2013 end.*

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

(In trillion cu m)	
Country	Reserves
World : Total	186.0
Algeria	4.5
Australia	3.7
Canada	2.0
China	3.3
Egypt	1.8
India	1.4
Indonesia	2.9
Iran	33.6
Iraq	3.6
Kazakhstan	1.5
Kuwait	1.8
Libya	1.5
Malaysia	1.1
Netherlands	0.9
Nigeria	5.1
Norway	2.0
Qatar	24.7
Russian Federation	31.3
Saudi Arabia	8.2
Turkmenistan	17.5
UAE	6.1
USA	9.3
Uzbekistan	1.1
Venezuela	5.6
Other countries	26.3

*Source: BP Statistical Review of World Energy, 2014.
* At 2013 end.*

Foreign Trade

Exports

Exports of natural gas drastically decreased in 2013-14 to 4,922 tonnes against 27,736 tonnes in 2012-13. Exports of natural gas were mainly to Nepal (63% and UAE (34%) (Table -13).

Exports of petroleum products (total- including light distillates, middle distillates and heavy ends) increased by 7.03% to 67.8 million tonnes in 2013-14 as compared to 63.41 million tonnes in the preceding year.

Imports

Imports of crude petroleum increased considerably to 189.18 million tonnes in 2013-14 as compared to 185.53 million tonnes in 2012-13. Imports were mainly from Saudi Arabia (21%), Iraq (13%), Venezuela & Kuwait (11% each), Nigeria (8%), UAE (7%) and Iran (6%). Imports of natural gas decreased marginally to 13.02 million tonnes in 2013-14 from 13.13 million tonnes in 2012-13. Main suppliers were Qatar (89%), Nigeria (5%), and Yemen Republic (4%) (Tables - 14 & 15).

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

Country	(In million tonnes)		
	2011	2012	2013
World : Total	3980	4095	4425
Algeria	74	67	69
Angola	84	87	87
Brazil	113	111	109
Canada	150	161	172
China #	204	207	208
Iran	206	177	166
Iraq	137	152	153
Kazakhstan	80	79	82
Kuwait @	140	154	151
Libya	22	71	46
Mexico	152	151	149
Nigeria	117	116	111
Norway	100	94	90
Qatar	78	83	84
Russia	509	517	523
Saudi Arabia @	526	547	542
UAE	151	155	466
UK	52	45	41
USA	359	409	464
Venezuela c	140	140	135
Other countries	586	572	577

Source: World Mineral Production, 2009-2013
 @ Including shares of production from the Neutral Zone.
 # Including oil from shale and coal.

Imports of petroleum products (total) at 16.72 million tonnes in 2013-14 increased by 5.98% as compared to 15.77 million tonnes in the preceding year. Besides, 13.03 million tonnes Liquefied Natural Gas (LNG) was imported in 2013-14 as against 13.14 million tonnes in 2012-13.

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

Country	(In '000 million cu m)		
	2011	2012	2013
World: Total	3379	3473	3509
Algeria	78	81	79
Argentina	46	44	44
Australia	54	60	61
Canada	145	141	140
China	102	107	117
Egypt	61	61	56
India	48	41	34
Indonesia	82	90	87
Iran	152	166	167
Kazakhstan	40	40	42
Malaysia	61	62	69
Mexico	58	57	57
Netherlands	76	76	81
Norway	102	115	109
Pakistan	42	44	43
Qatar	145	151	158
Russia	669	653	668
Saudi Arabia	99	103	103
Turkmenistan	59	62	62
UAE	52	54	56
UK	48	41	38
USA #	648	681	688
Uzbekistan	49	57	55
Other countries	463	486	495

Source: World Mineral Production, 2009-2013.

Dry gas.

Table – 13 : Export of Natural Gas (By Countries)

Country	2012-13		2013-14	
	Qty (t)	Value (₹'000)	Qty (t)	Value (₹'000)
All Countries	27736	1617704	4922	282766
Nepal	27413	1601071	3100	243289
UAE	-	-	1682	35709
Bhutan	200	10300	140	3716
Bangladesh	-	-	++	52
Other countries	123	6233	-	-

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**Table – 14 : Import of Petroleum (Crude)
(By Countries)**

Country	2012-13		2013-14	
	Qty (‘000 t)	Value (₹‘000)	Qty (‘000 t)	Value (₹‘000)
All Countries	185534	7856017148	189176	8696574352
Saudi Arabia	34970	1541505856	39319	1874435805
Iraq	24240	1040206237	24576	1106233380
Kuwait	18744	785240173	20063	911842585
Venezuela	20729	767455790	21304	843626344
Nigeria	12952	607920049	15877	822163112
UAE	15591	686833597	13649	667491845
Iran	13242	521051900	11267	515039278
Angola	8775	385695415	7539	363087424
Colombia	3057	114472380	7102	288567787
Qatar	8073	363396789	5116	258938918
Other countries	25161	1042236232	23364	1045147874

**Table – 15 : Import of Natural Gas
(By Countries)**

Country	2012-13		2013-14	
	Qty (t)	Value (₹‘000)	Qty (t)	Value (₹‘000)
All Countries	13135869	411417374	13020689	516992878
Qatar	10302368	311963866	11579139	453903919
Nigeria	1159479	39042735	609893	27226945
Yemen Republic	396466	13466031	513062	22061925
Egypt	574076	20330486	192035	8106917
Norway	-	-	64848	2995051
Brunei	-	-	61712	2698121
Other countries	703480	26614256	-	-

FUTURE OUTLOOK

Several measures are being taken by the Government to intensify exploration and enhance hydrocarbon reserves. These include 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 projects 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.

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.