

AT A GLANCE

- ❖ The production of crude oil declined marginally for the third year in a row, from 37.5 million tonnes (MT) in 2014/15 to 37.0 MT in 2015/16. Crude oil imports increased by 10 MT, although the value of imports fell for the second year in a row. The total share of imported crude oil in India's total supply was 84.3% in 2015/16.
- ❖ India's refining capacity increased to 230 MT per annum (MTPA) owing to the commissioning of the Paradip refinery in Odisha, with a capacity of 15 MTPA.
- ❖ Under-recoveries on the sale of liquefied petroleum gas and kerosene fell to ₹27 571 crore in 2015/16 from ₹65 450 in 2014/15.
- ❖ The production of natural gas declined for the fifth year in a row to 32.2 billion cubic metres in 2015/16.
- ❖ Imports of liquefied natural gas grew to 19.95 MT in 2015/16. The import dependency of natural gas stands at 46%.
- ❖ To boost domestic production and government revenues from the sector, the government announced the replacement of the New Exploration Licensing Policy (NELP) with the Hydrocarbons Exploration Licensing Policy (HELP).
- ❖ The government also announced the implementation of the Direct Benefit Transfer scheme for kerosene in 33 districts in nine states/UTs in India during 2016/17.

Introduction

The domestic production of both oil and natural gas continued to decline in 2015/16. Crude oil production has been declining since 2011/12, while natural gas production has been declining since 2010/11. To boost domestic production of crude oil and natural gas, the government has announced a few reforms, including the replacement of the New Exploration Licensing Policy (NELP) with the Hydrocarbons Exploration Licensing Policy (HELP).

The imports of crude oil increased significantly by 10 million tonnes (MT) to 199 MT in 2015/16. However, owing to the drop in international crude oil prices, the value of the imported crude oil fell for the second year in a row. Further, refining capacity increased by 15 MT per annum (MTPA) in 2015/16 owing to the commissioning of a new refinery in Paradip, Odisha. Further, there were no under-recoveries on the sale of diesel and petrol as their prices have been decontrolled. The under-recoveries on domestic liquefied petroleum gas (LPG) and public distribution scheme (PDS) kerosene reduced to ₹27 571 crore in 2015/16, from ₹65 450 crore in 2014/15. The government has pushed the Direct Benefit Transfer of LPG (DBTL) scheme and the "Give it up" campaign in its efforts to reduce subsidies. The government has also announced a Direct Benefit Transfer (DBT) scheme for PDS kerosene in 33 districts in nine states/UTs in India in 2016/17.

Liquefied natural gas (LNG) imports of India grew from 15.47 MT in 2014/15 to 19.95 MT in 2015/16, now constituting around 46% of the total consumption of natural gas in the country. The fall

in the spot LNG prices in the Asian market made spot LNG more affordable relative to long-term rates between RasGas of Qatar and Petronet LNG (the largest supplier of long-term LNG for India). This triggered a renegotiation of the contract between the two entities, leading to a downward revision of the long-term price. Further, as the demands for natural gas and India's imports are projected to increase in the future, several LNG terminals are scheduled to be commissioned between 2016 and 2020, and they are at various stages of construction.

Oil

Crude oil

Domestic production

Oil production in India marginally fell to 37 MT in 2015/16. Specifically, the drop in production was from onshore blocks (Table 1). Offshore production,

on the contrary, marginally improved from 2014/15. In particular, Oil and Natural Gas Corporation (ONGC) increased production from its offshore fields, including Mumbai High and Heera fields. This follows the company's plan to increase production using improved oil recovery and enhanced oil recovery techniques (The Hindu 2014). However, offshore production by ONGC is still below its 2004/05 levels of 18.2 MT. Further, onshore production fell in nearly all regions compared to the previous fiscal year, with the exception of Andhra Pradesh and Tamil Nadu (Table 2), which contribute to only 3% of all onshore production. In particular, there was a decline in production from Cairn India's Rajasthan fields. Private offshore production too has been falling since 2007/08.

The Government of India has also announced a target of cutting import dependence on oil by 10% by 2022. To achieve this goal, the government has announced the following measures to boost domestic production:

Table 1 Trends in onshore-offshore crude oil production (in MT)

Year	Onshore				Offshore			Grand total
	ONGC	OIL	Private/JV	Total	ONGC	Private/JV	Total	
2015/16 (P)	5.8	3.2	8.8	17.9	16.5	2.5	19.1	37.0
2014/15	6.1	3.4	9.1	18.5	16.2	2.7	18.9	37.5
2013/14	6.7	3.5	9.4	19.6	15.5	2.7	18.2	37.8
2012/13	6.9	3.7	8.8	19.4	15.6	2.8	18.4	37.9
2011/12	7.4	3.9	6.8	18.0	16.3	3.7	20.1	38.1
2010/11	7.5	3.6	5.4	16.4	17.0	4.3	21.3	37.7
2009/10	7.5	3.6	0.7	11.8	17.3	4.5	21.9	33.7
2008/09	7.6	3.5	0.2	11.3	17.8	4.4	22.2	33.5
2007/08	7.9	3.1	0.2	11.2	18.0	4.9	22.9	34.1
2006/07	8.1	3.1	0.2	11.3	18.0	4.7	22.7	34.0
2005/06	8.1	3.2	0.1	11.4	16.3	4.5	20.8	32.2
2004/05	8.3	3.2	0.1	11.6	18.2	4.2	22.4	34.0
2003/04	8.4	3.0	0.1	11.5	17.7	4.2	21.9	33.4
2002/03	8.5	3.0	0.1	11.5	17.6	4.0	21.6	33.0
2001/02	8.6	3.2	0.1	11.9	16.1	4.1	20.1	32.0
2000/01	8.4	3.3	0.1	12.0	16.6	3.8	20.4	32.4

JV – joint venture; MT – million tonnes; OIL – Oil India Ltd; ONGC – Oil and Natural Gas Corporation; P – provisional

Note The production figures are rounded off to one decimal place.

Source MoPNG (2016)

Table 2 Production of crude oil by region (in MT)

Year	Onshore					Offshore			Grand total
	Arunachal Pradesh	Andhra Pradesh/ Tamil Nadu	Assam/ Nagaland	Gujarat/ Rajasthan	Onshore Total	Private/JV	ONGC	Offshore total	
2015/16 (P)	0.06	0.6	4.2	13	17.9	2.5	16.5	19.1	37.0
2014/15	0.08	0.5	4.5	13.5	18.5	2.7	16.2	18.9	37.5
2013/14	0.1	0.5	4.7	14.2	19.6	2.7	15.5	18.2	37.8
2012/13	0.1	0.5	4.9	13.9	19.4	2.8	15.6	18.4	37.9
2011/12	0.1	0.6	5.0	12.3	18.0	3.7	16.3	20.1	38.1
2010/11	0.1	0.5	4.7	11.1	16.4	4.3	17.0	21.3	37.7
2009/10	0.1	0.5	4.7	6.4	11.8	4.5	17.3	21.9	33.7
2008/09	0.1	0.6	4.7	5.9	11.3	4.4	17.8	22.2	33.5
2007/08	0.1	0.6	4.4	6.2	11.2	4.9	18.0	22.9	34.1
2006/07	0.1	0.6	4.4	6.2	11.3	4.7	18.0	22.7	34.0
2005/06	0.1	0.6	4.5	6.3	11.4	4.5	16.3	20.8	32.2
2004/05	0.1	0.6	4.7	6.2	11.6	4.2	18.2	22.4	34.0
2003/04	0.1	0.7	4.6	6.1	11.5	4.2	17.7	21.9	33.4
2002/03	0.1	0.7	4.7	6.0	11.5	4.0	17.6	21.6	33.0
2001/02	0.1	0.7	5.1	6.0	11.9	4.1	16.1	20.1	32.0
2000/01	0.1	0.7	5.2	5.8	11.8	4.0	16.6	20.4	32.4

JV – joint venture; MT – million tonnes; P – provisional

Source MoPNG (2016)

- Reassessing hydrocarbon resources in all sedimentary basins in India
 - Appraisal of unappraised areas within basins
 - Drafting a policy for the assessment of unexplored sedimentary basins
 - Promoting the use of improved oil recovery and enhanced oil recovery techniques by national oil companies (NOCs)
 - Creating a policy framework to promote the early monetization of hydrocarbon discoveries
 - Drafting a policy for the exploration in the mining lease (ML) areas after the expiry of the exploration period
 - Encouraging the production of alternative energy sources such as coalbed methane (CBM), shale oil and gas, and gas hydrates (Rajya Sabha 2015e)
 - Relaxing the production sharing contract (PSC) regime
 - Announcing a price premium for deep water, ultra-deep water, and high pressure-high temperature (HPHT) areas
 - Providing a 40% subsidy in the North-East region to private companies (Rajya Sabha 2015)
- The government announced a few policy changes to encourage domestic production. An important policy change was the replacement of the NELP with the HELP as the governing contractual framework. The NELP had been the policy regime for 18 years. During this period, there were separate policies for different types of hydrocarbons (e.g. CBM, gas hydrates, shale gas, conventional natural gas). Further, the PSC under the NELP was based on the profit sharing principle, wherein an operator would begin to share revenue with the government only after the costs were recovered. This led to concerns of “gold plating” of costs by operators and, therefore, low revenue for the government. Additionally, only those blocks that the government put on tender were accessible to participants in NELP. Finally, the policy did not distinguish between shallow fields and deep water fields while determining prices of natural gas.

With the HELP, the government has tried to address these concerns. Under this new policy, first, there will be a uniform licensing system that will cover all hydrocarbons under a single license and policy framework. Second, the contracts will be based on “biddable revenue sharing” concept, whereby contractors will bid the shares they are ready to offer to the government based on a revenue sharing principle, that is, revenue is split between the government and the operator from the first day. Third, an Open Acreage Licensing Policy (OALP) will be followed, whereby companies can seek to explore any block that has not been offered and explored yet. Fourth, a concessional royalty regime will be implemented for deep water and ultra-deep water blocks. Finally, contractors will have the freedom to price and market gas produced from HPHT areas on an arm’s length basis.

Another reform announced was the extension of 28 PSCs. These 28 small- and medium-sized fields discovered by NOCs (ONGC and Oil India Ltd [OIL]) were awarded to private joint ventures between 1994 and 1998 for periods varying from 18 to 25 years. The contracts have now been extended, giving more time for the adequate production from these fields.

In May 2016, the Ministry of Petroleum and Natural Gas (MoPNG) also launched its auction of 67 marginal oil and gas discoveries with the aim to produce 30 MT of oil worth ₹70,000 crore. These blocks will be auctioned under a revenue sharing contractual framework. These marginal discoveries were surrendered by ONGC and OIL owing to their remote location and small size (The Times of India 2016).

Imports of crude oil

India’s imports of crude oil increased by 10 MT to 199 MT in 2015/16, after being at 189 MT for 2 years before that. However, owing to low international crude oil prices, the value of these imports fell from ₹864,875 crore in 2013/14 to ₹687,350 crore in 2014/15 and to ₹454,756 crore in 2015/16. The share of imported crude oil increased to 84.3% in 2015/16 from 82.5% in 2014/15. Imports as a share of overall crude supply has been rising over the years (Figure 1). However, the share of petroleum in the overall imports in value terms was 23.6% in 2014/15, down from a high of 26.9% in 2013/14 (Figure 2).

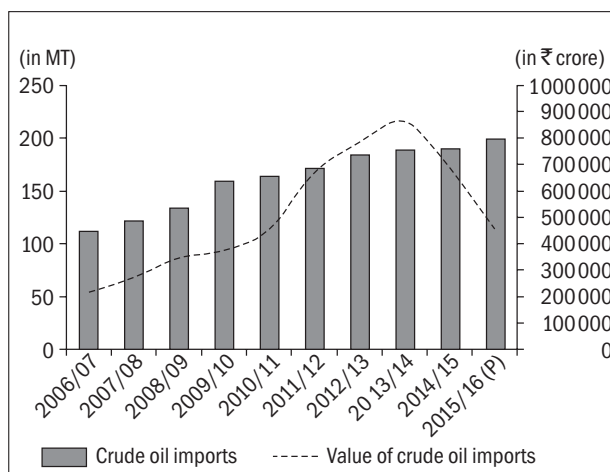


Figure 1 Quantity and value of crude oil imports in India

P – provisional

Note 2015/16 figures are estimates based on April–December actuals.

Source MoPNG (2016)

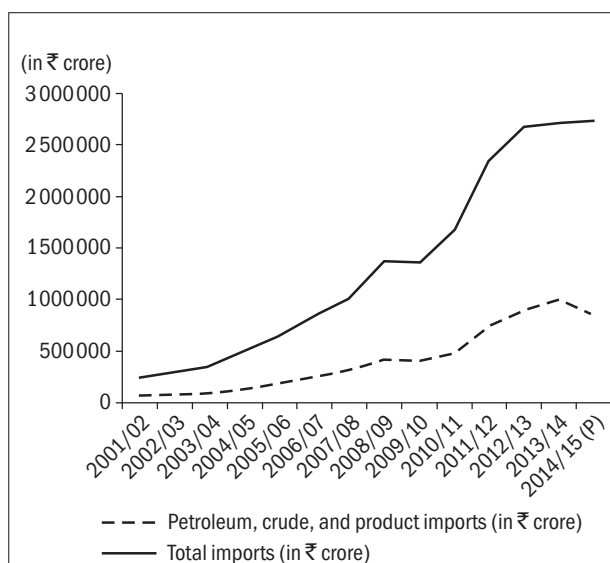


Figure 2 Imports of crude oil and petroleum products in relation to total imports

P – provisional

Source RBI (2015)

India continues to depend on the Middle East for its oil supplies, with Saudi Arabia being the largest supplier to India (Rajya Sabha 2015). The top five countries that export crude oil to India also include Venezuela and Nigeria (Table 3).

Table 3 Top five countries from which India imported crude oil in 2014/15 (provisional)

Rank	Country	2014/15 (April–December) in MT
1	Saudi Arabia	25.87
2	Venezuela	17.58
3	Iraq	17.52
4	Nigeria	14.43
5	Kuwait	12.96
Total		88.37

Note Reliance Industries Ltd did not provide details of the country of origin of its imports, and hence it is not included in the table.

Source Rajya Sabha (2015f)

Crude oil pipelines

India has more than 9500 km of crude oil pipelines. Table 4 lists the major pipelines, operators, capacities, and lengths.

Strategic petroleum reserves

In order to enhance India's oil security, the government set up the Indian Strategic Petroleum Reserves Ltd for constructing strategic petroleum reserves (SPRs). The total planned capacity of SPRs in the first phase is 5.33 MT, and the SPRs are

located in Visakhapatnam (1.33 MT), Mangalore (1.5 MT), and Padur (2.5 MT) (PIB, 2015c). In the second phase, storage would be built in Chandikhol (3.75 MT), Bikaner (3.75 MT), and Rajkot (2.5 MT). The filling of the Visakhapatnam SPR with crude oil has been completed. Mangalore and Padur SPRs are being readied to receive crude oil. The government allocated ₹4948 crore in 2015 for the filling of these SPRs. The government is exploring alternative models for filling up the Mangalore and Padur caverns, including collaborations with Abu Dhabi National Oil Company. The annual operation and maintenance costs are estimated to be ₹47 crore for Visakhapatnam SPR and ₹179 crore for all of them put together in the first phase. This includes the cost of their physical security (PIB 2015a).

Refining

Capacity and throughput of existing refineries

Although India is heavily dependent on crude oil imports, it has been a net exporter of petroleum products since 2001 (EIA 2014). India's refining capacity as of 1 April 2015 stood at 215.07 MTPA. India's refining capacity has increased steadily over the years. In 1997/98, it was only 62 MTPA, which increased to 148.97 MTPA in 2006/07. A new refinery

Table 4 Capacity, length, and operators of major crude pipelines

Operator	Pipeline	Capacity (MTPA)	Length (km)
OIL	Duliajan–Digboi–Bongaigaon–Barauni	8.40	1 193
IOCL	Salaya–Mathura–Panipat (including loop lines)	21.00	1 870
IOCL	Paradip–Haldia–Barauni	11.00	1 384
IOCL	Mundra–Panipat	8.4	1 194
HMEL (JV with HPCL)	Mundra–Bathinda	9.00	1 017
BORL (JV with BPCL)	Vadinar–Bina	6.00	937
Cairn	Barmer–Salaya	6.25	591
ONGC	Mumbai High–Uran trunk (offshore)	15.6	204
ONGC	Heera–Uran trunk (offshore)	11.5	81
ONGC	30" BUT (OIL) (offshore)	18	203
Total	All pipelines, including those not listed above	146.6	9 572.2

BORL – Bharat Oman Refineries Ltd; BPCL – Bharat Petroleum Corporation Ltd; HMEL – Hindustan Mittal Energy Ltd; HPCL – Hindustan Petroleum Corporation Ltd; IOCL – Indian Oil Corporation Ltd; JV – joint venture; MTPA – million tonnes per annum; OIL – Oil India Ltd; ONGC – Oil and Natural Gas Corporation

Note Smaller pipelines operated by ONGC are not included in this table.

Source MoPNG (2015b)

Table 5 Installed capacity and crude throughput

Refinery and location	Refining capacity (MTPA) as on 1 April				Refining crude throughput (MT)					
	2013	2014	2015	2016	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16 (P)
IOCL Guwahati, Assam	1.00	1.00	1.00	1.00	1.12	1.06	0.96	1.02	1.01	0.9
IOCL Barauni, Bihar	6.00	6.00	6.00	6.00	6.21	5.73	6.34	6.48	5.94	6.54
IOCL Koyali, Gujarat	13.70	13.70	13.70	13.70	13.56	14.25	13.16	12.96	13.29	13.82
IOCL Haldia, West Bengal	7.50	7.50	7.50	7.50	6.88	8.07	7.49	7.95	7.65	7.78
IOCL Mathura, Uttar Pradesh	8.00	8.00	8.00	8.00	8.88	8.20	8.56	6.64	8.52	8.86
IOCL Paradip, Odisha	—	—	—	15.00	—	—	—	—	—	—
IOCL Digboi, Assam	0.65	0.65	0.65	0.65	0.65	0.62	0.66	0.65	0.59	0.56
IOCL Panipat, Haryana	15.00	15.00	15.00	15.00	13.66	15.50	15.13	15.10	14.19	15.28
IOCL Bongaigaon, Assam	2.35	2.35	2.35	2.35	2.01	2.19	2.36	2.33	2.4	2.44
BPCL Mumbai, Maharashtra	12.00	12.00	12.00	12.00	13.02	13.36	13.08	12.68	12.82	13.37
BPCL Kochi, Kerala	9.50	9.50	9.50	9.50	8.70	9.47	10.11	10.29	10.36	10.71
HPCL Mumbai, Maharashtra	6.50	6.50	6.50	6.50	6.64	7.51	7.75	7.79	7.41	8.01
HPCL Visakhapatnam, Andhra Pradesh	8.30	8.30	8.30	8.30	8.20	8.68	8.03	7.78	8.77	9.22
CPCL Manali, Tamil Nadu	10.50	10.50	10.50	10.50	10.10	9.95	9.11	10.07	10.25	9.10
CPCL Narimanam, Tamil Nadu	1.00	1.00	1.00	1.00	0.70	0.61	0.64	0.56	0.53	0.54
NRL Numaligarh, Assam	3.00	3.00	3.00	3.00	2.25	2.83	2.48	2.61	2.78	2.52
ONGC Tatipaka, Andhra Pradesh	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.07	0.05	0.07
MRPL Mangalore, Karnataka	15.00	15.00	15.00	15.00	12.66	12.80	14.42	14.59	14.63	15.53
RIL Jamnagar, Gujarat	33.00	33.00	33.00	33.00	31.20	32.50	32.61	30.31	30.87	32.42
RIL (SEZ) Jamnagar, Gujarat	27.00	27.00	27.00	27.00	35.61	35.19	35.89	37.72	37.17	37.13
EOL Vadinar, Gujarat	18.00	20.00	20.00	20.00	14.87	13.50	19.77	20.20	20.49	19.1
BORL Bina	6.00	6.00	6.00	6.00	—	2.05	5.73	5.45	6.21	6.4
HMEL Bathinda	9.00	9.00	9.00	9.00	—	—	4.90	9.27	7.32	10.71
Total	213.07	215.07	215.07	230.07	196.99	204.12	219.21	222.50	223.24	232.05

BORL – Bharat Oman Refineries Ltd; BPCL – Bharat Petroleum Corporation Ltd; CPCL – Chennai Petroleum Corporation Ltd; EOL – ESSAR Oil Ltd; HMEL – Hindustan Mittal Energy Ltd; HPCL – Hindustan Petroleum Corporation Ltd; IOCL – Indian Oil Corporation Ltd; MRPL – Mangalore Refinery and Petrochemicals Ltd; MT– million tonnes; MTPA – million tonnes per annum; NRL – Numaligarh Refinery Ltd; ONGC – Oil and Natural Gas Corporation; P – provisional; RIL – Reliance Industries Ltd; SEZ – special economic zone

Source MoPNG (2016)

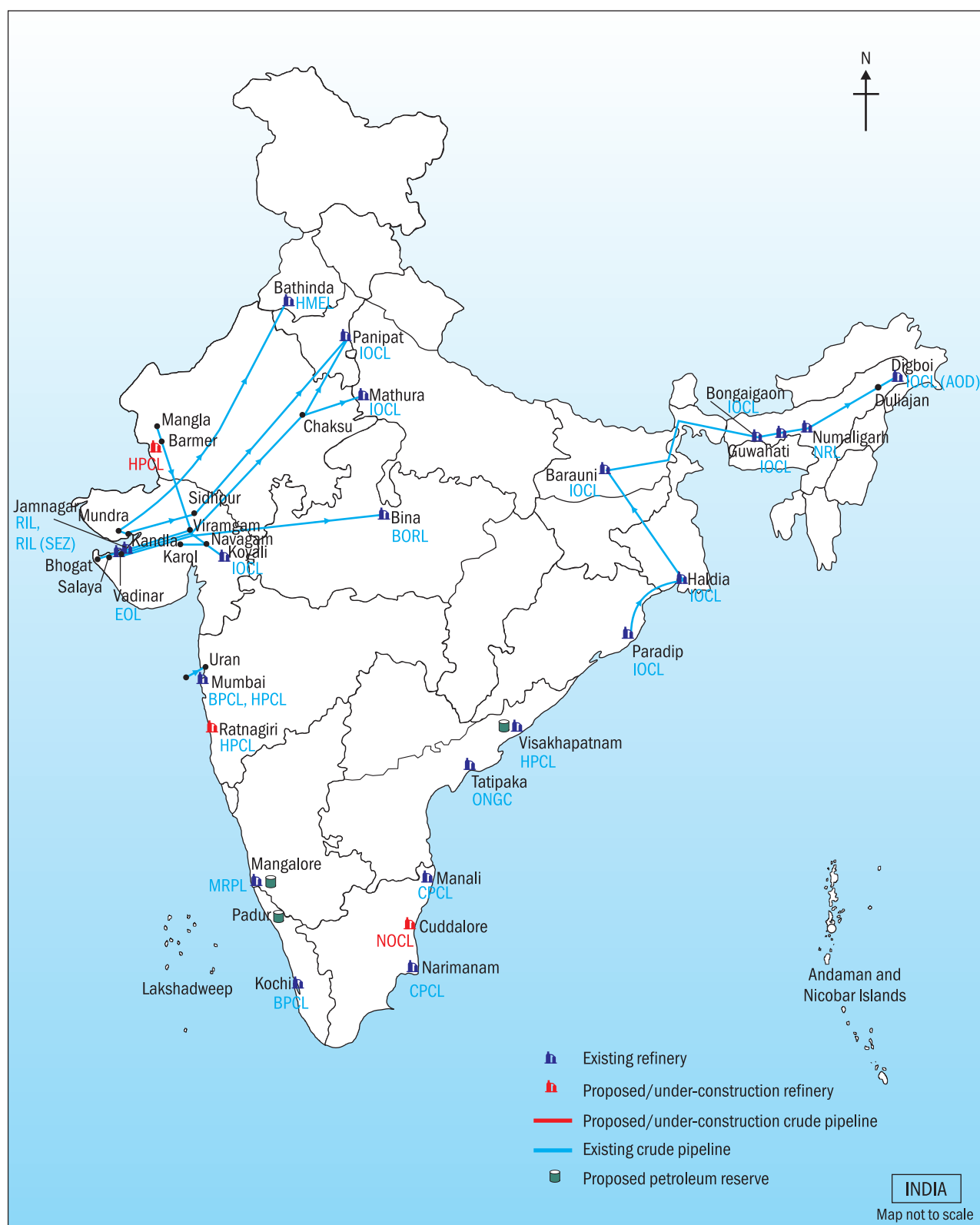
with a capacity of 15 MTPA was commissioned on 7 February 2016 in Paradip, Odisha. It was completed at the cost of ₹ 34 555 crore. With this, India's refining capacity increased to 230 MTPA (MoPNG 2016) as on 1 April 2016 (Table 5).

Prior to this, new refineries were last commissioned in 2012, when Hindustan Mittal Energy Ltd (Bathinda, Punjab) and Bharat Oman Refineries Ltd (Bina, Madhya Pradesh) started the refining activity. However, capacity expansion has taken place in existing refineries. At present, new refineries are being constructed in Cuddalore, Tamil Nadu

(by Nagarjuna Oil Corporation Ltd with a capacity of 6 MTPA); Ratnagiri, Maharashtra (by Hindustan Petroleum Corporation Ltd [HPCL] with a capacity of 9 MTPA); and Barmer, Rajasthan (by HPCL with a capacity of 9 MTPA) (Map 1).

Gross refining margin

Gross refining margin (GRM) measures the profitability of refineries. GRM is the difference between the cost of crude oil and the price realized from the refined product. GRMs across all refineries in India were higher in the first half of 2015/16 compared



Map 1 Petroleum refineries and major crude oil pipelines in India

Source MoPNG (2015b)

to the previous year, among others, owing to the decrease in crude oil prices (Table 6). In particular, GRMs of private sector refineries (Reliance Industries Ltd [RIL], ESSAR Oil Ltd) have been traditionally higher than those of government-owned refineries because of the following reasons: First, private sector refineries are relatively newer and, therefore, more energy efficient; second, they are located at the coast, which helps them save on transport costs; third, their refinery configurations enable them to refine low-quality crude oil, which is cheaper to acquire; and finally, they buy the cheapest available oil from the open market, unlike public sector refineries that invariably buy crude oil via tenders from NOCs and other registered tenderers.

Petroleum products

Production

India's petroleum production for the first 9 months of 2015/16 stood at 170 MT, while the target for the fiscal year was 221 MT. If this target is met, it would indicate, in particular, a rise in production of LPG, aviation turbine fuel (ATF), high-speed diesel (HSD), and light diesel oil (LDO), while the production of motor spirit (petrol), naphtha, kerosene, furnace oil, and petroleum coke would be lower (Table 7).

Consumption

The MoPNG estimated that the consumption of petroleum products (based on April–December actuals) would rise to 177 MT in 2015/16 from 165.5 MT in 2014/15. In particular, consumptions of LPG, petrol, ATF, and HSD were indicated to rise (Table 8).

Imports and exports of petroleum products

The exports of petroleum products fell in 2015/16 for the second year in a row, while imports increased by 7 MT over the previous financial year. Tables 9 and 10 give the imports and exports of petroleum products, respectively.

Petroleum product pipelines

India has more than 14 000 km of petroleum product pipelines across the country. Table 11 gives the capacity and length of major petroleum pipelines in the company categorized as per operators.

Subsidies

The Government of India has undertaken several key subsidy reforms since 25 June 2010, when it decontrolled petrol prices. However, informal control of petrol prices continued till January 2013. Diesel

Table 6 Gross refining margins (\$/barrel)

Year	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16 (April–September)
IOCL (average of eight refineries)	5.72	3.63	3.16	4.24	0.27	5.76
BPCL (Mumbai)	4.23	1.73	4.67	3.95	3.97	5.39
BPCL (Kochi)	4.83	3.09	5.36	4.8	3.17	7.18
HPCL (Mumbai)	4.65	2.82	2.08	5.38	4.88	6.08
HPCL (Visakhapatnam)	5.81	2.95	2.08	1.5	1.12	4.91
CPCL (Chennai)	5.38	4.16	0.99	4.06	1.97	5.99
RIL	8.4	8.6	9.20	8.10	8.60	10.50
EOL	4.53	4.45	7.96	7.98	8.37	10.25
NRL	15.39	11.97	10.52	12.09	16.67	22.09
MRPL	5.9	5.96	2.45	2.67	–0.64	3.56
BORL	—	—	7.00	7.70	6.10	12.80

BORL – Bharat Oman Refineries Ltd; BPCL – Bharat Petroleum Corporation Ltd; CPCL – Chennai Petroleum Corporation Ltd; EOL – ESSAR Oil Ltd; HPCL – Hindustan Petroleum Corporation Ltd; IOCL – Indian Oil Corporation Ltd; MRPL – Mangalore Refinery and Petrochemicals Ltd; NRL – Numaligarh Refinery Ltd; RIL – Reliance Industries Ltd

Source: PPAC (2015b)

Table 7 Production of petroleum products (in '000 tonnes)

Petroleum product	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16 (April–December)	2015/16 (Targets)
LPG	9 708	9 547	9 825	10 030	9 840	7 649	9 997
Motor spirit	26 138	27 186	30 118	30 275	32 325	26 012	31 987
Naphtha	19 196	18 825	19 018	18 505	17 391	13 059	17 207
Kerosene	7 809	7 861	7 971	7 418	7 559	5 614	6 643
ATF	9 589	10 065	10 088	11 220	11 103	8 166	12 414
HSD	78 057	82 880	91 103	93 759	94 428	72 789	94 854
LDO	590	502	400	423	358	309	417
Furnace oil	18 659	16 732	13 690	12 920	11 248	7 011	9 535
LSHS/HHS/RFO	1 860	1 701	1 364	485	671	308	733
Fuel oil	20 519	18 433	15 054	13 405	11 919	7 319	10 268
Lube oils	884	1 028	896	941	946	754	973
Bitumen	4 478	4 610	4 670	4 785	4 632	3 460	5 157
Petroleum coke	2 711	7 837	10 943	12 068	12 448	9 798	10 108
Others	15 142	14 429	17 650	17 927	18 188	15 416	20 939
Total production	194 821	203 202	217 736	220 756	221 136	170 345	220 964

ATF – aviation turbine fuel; HHS – hot heavy stock; HSD – high-speed diesel; LDO – light diesel oil; LPG – liquefied petroleum gas; LSHS – low sulphur heavy stock; RFO – residual fuel oil

Source MoPNG (2016)

Table 8 Consumption of petroleum products (in '000 tonnes)

Petroleum product	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16 (April–December)	2015/16 (estimated)
LPG	14 331	15 350	15 601	16 294	18 000	14 281	20 857
MS	14 194	14 992	15 744	17 128	19 075	16 146	20 766
Naphtha	10 676	11 222	12 289	11 305	11 082	9 904	11 022
SKO	8 928	8 229	7 502	7 165	7 087	5 141	7 033
ATF	5 078	5 536	5 271	5 505	5 723	4 596	7 849
HSD	60 071	64 750	69 080	68 364	69 416	55 198	76 904
LDO	455	415	399	386	365	293	400
Fuel oil	10 789	9 307	7 656	6 236	5 073	4 730	7 872
Lubes/greases	2 429	2 633	3 196	3 305	3 310	2 318	2 945
Bitumen	4 536	4 638	4 676	5 007	5 073	3 860	5 971
Petroleum coke	4 982	6 138	10 135	11 756	14 558	13 018	9 268
Others	4 569	4 924	5 509	5 956	6 758	4 920	6 085
Total consumption	141 040	148 132	157 057	158 407	165 520	134 371	176 972

ATF – aviation turbine fuel; HSD – high-speed diesel; LDO – light diesel oil; LPG – liquefied petroleum gas; MS – motor spirit; SKO – superior kerosene oil

Source MoPNG (2016)

Table 9 Import of petroleum products by quantity (in '000 tonnes) and value (in ₹ crore)														
Petroleum product	2010/11		2011/12		2012/13		2013/14		2014/15		2015/16 (April-December)		2015/16 (estimated)	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
LPG	4 484	15 888	5 790	27 019	6 293	31 696	6 607	37 425	8 313	36 571	6 691	20 137	8 921	26 849
Petrol	1 702	6 427	654	3 311	147	891	235	1 481	372	2 301	952	4 025	1 269	5 367
Naphtha	2 063	6 853	2 091	9 827	1 735	9 791	1 026	6 067	1 034	4 592	2 329	8 234	3 105	10 979
Kerosene	1 381	4 939	564	2 710	0	0	0	0	30	172	41	158	55	211
Diesel	1 996	6 969	1 059	5 039	626	3 219	84	503	124	670	39	311	52	415
Lubes	1 291	4 093	1 434	8 314	1 468	9 259	1 674	10 664	2 148	12 702	1 411	6 692	1 882	8 922
Fuel oil	1 013	2 455	1 203	4 392	1 068	4 546	1 283	5 537	902	3 659	785	1 946	1 047	2 595
Bitumen	98	210	78	197	85	235	237	773	517	1 623	525	1 383	699	1 844
Others	3 352	8 164	2 977	7 282	4 352	8 727	5 571	12 156	7 861	12 356	8 402	9 337	11 202	12 450
Total	17 379	55 998	15 849	68 091	15 774	68 363	16 718	74 605	21 301	74 644	21 175	52 224	28 233	69 631

LPG – liquefied petroleum gas

Source MoPNG (2016)

Table 10 Export of petroleum products by quantity (in '000 tonnes) and value (in ₹ crore)														
Petroleum product	2010/11		2011/12		2012/13		2013/14		2014/15		2015/16 (April-December)		2015/16 (estimated)	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
LPG	154	693	174	947	200	1 294	227	1 589	254	1 455	137	561	182	748
Petrol	13 578	49 480	14 524	73 982	16 657	95 346	15 247	92 977	16 048	81 971	12 228	46 591	16 304	62 121
Naphtha	10 655	37 138	10 139	45 620	8 647	43 533	8 322	46 059	7 008	31 619	5 175	15 754	6 900	21 005
ATF	4 478	16 140	4 561	21 857	4 664	25 223	5 745	33 246	5 520	25 413	3 697	11 567	4 929	15 422
Kerosene	33	141	34	191	23	140	15	98	15	81	17 240	52 663	22 987	70 217
Diesel	20 335	69 300	20 407	104 572	22 464	115 554	26 469	148 138	25 559	115 149	6	26	9	35
LDO	98	260	84	331	9	42	30	135	6	28	0	0	0	0
Lubes	29	154	27	181	59	381	20	138	11	100	14	95	19	127
Fuel oil	6 734	15 098	7 895	25 576	5 922	20 415	6 159	22 407	4 762	14 251	2 277	3 947	3 036	5 263
Bitumen	56	124	5	27	87	281	95	321	94	245	78	151	104	201
Others	2 927	8 332	2 88	11 360	4 675	17 880	5 535	23 169	4 653	18 267	2 927	7 484	3 903	9 979
Total product export	59 077	196 861	60 837	284 643	63 408	320 090	67 864	368 279	63 932	288 580	43 779	138 839	58 372	185 118
Net product export	41 698	140 862	44 988	216 552	47 634	251 727	51 146	293 674	42 631	213 936	22 604	86 615	30 138	115 487

ATF – aviation turbine fuel; LDO – light diesel oil; LPG – liquefied petroleum gas

Source MoPNG (2016)

Table 11 Length of major petroleum product pipelines

Operator	Pipeline	Capacity (MTPA)	Length (km)
GAIL	Jamnagar-Loni LPG	2.5	1 414
GAIL	Vizag-Secunderabad LPG	1.3	618
IOCL	Koyali-Sanganer	4.6	1 287
IOCL	Mathura-Delhi-Bijwasan-Panipat	3.7	258
IOCL	Barauni-Kanpur	3.5	745
IOCL	Panipat-Delhi	3	189
BPCL	Mumbai-Manmad-Manglya-Piyala-Bijwasan	6	1 389
BPCL	Bina-Kota	4.4	259
HPCL	Mumbai-Pune-Solapur	4.3	508
HPCL	Visakh-Vijayawada-Secunderabad	5.4	572
HPCL	Mundra-Delhi	5	1 054
HPCL	Ramanandi-Bahadurgarh	4.7	243
PCCK	Cochin-Coimbatore-Karur	3.3	293
Total	All pipelines, including those not listed above	92.1	14 463

BPCL – Bharat Petroleum Corporation Ltd; GAIL – Gas Authority of India Ltd; HPCL – Hindustan Petroleum Corporation Ltd; IOCL – Indian Oil Corporation Ltd; MTPA – million tonnes per annum; PCCK – Petronet Cochin-Coimbatore-Karur

Source MoPNG (2016)

prices were decontrolled in October 2014, leading to the elimination of under-recoveries on both transport fuels. The government has also increased excise duties on petrol and diesel. The government now intends to end subsidies on these products and increase taxation in the form of “green tax”. The government claims that these measures would lead to a net reduction of 11 MT of CO₂ emissions in less than a year. This would constitute 0.6% of India’s annual emissions (PIB 2015d).

Unlike petrol and diesel, subsidies continue to be provided on the sale of domestic LPG and kerosene. However, the mechanism of transmission of these subsidies has undergone significant reforms. In order to administer the domestic LPG subsidy, the government launched DBTL in 2013. This direct transfer of subsidies was linked to Aadhaar (unique identification number) for 20 districts initially

and then was scaled up to 291 districts. The DBTL was temporarily suspended in March 2014 because of the low penetration of Aadhaar in some districts.¹ The Dhande Committee was then set up to review the challenges faced in the implementation of DBTL, following which the Pratyaksh Hastantarit Labh (PAHAL) scheme was launched in November 2014 in 54 districts in India. It was extended to the rest of India on 1 January 2015. Under PAHAL, customers can link their LPG customer IDs to Aadhaar or their bank accounts. PAHAL is now the world’s largest DBT scheme and has more than 14.88 crore registered consumers.

Further, in March 2015, the Prime Minister launched the “Give it up” campaign and appealed to well-off people to voluntarily give up LPG subsidy (PIB 2015g). As of March 2016, nearly 88 lakh LPG consumers have voluntarily given up their LPG subsidy under this campaign.

Yet another reform to increase the penetration of LPG is the Pradhan Mantri Ujjwala Yojana, which was launched in February 2016. Under this programme, 5 crore below poverty line (BPL) households will be provided with LPG connections within 3 years. These LPG connections will be given in the name of the woman of the household.

The government has also announced a DBT scheme for PDS kerosene in 33 districts of 9 states in India. The government is considering phasing out kerosene subsidies as the Deendayal Upadhyaya Gram Jyoti Yojana, which has a goal of 100% electrification at the village level, nears completion in 2017 (The Financial Express 2015).

Tables 12 gives under-recoveries to oil companies by product and DBT subsidy on PDS kerosene and LPG. The burden sharing of under-recoveries is given in Table 13.

Ethanol blended petrol and bio-diesel

The Ethanol Blended Petrol Programme began in 2003. In 2006, this programme was extended to the entire country, barring the north-eastern states, Jammu and Kashmir, Andaman and Nicobar Islands, and Lakshadweep. Since November 2012, the government has mandated 5% blending of ethanol with petrol. To achieve this goal, the government permits up to 10% share of ethanol as per the

¹ In November 2013, the Supreme Court of India, upholding its interim order of September 2013 (which was in response to a public interest litigation), ruled that Aadhaar could not be made mandatory for receiving subsidies (IISD 2014).

Year	Petrol	Diesel	Domestic LPG	DBTL	PDS kerosene	Total
2005/06	2 723	12 647	10 246	—	14 384	40 000
2006/07	2 027	18 776	10 701	—	17 883	49 387
2007/08	7 332	35 166	15 523	—	19 102	77 123
2008/09	5 181	52 286	17 600	—	28 225	103 292
2009/10	5 151	9 279	14 257	—	17 364	46 051
2010/11	2 227	34 706	21 772	—	19 484	78 190
2011/12	0	81 192	299 970	—	273 520	1 385 410
2012/13	0	92 061	39 558	—	29 410	161 029
2013/14	0	62 837	46 457	3 869	30 574	143 738
2014/15	0	10 935	36 580	3 971	24 799	76 385
2015/16 (P)	0	0	18	16 056	11 496	27 571

DBTL – Direct Benefit Transfer of LPG; LPG – liquefied petroleum gas; P – provisional; PDS – public distribution system

Source MoPNG (2016)

specifications of the Bureau of Indian Standards (BIS). However, there exist bottlenecks in the supply of ethanol, including the time-consuming transportation procedures adopted by states and the cyclical nature of sugarcane production, owing to which the supply of ethanol varies from year to year.

To foster the availability of ethanol, in December 2014, the government fixed its price between ₹48.5 and ₹49.5 per litre, depending on the distance of distillery from oil company's storage point (PIB 2015a, PIB 2015b). Further, ethanol produced from non-food feedstocks besides molasses has also been allowed to be procured subject to meeting the relevant BIS specifications. In 2014, the government

also began providing soft loans of up to 40% of the project cost to promote ethanol production (PIB 2015h). The government also provided soft loans of ₹6000 crore and other financial assistance to sugarcane farmers. Owing to these measures, 67.42 crore litres of ethanol was procured in 2014/15, as against the oil industry requirement of 128.17 crore litres. In 2015/16, contracts for the supply of 99 crore litres of ethanol were signed.

Apart from the Ethanol Blended Petrol Programme, MoPNG implemented the Bio-diesel Purchase Policy in 2006. Under this policy, bio-diesel meeting prescribed BIS specifications would be purchased at a uniform price for blending with HSD up to 5% by volume at 20 purchase centres across the country (PIB 2015i). The government allowed the direct sale of bio-diesel to bulk consumers such as the Indian Railways and state transport corporations by private manufacturers. Bio-diesel sale started in August 2015 when oil marketing companies (OMCs) launched bio-diesel supplies in some retail outlets in Delhi, Vijayawada, Haldia, and Vizag (PIB 2015f). Currently, OMCs are selling this fuel in more than 750 retail outlets in India.

Natural gas

Domestic natural gas production

Natural gas production fell again in 2015/16 to 32.25 billion cubic metres (BCM) from 33.65 BCM in 2014/15 (Table 14). Production has been consistently falling since 2010/11. While onshore production marginally rose primarily owing to increased production in Rajasthan (Table 15), offshore

	Under-recovery and burden sharing (in ₹ crore)							
	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15 (P)
Total under-recovery	77 123	103 292	46 051	78 190	138 541	161 029	139 869	72 314
Burden sharing through oil bonds/cash subsidy [#]	35 290	71 292	26 000	41 000	83 500	100 000	70 772	22 085
Borne by OMCs	16 125	0	5 621	6 893	41	1 029	2 076	7 407
Upstream companies*	25 708	32 000	14 430	30 297	55 000	60 000	67 021	42 822

*Oil India Ltd, Oil and Natural Gas Corporation, and Gas Authority of India Ltd

[#]Since 2009/10, cash subsidy was provided by the government in place of oil bonds.

OMC – oil marketing company; P – provisional

Source MoPNG (2015b)

production of both public and private companies dropped. The steep rise in natural gas production starting 2009/10 and the unexpected fall after 2010/11 were owing to changes in production from RIL-BP-Niko's KG-DWN-98/3 (popularly known as the KG-D6) block. Figure 3 shows the share of private and public sectors in the total natural gas production since 1999/2000.

Table 14 Production of natural gas by company (in BCM)

Year	ONGC	OIL	Private/JV	Total
2015/16 (P)	21.18	2.38	8.23	32.25
2014/15	22.03	2.72	8.9	33.65
2013/14	23.27	2.62	9.48	35.4
2012/13	23.55	2.64	14.49	40.68
2011/12	23.31	2.63	21.61	47.55
2010/11	23.09	2.35	26.77	52.21
2009/10	23.17	2.41	21.98	47.57
2008/09	22.49	2.26	8.09	32.84
2007/08	22.21	2.34	7.78	32.27
2006/07	22.25	2.27	7.04	31.56
2005/06	22.57	2.27	7.36	32.2
2004/05	22.99	2.01	6.78	31.77
2003/04	23.58	1.88	6.49	31.96
2002/03	24.24	1.74	5.41	31.4
2001/02	24.04	1.62	4.05	29.71
2000/01	24.02	1.86	3.6	29.48
1999/2000	23.25	1.73	3.47	28.45

BCM – billion cubic metres; JV – joint venture; OIL – Oil India Ltd; ONGC – Oil and Natural Gas Corporation

Source MoPNG (2016)

Natural gas imports

Natural gas imports in India are in the form of LNG. In 2015/16, LNG imports in India grew to 19.95 MT from 15.47 MT in 2014/15 (Figure 4). The total natural gas supply (including LNG) in India in 2015/16 increased to 59.76 BCM compared to 46.2 BCM in 2014/15. Imports in 2015/16 constituted 46% of the total supply, up from 38.8% in 2014/15. As spot LNG prices fell to \$6–7 per million British Thermal Unit (MBTU) in 2015 and then to \$4.2/MBTU in 2016, the price of India's long-term LNG supply from Qatar's RasGas at \$13/MBTU turned out to be relatively much higher than spot cargoes. Therefore, for the first time in 10 years, Petronet LNG asked for a 10% cut in quantities delivered from

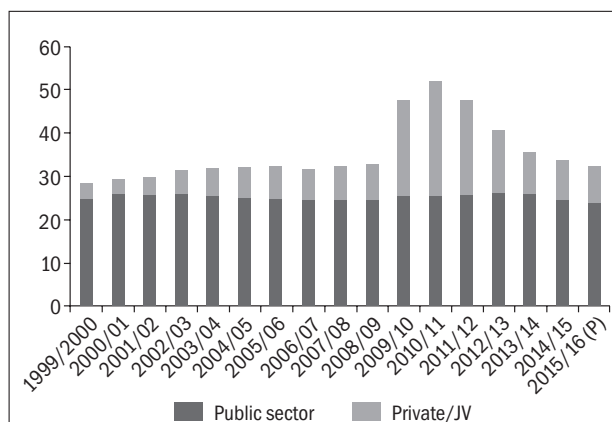


Figure 3 Natural gas production in India by sector (in BCM)

JV – joint venture; P – provisional

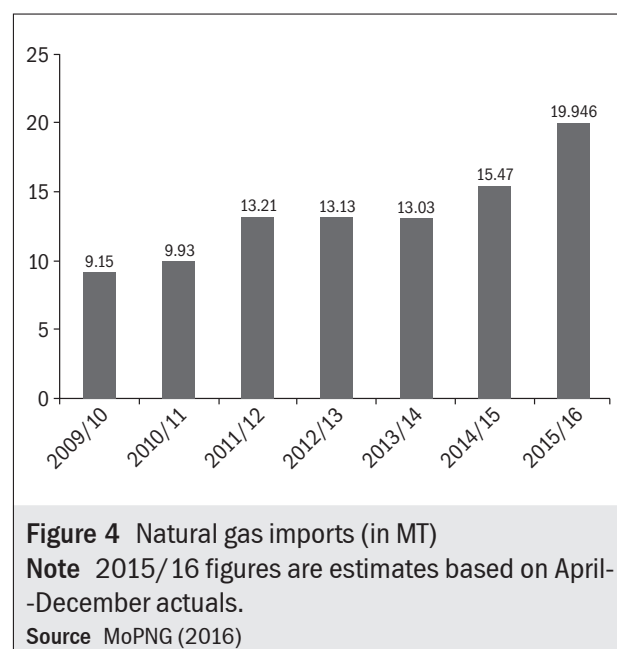
Source MoPNG (2016)

Table 15 Production of onshore natural gas by region (in BCM)

Year	Andhra Pradesh	Arunachal Pradesh	Assam	Gujarat	Rajasthan	Tamil Nadu	Tripura	Total
2015/16 (P)	0.62	0.03	3.24	1.49	1.34	1.01	1.33	9.24
2014/15	0.54	0.03	2.96	1.52	1.18	1.19	1.14	8.79
2013/14	1.17	0.04	2.87	1.66	0.98	1.30	0.82	9.01
2012/13	1.25	0.04	2.91	2.03	0.68	1.21	0.65	8.77
2011/12	1.25	0.04	2.91	2.03	0.69	1.21	0.65	8.77
2010/11	1.38	0.04	2.68	2.26	0.043	1.12	0.61	8.53
2009/10	1.47	0.04	2.72	2.45	0.24	1.18	0.65	8.76

P-provisional

Source MoPNG (2016)



Qatar (maximum allowed contractually) in 2015. In 2016, India successfully renegotiated LNG price with Qatar. Under the new contract, the price is fixed to below \$5/MBTU based on prevailing crude oil prices. In return, Petronet LNG will import an additional 1 MT of LNG every year for the next 12 years with effect from 1 January 2016 at the prevailing market prices (The Economic Times 2016).

Some of the countries from which India sourced its LNG in 2014/15 were Qatar, Nigeria, Yemen, Egypt, Norway, Algeria, Equatorial Guinea, Algeria, France, South Korea, Malaysia, Norway, Oman, Spain, Trinidad, UAE, and Yemen (Lok Sabha 2014).²

Long-term LNG supply contracts signed by Indian companies are as follows:

- RasGas, Qatar: 7.5 + 1 MTPA for 25 years (signed by Petronet)
- Sabine Pass Liquefaction LLC, USA: 3.5 MTPA for 20 years (signed by GAIL)
- Dominion Resources, USA: 2.30 MTPA for 20 years (signed by GAIL)
- Gazprom, Russia: 2.5 MTPA for 20 years (signed by GAIL)
- Gas Natural Fenosa, Spain: 0.75 MTPA for 3 years (signed by GAIL)
- Gas de France, France: 0.36 MTPA for 2 years (signed by GAIL)

- Canada: 1.2 MTPA for 20 years (signed by IOCL)
- BG Group, United Kingdom: to initially supply 1.25 MTPA from 2015 with the potential increase to 2.5 MTPA for 20 years (signed by Gujarat State Petroleum Corporation, GSPC) (BG Group 2013)
- Mobil Australia Resources Company (MARC), Australia's Gorgon project: 1.44 MTPA for 20 years starting 2016 (signed by Petronet LNG) (Petronet LNG 2015)

LNG terminals

Currently, there are four operating terminals on the west coast of India: two in Gujarat, one in Maharashtra, and the recent one in Kerala (Table 16). To meet the rising demand, several more are under construction or in the advanced planning stage (Map 2).

If all the planned capacity additions listed in Table 16 come up, India's import capacity would rise to around 86 MTPA. Table 16 shows the existing and planned LNG terminals in India.

Natural gas pipelines

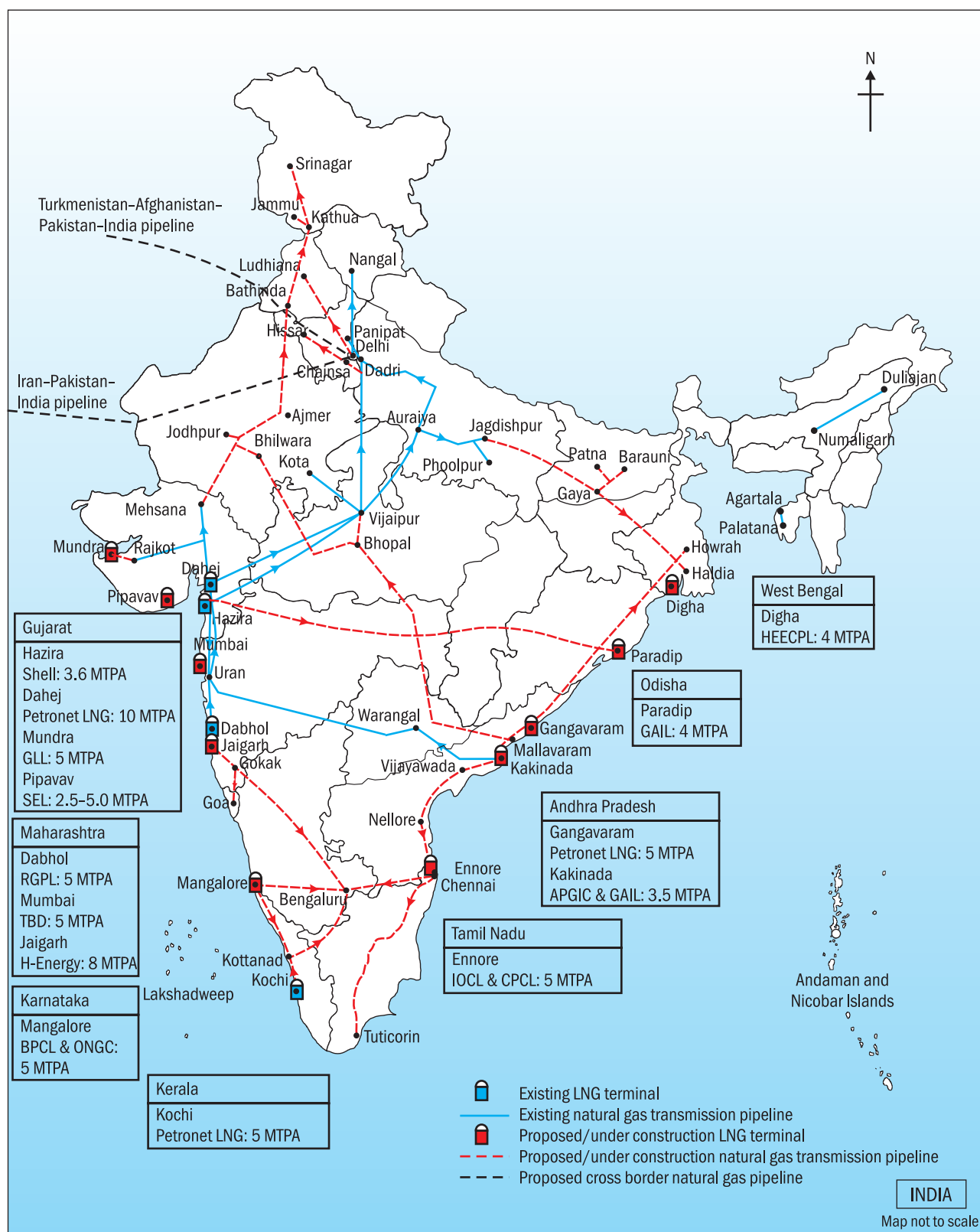
The country has more than 16 000 km of natural gas pipelines. The government has announced its intention to create a national gas grid by adding another 15 000 km of pipelines, of which 13 000 km is already authorized and is at various stages of completion. There are currently three major natural gas pipeline entities: GAIL India Limited, Reliance Gas Transportation Infrastructure (RGTI), and Gujarat State Petronet Ltd (GSPL). GAIL has a network of 11 077 km. RGTI operates the 1469 km long East West Pipeline (EWPL) to evacuate gas from KG-D6. This pipeline is integrated with GAIL's and GSPL's networks.

The existing pipelines are not functioning at full capacity partly due to the shortage of domestic gas. Tables 17 and 18 provide details of the existing and under-construction pipelines, respectively.

Natural gas consumption

According to the Gas Utilization Policy introduced by the Government of India, the order of priority of

² This does not include the LNG imported by the Gujarat State Petroleum Corporation and Hazira LNG Pvt. Ltd.



Map 2 LNG terminals and natural gas pipelines in India

Sources MoPNG (2015b); PPAC (2014f); TERI (2014a); The Hindu (2013a, 2013b); Business Standard (2013a, 2013b); Natural Gas Asia (2015); LNG World News (2015); Lok Sabha (2013a, 2013c, 2015a)

Table 16 Existing and planned LNG terminals in India

Project and developer	Location (state)	Capacity (in MTPA)	Suppliers	Status
Dahej LNG terminal (Petronet LNG Ltd)	Dahej (Gujarat)	10 (operating at 11 MTPA; to be expanded to 15 MTPA by 2016; plans for further expansion to 17.50 MTPA)	RasGas (Qatar-based LNG supply company) and spot cargoes	Commissioned in February 2004 and commercial sales began in April 2004
Hazira LNG (Shell and Total)	Hazira (Gujarat)	5 (to be expanded to 7.5 MTPA by 2016/17)	Spot cargoes	Commissioned in April 2005
Dabhol terminal (Ratnagiri Gas and Power Pvt. Ltd)	Dabhol (Maharashtra)	5 (limited usage till breakwater facilities added by 2016/17)	Spot cargoes (long-term agreement for supply of LNG is yet to be finalized)	Commissioned in 2012
Kochi LNG (Petronet LNG Ltd)	Kochi (Kerala)	5	LNG sale and purchase agreement with Exxon Mobil Corporation for supply of approximately 1.5 MTPA of LNG from Gorgon LNG project, Australia	Commissioned in 2013
Ennore LNG (IOCL and CPCL)	Ennore (Tamil Nadu)	5	Yet to be finalized	Expected to be commissioned by 2016/17
Mundra LNG terminal (GSPC and Adani)	Mundra (Gujarat)	5	Yet to be finalized	Expected to be commissioned by 2016/17
Mangalore LNG (ONGC, BPCL, Mitsui)	Mangalore (Karnataka)	2-3	Yet to be finalized	Expected to be completed by 2018/19
APGDC-Kakinada FSRU terminal (APGIC, Shell, GDF Suez, and GAIL)	Kakinada (Andhra Pradesh)	3.5-5.0 (expandable to 10 MT)	Yet to be finalized	Expected to be completed by 2017/18
Gangavaram (Petronet LNG Ltd)	Gangavaram (Andhra Pradesh)	5	Yet to be finalized	Expected to be commissioned by 2016
HEECPL-Digha FSRU terminal	Digha region (West Bengal)	4	Yet to be finalized	Expected to be commissioned by 2017
Paradip FSRU Terminal (GAIL)	Odisha	4	Yet to be finalized	Expected to be commissioned by 2017
Pipavav port FSRU terminal (SEL)	Gujarat	2.5-5.0	Yet to be finalized	Planned
Mumbai port FSRU (bids invited)	Mumbai (Maharashtra)	5	Yet to be finalized	Expected to be completed by 2018
Jaigarh LNG Terminal (H-Energy Gateway Pvt. Ltd)	Jaigarh (Maharashtra)	8	Yet to be finalized	Expected to be completed by 2018/19
HPCL LNG Terminal, a JV partnership with SP Ports Pvt. Ltd (a group company of Shapoorji Pallonji)	Chhara (Gujarat)	5	Yet to be finalized	Project activities initiated

APGDC - Andhra Pradesh Gas Distribution Corporation; APGIC - Andhra Pradesh Gas Infrastructure Corporation; CPCL - Chennai Petroleum Corporation Ltd; FSRU - floating storage re-gasification unit; GAIL - Gas Authority of India Ltd; GSPC - Gujarat State Petroleum Corporation; HEECP - H-Energy East Coast Pvt. Ltd; IOCL - Indian Oil Corporation Ltd; LNG - liquefied natural gas; MT - million tonnes; MTPA - million tonnes per annum; ONGC - Oil and Natural Gas Corporation; SEL - Swan Energy Ltd

Sources Business Standard (2013a); Business Standard (2013b); Lok Sabha (2013a); Lok Sabha (2013c); Lok Sabha (2015a); MoPNG (2016); Natural Gas Asia (2015); TERI (2014a); The Hindu (2013a); The Hindu (2013b)

Table 17 Length and capacity of natural gas pipelines in India

Network/region	Entity	Length (in km)	Design capacity (in MMSCMD)	Pipeline size (inch)	Per cent capacity utilization as on 30 September 2015
Hazira-Vijaipur-Jagdishpur Pipeline/GREP/Dahej-Vijaipur Pipeline and spur /HVJ/ Vijaipur-Dadri Pipeline (VDPL)	GAIL	4 658.00	53.00	36"	65.65
Dahej-Vijaipur Pipeline-GREP upgradation (DVPL-2 and VDPL)	GAIL	1 119.00	54.00	48"	38.83
Chhainsa-Jhajjar-Hissar Pipeline (including spur lines) commissioned up to Sultanpur, Jhajjar-Hissar on hold (111 km)	GAIL	265.00	5.00	36"/16"	15.07
Dahej-Uran-Panvel Pipeline including spur lines	GAIL	875.00	19.90	30"/18"	43.48
Dadri-Bawana-Nangal Pipeline, Dadri-Bawana (106 km); Bawana-Nangal (501 km); Spur line of BNPL (196 km)	GAIL	834.80	31.00	36"/30"/24"/18"	12.85
Dabhol-Bangalore Pipeline (including spur)	GAIL	1 097.00	16.00	36"-4"	7.48
Kochi-Koottanad-Bangalore-Mangalore (Phase 1)	GAIL	48.00	6.00	16"-4"	12.25
Assam (Lakwa)	GAIL	8.00	2.50	24"	16.80
Tripura (Agartala)	GAIL	61.00	2.26	12"	65.36
Ahmedabad	GAIL	133.00	2.90	12"	9.29
Rajasthan (Focus Energy)	GAIL	152.00	2.35	12"	56.77
Bharuch-Badodara (Undera), including RLNG + RIL	GAIL	538.00	15.40	24"/16"	10.78
Mumbai	GAIL	129.00	7.04	26"	111.86
KG Basin (including RLNG + RIL)	GAIL	881.00	16.00	18"	28.70
Cauvery Basin	GAIL	278.00	8.66	18"	34.46
East West Pipeline (RGTEL)	Reliance	1 469.00	80.00	48"	25.00
GSPL Network, including spur lines	GSPL	2 354.90	43.00	Assorted	56.40
Assam Regional Network	AGCL, DNPL	1 000.00	6.00	16"	63.46
Dadri-Panipat	IOCL	140.41	9.50	30"/10"	40.00
Uran-Trombay	ONGC	24.00	6.00	20"	84.50
Total		16 065.11	386.50		

AGCL – Assam Gas Company Ltd; BNPL – Bawana-Nangal pipeline; DVPL – Dahej-Vijaipur Pipeline; GAIL – Gas Authority of India Ltd; GSPL – Gujarat State Petronet Ltd; IOCL – Indian Oil Corporation Ltd; MMSCMD – million metric standard cubic metre per day; ONGC – Oil and Natural Gas Corporation; RGTEL – Reliance Gas Transportation Infrastructure Ltd; RIL – Reliance Industries Ltd; RLNG – re-gasified liquefied natural gas; VDPL – Vijaipur-Dadri pipeline

Source PPAC (2014f)

supply of natural gas would be gas-based urea plants, followed by LPG plants, city gas distribution projects, and gas-based power plants (MoPNG 2008). These guidelines were modified to include also non-priority sectors, namely steel plants, refineries, and petrochemical plants. The allocation to the non-core sectors was reduced due to the falling gas production. However, city gas distribution projects were taken up

in priority with an MoPNG notification in February 2014, which stated that “the requirement of natural gas for compressed natural gas (transport) and piped natural gas (domestic) shall be met by allocation of domestic gas to the maximum extent possible” (MoPNG 2014a). Table 19 gives the off-take of natural gas since 2010/11 by industry.

Table 18 Gas pipelines under construction

Network/region	Entity	Length (in km)	Design capacity (in MMSCMD)	Status of pipeline laid (as on 31 March 2015)
Kochi-Koottanad-Bangalore-Mangalore	GAIL	1 063	16	0
Dabhol-Bangalore	GAIL	410	16	0
Surat-Paradip	GAIL	2 112	75	0
Jagdishpur-Haldia	GAIL	1 860	32	0
Mallavaram-Bilwara	GITL	2 042	76.25	0
Mehsana-Bathinda	GIGL	2 052	77.11	0
Bathinda-Srinagar	GIGL	725	42	0
Kakinada-Srikakulam	APGDC	391	90	0
Shahdol-Phulpur	RGPL	312	3.5	0
Ennore-Nellore	KEI-RSOS PEPL	430	36	0
Subtotal		11 397		0

APGDC – Andhra Pradesh Gas Distribution Corporation; GAIL – Gas Authority of India Ltd; GIGL – GSPL India Gasnet Ltd; GITL – GSPL India Transco Ltd; GSPL – Gujarat State Petronet Ltd; KEI-RSOS PEPL – KEI-RSOS Petroleum and Energy Pvt. Ltd; MMSCMD – million metric standard cubic metre per day; RGPL – Reliance Gas Pipeline Ltd

Source: PPAC (2014f)

Natural gas pricing

While India's natural gas sector is characterized by multiple prices, the new gas price formula announced in October 2014 provides clarity and uniformity (CCEA 2014). The new gas price formula is as follows:

$$P = (VHH \cdot PHH + VAC \cdot PAC + VNBP \cdot PNBP + VR \cdot PR) / (VHH + VAC + VNBP + VR)$$

where

- VHH is the total annual volume of natural gas consumed in the United States and Mexico;
- VAC is the total annual volume of natural gas consumed in Canada;

- VNBP is the total annual volume of natural gas consumed in European Union and former Soviet Union, excluding Russia;
- VR is the total annual volume of natural gas consumed in Russia;
- PHH and PNBP are the annual average of daily prices at Henry Hub (HH) and National Balancing Point (NBP) less the transportation and treatment charges; and
- PAC and PR are the annual average of monthly prices at Alberta Hub and Russia, respectively, less the transportation and treatment charges.

The prices are determined on a half-yearly basis. The data used are of four quarters, with a lag of one quarter, and prices announced are on gross calorific value (GCV), rather than on net calorific value (NCV). The new pricing formula came into effect on 1 November 2014.

This new price applies to all gas produced from “nominated blocks” given to ONGC and OIL, all NELP blocks, and pre-NELP blocks where PSC provides for government approval of gas prices. It also applies to CBM blocks. This price, however, does not apply to (i) small and isolated nominated blocks, (ii) blocks where the prices are fixed contractually for a fixed period of time (although it will apply here after the end of such a contractual period), (iii) blocks where the PSC provides a specific formula for natural gas price indexation or fixation, and (iv) pre-NELP blocks where no government approval is needed under the PSC.

Further, since arbitration is on in the KG-DWN-98-3 block (popularly known as KG-D6), the operator (RIL-BP-Niko) would continue to receive the earlier price of \$4.2/MMBTU and the balance between the new price and this older price would be credited to a gas pool account maintained by GAIL.

With the provision of marketing and pricing freedom of gas produced from HPHT areas, a ceiling price will now be announced based on a formula. The ceiling price shall be calculated as the lowest of the

- Landed price of imported fuel oil
- Weighted average landed price of imported substitute fuels (namely, coal, fuel oil, and naphtha)
- Landed price of imported LNG

The weighted average import landed price of substitute fuels in (ii) above will be defined as: $0.3 \times (\text{price of coal}) + 0.4 \times (\text{price of fuel oil}) + 0.3 \times (\text{price of naphtha})$.

Table 19 Off-take of natural gas by industry (in MCM)

	2010/11	2011/12	2012/13	2013/14	2014/15
1. Energy use					
Power	25 787	22 628	16 078	11 284	10 720
Industry	—	284	269	156	395
Manufacturing	—	30	0	105	138
Road transport	—	0	0	66	0
City gas distribution	3 427	5 599	5 780	5 838	5 415
Tea plantation	193	175	182	196	188
LPG shrinkage	—	1 068	1 027	982	1 005
International conference for pipeline system	—	385	387	372	351
Miscellaneous	7 546	9 064	7 976	7 479	5 934
Total (1)	36 953	39 233	31 699	26 477	24 146
2. Non-energy use					
Fertilizer	11 464	14 003	14 733	15 869	15 190
Petrochemical	1 309	1 858	2 486	2 405	2 890
Refinery	1 529	4 257	3 891	3 968	4 575
Sponge iron	765	1 333	1 106	274	154
Total (2)	15 066	21 451	22 216	22 517	22 809
Grand total (1 + 2)	52 019	60 684	53 915	48 994	46 955

LPG – liquefied petroleum gas; MCM – million cubic metre

Source MoPNG (2015b)

Domestic gas prices in India according to the formula is given in Table 20.

The ministry has also announced pooling of prices for the fertilizer sector, which came into effect on 1 July 2015. The domestic gas will be pooled with

re-gasified liquefied natural gas (RLNG) to provide natural gas at a uniform delivered price to all natural gas-grid-connected plants for the purpose of manufacturing urea (MoPNG 2015a). To monitor the pool, the Empowered Pool Management Committee (EPMC) comprising senior bureaucrats from the MoPNG, Department of Fertilizers, Department of Expenditure, Petroleum Planning and Analysis Cell (PPAC), Fertilizer Industry Coordination Committee (FICC), and GAIL has been constituted. GAIL has been designated as the pool operator.

The EPMC is responsible for approving plant-wise gas supplies made under the pool mechanism; approving LNG purchase agreements for medium-term/spot LNG; monitoring both optimum utilization of domestic gas for the pool, and the operator's activities to ensure transparency; and deciding "the rate of interest the FICC shall charge on the amount paid by it to Pool Fund Account (PFA) on behalf of a fertilizer plant in case it fails to deposit full/part amount to PFA against debit note within due date."

Table 20 Price of natural gas produced in India on a gross calorific value basis (in \$/MMBTU)

Period	Price of natural gas produced in India	Price ceiling for natural gas from HPHT and deep water and ultra-deep water areas
November 2014 to March 2015	5.05	—
April 2015 to September 2015	4.66	—
October 2015 to March 2016	3.82	—
April 2016 to September 2016	3.06	6.61

HPHT – high pressure-high temperature

Source PPAC (2015a)

The operator (GAIL) will collect data regarding the anticipated gas supplies to fertilizer units as per the existing contract on a quarterly basis; determine the additional quantity of RLNG required for meeting the demand; determine plant-wise and uniform weighted average delivered cost of gas based on the anticipated supply, the additional quantity of RLNG decided by the EPMC, and the information submitted by FICC; and procure LNG in a transparent manner.

On the first of every month, the operator is mandated to declare the uniform delivered pool price of gas for the fertilizer (urea) sector for the month.

This pooling, as per the ministry notification, will be carried out in two phases. Phase I from 2015/16 to 2017/18 is for the existing fertilizer units, along with conversion units that will be supplied gas when pipeline connectivity is established. Phase II from 2018/19 onwards would cover requirements of the existing units, as well as the proposed brownfield and greenfield units.

Unconventional fossil fuels

Coalbed methane

Coalbed methane is natural gas extracted from coal seams instead of the conventional reservoirs (Figure 5). In 2015/16, 393 million metric standard cubic metre (MMSCM) of CBM was produced in India, up from 228 MMSCM in 2014/15 (Table 21). Of this, 389 MMSCM was produced in West Bengal's Raniganj South and East, Sohagpur East and West, and Jharia. The companies operating these blocks are Great Eastern Energy Corporation Ltd (GEECL),

ESSAR, ONGC, and RIL. The two Raniganj blocks being operated by GEECL and ESSAR are the most productive of all CBM blocks. The erstwhile Planning Commission (2011) projected CBM production to be 1256 MMSCM in 2016/17. The MoPNG has also stated that ₹10 000 crore have been invested in CBM in India and that by 2017, it would constitute 5% of India's natural gas production (Pradhan 2016). However, CBM production in the past did not meet its potential.

Shale gas

In October 2013, the government announced policy guidelines for the development of shale oil and gas in India. Under this, 54 licences (50 to ONGC and 4 to OIL) were handed out to NOCs in the first phase. ONGC had drilled one well, spudded one, and collected the cores from eight other wells till 31 December 2014, after which no new information has been provided. In all, ₹79 crore was spent on the exploration of shale oil and gas until the end of 2014. OIL's exploration efforts, on the other hand, have been at a nascent stage (Rajya Sabha 2015c). The production data from these wells have not yet been generated (Rajya Sabha 2015a).

There are varying estimates of shale gas reserves in India. The Energy Information Administration (EIA) has reported 584 trillion cubic feet (TCF) of gas reserves and 87 billion barrels of shale oil in four basins. Schlumberger estimated 300–2100 TCF shale gas resources, while ONGC has estimated 187.5 TCF in five basins (Rajya Sabha 2015b).

Table 21 Coalbed methane production in India (in MMSCM)

State	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
West Bengal	20	38	41	79	101	156	224	389
Madhya Pradesh	0	0	0	2	3	6	2	2
Jharkhand	0	0	0	4	3	3	2	2
Total	20	38	41	85	107	162	228	393

Source: MoPNG (2016)

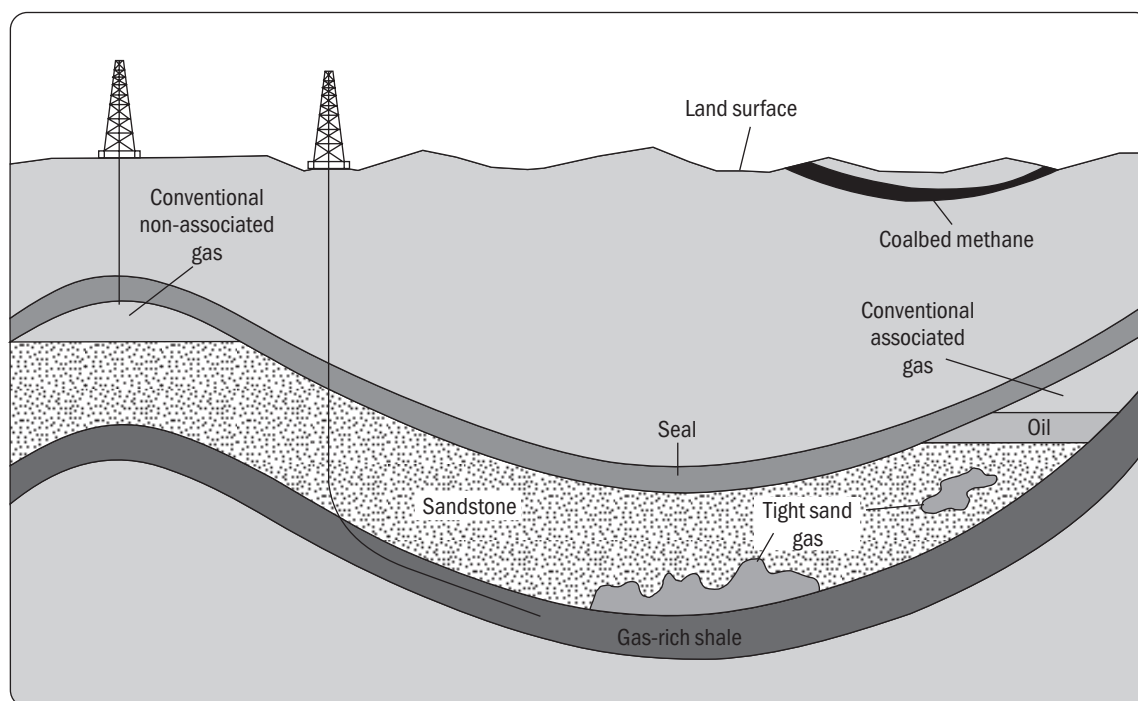


Figure 5 Geology of natural gas resources

Source EIA (2011)



Cleaner transport fuels

Urban air pollution has become a major environmental issue that has been making headlines in India. The World Health Organization (WHO) studies point out that 6 of the top 10 most polluted cities (in terms of particulate air pollution) in the world are located in India (The Guardian 2016). Source apportionment study has revealed that the transport sector plays a major role in urban air pollution (The Economic Times 2016). To ensure that transport fuels are cleaner, the government has been following the Auto Fuel Vision Policy 2003, which proposes incrementally more stringent fuel efficiency norms to address the environmental challenge.

Fuel standards in India comparable to Euro 1, Euro 2, Euro 3, and Euro 4 are India 2000, Bharat Stage (BS) II, Bharat Stage III, and Bharat Stage IV, respectively. These standards have specifications for both petrol and diesel, which are the two dominant transport fuels. Although BS III came into effect in 2005, it was extended to all cities in India only in 2010. BS IV auto fuel was introduced in 13 cities in 2010, which has now been extended to 50 more cities. Cities with high pollution have been prioritized, subject to availability and logistical constraints. BS IV is expected to cover the entire country by April 2019. Owing to the growing concerns over pollution, oil marketing companies have now been advised to be ready to leapfrog directly from BS IV to BS VI fuel standards by April 2020 (MoPNG 2016). However, emission norms for BS VI have not been defined yet. Therefore, for comparison, Euro 6 norms are considered in Table A. A successful switch to BS VI would prove to be critical in India's efforts towards combating urban air pollution.

Table A BS III, BS IV, and Euro 6 norms

Petrol emission norms (g/km)					
Emission norm	CO	HC	NO _x	HC + NO _x	PM
BS III	2.30	0.20	0.15	—	—
BS IV	1.00	0.10	0.08	—	—
Euro 6	1.00	0.10	0.06	—	0.005
Diesel emission norms (g/km)					
Emission norm	CO	HC	NO _x	HC + NO _x	PM
BS III	0.64	—	0.50	0.56	0.05
BS IV	0.50	—	0.25	0.30	0.025
Euro 6	0.50	—	0.06	0.17	0.005

CO – carbon monoxide; HC – hydrocarbons; NO_x – nitrogen oxides; PM – particulate matter

Source CPCB (2016)

References

- BG Group. 2013. BG Group completes agreement on long-term LNG sales to India. Details available at www.bg-group.com/292/where-we-work/india/
- Business Standard. 2013a. GAIL to set up Rs. 3,108 cr LNG terminal at Paradip. Details available at www.business-standard.com/article/companies/gail-to-set-up-rs-3-108-cr-lng-terminal-at-paradip-113102600351_1.html
- Business Standard. 2013b. Swan Energy gets green nod for LNG terminal at Pipavav. Details available at www.business-standard.com/article/companies/swan-energy-gets-green-nod-for-lng-terminal-at-pipavav-113121600601_1.html
- Cairn India. 2008. L&T to build India's first heated pipeline for crude. Details available at www.cairnindia.com/sites/default/files/press_releases/LnT21.02.08_0.pdf
- CCEA (Cabinet Committee on Economic Affairs). 2014. Revision of domestic gas prices. Details available at <http://pib.nic.in/newsite/PrintRelease.aspx?relid=110696>
- CPCB (Central Pollution Control Board). 2016. Vehicular exhaust. Details available at www.cpcb.nic.in/Vehicular_Exhaust.php
- EIA (Energy Information Administration). 2011. The geology of natural gas resources. Details available at www.eia.gov/todayinenergy/detail.cfm?id=110
- EIA (Energy Information Administration). 2014. India. Details available at www.eia.gov/countries/cab.cfm?fips=in
- IISD (International Institute for Sustainable Development). 2014. *Subsidies to Liquefied Petroleum Gas in India: an assessment of the direct benefit transfer in Alwar*. New Delhi: Global Subsidies Initiative and IISD
- LNG World News. 2015. *LNG World News: The Industry's LNG News Terminal*. Details available at www.lngworldnews.com/four-companies-bid-to-build-fsr-in-mumbai-port/; last accessed on 9 September 2016
- Lok Sabha. 2013a. Unstarred Question No. 2515 (MoPNG). Details available at <http://164.100.47.132/LssNew/psearch/QResult15.aspx?qref=144643>
- Lok Sabha. 2013b. Unstarred Question No. 247 (MoPNG). Details available at <http://164.100.47.132/LssNew/psearch/QResult15.aspx?qref=148632>
- Lok Sabha. 2013c. Starred Question No. 521 (MoPNG). Details available at <http://164.100.47.132/LssNew/psearch/QResult15.aspx?qref=140700>
- Lok Sabha. 2014. Unstarred Question No. 1564: Export Import of Natural Gas (MoPNG). Details available at <http://164.100.47.132/LssNew/psearch/QResult16.aspx?qref=1963>
- Lok Sabha. 2015a. *Unstarred Question No. 1015*: Setting up of LNG Terminals. Details available at <http://164.100.47.132/LssNew/psearch/QResult16.aspx?qref=23886>
- MoPNG (Ministry of Petroleum and Natural Gas). 2008. Press Note: Decision regarding sale of natural gas by NELP contractors and order of priority to supply gas from RIL's KG-D6 field
- MoPNG (Ministry of Petroleum and Natural Gas). 2014a. *Annual Report 2013-14*. New Delhi: MoPNG
- MoPNG (Ministry of Petroleum and Natural Gas). 2015a. *Guidelines for Pooling of Gas in Fertilizer (Urea) Sector*. New Delhi: MoPNG
- MoPNG (Ministry of Petroleum and Natural Gas). 2015b. Petroleum and Natural Gas Statistics 2014-15. New Delhi: MoPNG
- MoPNG (Ministry of Petroleum and Natural Gas). 2016. *Annual Report 2015-16*. New Delhi: MoPNG
- Natural Gas Asia. 2015. ONGC, BPCL, Mitsui to delay Mangalore LNG re-gasification terminal project. Details available at www.naturalgasasia.com/ongc-bpcl-mitsui-delay-mangalore-lng-re-gasification-terminal-project-16652
- PetronetLNG. 2015. *Annual Report 2014-15*. New Delhi: Petronet LNG
- PIB (Press Information Bureau). 2015a. Allocation of Rs. 4948 crore for Gross Budgetary Support to the Indian Strategic Storage Programme for Crude Oil. Details available at <http://pib.nic.in/newsite/PrintRelease.aspx?relid=117886>
- PIB (Press Information Bureau). 2015b. Blending of ethanol. Details available at <http://pib.nic.in/newsite/PrintRelease.aspx?relid=116604>
- PIB (Press Information Bureau). 2015c. Building strategic reserve of crude oil. Details available at <http://pib.nic.in/newsite/PrintRelease.aspx?relid=116429>
- PIB (Press Information Bureau). 2015d. From carbon subsidy to carbon tax: India's green actions. Details available at <http://pib.nic.in/newsite/PrintRelease.aspx?relid=116058>
- PIB (Press Information Bureau). 2015e. Incentives given to sugar sector to facilitate payment of Cane dues to farmers. Details available at <http://pib.nic.in/newsite/printrelease.aspx?relid=128365>
- PIB (Press Information Bureau). 2015f. Installation of bio-fuel pumps. Details available at <http://pib.nic.in/newsite/PrintRelease.aspx?relid=125018>
- PIB (Press Information Bureau). 2015g. PM at UrjaSangam 2015. Details available at <http://pib.nic.in/newsite/PrintRelease.aspx?relid=117760>
- PIB (Press Information Bureau). 2015e. States urged to liberalize restrictions on ethanol supply. Details available at <http://pib.nic.in/newsite/PrintRelease.aspx?relid=115627>
- PIB (Press Information Bureau). 2015h. Steps for implementation of Bio- Fuel Programme. Details available at <http://pib.nic.in/newsite/PrintRelease.aspx?relid=124076>
- Planning Commission. 2011. *Report of the Working Group on Petroleum and Natural Gas Sector for the 12th Five Year Plan (2012-17)*. New Delhi: Planning Commission
- PPAC (Petroleum Planning and Analysis Cell). 2015a. *Natural Gas Prices*. New Delhi: PPAC
- PPAC (Petroleum Planning and Analysis Cell). 2015b. *Ready Reckoner: Oil Industry at a Glance*. New Delhi: PPAC
- Pradhan, D. 2016. About Rs.10000 crore have been invested in coal bed methane (CBM) in India. By 2017 it is likely to contribute 5% of national gas production. *Twitter*
- Rajya Sabha. 2015a. Starred Question No. 253. New Delhi: Rajya Sabha
- Rajya Sabha. 2015b. Unstarred Question No. 1081. New Delhi: Rajya Sabha
- Rajya Sabha. 2015c. Unstarred Question No. 1089. New Delhi: Rajya Sabha

RajyaSabha. 2015d. Unstarred Question No. 1162. New Delhi: RajyaSabha

RajyaSabha. 2015e. Unstarred Question No. 1165. New Delhi: RajyaSabha

RajyaSabha. 2015f. UnstarredNo. 273. New Delhi: RajyaSabha

RajyaSabha. 2015g. Unstarred Question No. 715. New Delhi: RajyaSabha

RBI (Reserve Bank of India). 2015. Table 131: Imports of principal commodities-Rupees. Details available at <https://rbi.org.in/Scripts/PublicationsView.aspx?id=16572>

TERI (The Energy and Resources Institute). 2014a. **TERI Energy & Environment Data Directory and Yearbook 2013/14**. New Delhi: TERI

The Economic Times. 2016a. Fight against pollution: Need to focus on both NCR and Delhi, says IIT-Kanpur report. Details available at http://articles.economictimes.indiatimes.com/2016-01-13/news/69735187_1_air-pollution-control-measures-air-quality

The Economic Times. 2016b. India re-negotiates gas price with Qatar to below \$5/unit. Details available at http://articles.economictimes.indiatimes.com/2016-05-03/news/72804294_1_petronet-Ing-ltd-rasgas-ras-gas

The Financial Express. 2015. Sop on kerosene to end in 3 years. Details available at www.financialexpress.com/article/economy/sop-on-kerosene-to-end-in-3-years/106495/

The Guardian. 2016. Calls for action mount as six Indian cities hit top 10 of air pollution. Details available at <https://www.theguardian.com/environment/2016/may/12/calls-for-action-mount-as-six-indian-cities-hit-top-10-of-air-pollution>

The Hindu. 2013a. LNG terminal to be commissioned by 2016: Saurabh PatelDetails available at www.thehindu.com/business/Industry/Lng-terminal-to-be-commissioned-by-2016-saurabh-patel/article4912029.ece

The Hindu. 2013b. Dabhol LNG import terminal gets shipment after six-month gap. Details available at www.thehindu.com/business/Industry/dabhol-Ing-import-terminal-gets-shipment-after-sixmonth-gap/article5389753.ece

The Times of India. 2016. Govt launches auctions to unlock Rs 70k-cr oil, gas. Details available at <http://timesofindia.indiatimes.com/business/india-business/Govt-launches-auctions-to-unlock-Rs-70k-cr-oil-gas/articleshow/52441594.cms>

Bibliography

BG Group. 2015. **Global LNG Market Outlook 2014-15**. BG Group

Bhattacharya, S. 2016. Which cities in the world have the worst air pollution? Details available at <http://blogs.wsj.com/indiarealtime/2016/05/12/which-cities-in-the-world-have-the-worst-air-pollution/>

BPCL (Bharat Petroleum Corporation Ltd). 2014. **Annual Report 2013-14**. Mumbai: BPCL

BPCL (Bharat Petroleum Corporation Ltd). 2015. **Sustainable Development Report 2014-15**. Mumbai: BPCL

DGH (Directorate General of Hydrocarbons). 2013. **Annual Report 2012-13**. Noida: DGH

DGH (Directorate General of Hydrocarbons). 2014. Gas hydrate. Details available at <http://dghindia.org/index.php/page?pageld=39>

Elvidge, C. D., K. E. Baugh, B. T. Tuttle, A. T. Howard, D. W. Pack, C. Milesi, and E. H. Erwin. 2007. A twelve year record of national and global gas flaring volumes estimated using satellite data. Final report to the World Bank. Details available at http://siteresources.worldbank.org/INTGGF/Resources/DMSF_flares_20070530_b-sm.pdf

Forbes. 2014. Key trends impacting global refining margins. Details available at www.forbes.com/sites/greatspeculations/2014/03/03/key-trends-impacting-global-refining-margins/

GAIL (Gas Authority of India Ltd). 2014. **Sustainability Report 2013-14**. New Delhi: GAIL (India) Ltd

GE Energy. 2010. Flare gas reduction: Recent global trends and policy considerations. Details available at www.ge-spark.com/spark/resources/whitepapers/Flare_Gas_Reduction.pdf

HPCL (Hindustan Petroleum Corporation Ltd). 2014a. Annual Report 2013-14. Mumbai: HPCL

HPCL (Hindustan Petroleum Corporation Ltd). 2014b. **Sustainability Report 2013-14**. Mumbai: HPCL

ICRA. 2012. HPCL-Mittal Pipelines Limited. Details available at www.icra.in/Files/Reports/Rationale/HPCL-Mittal%20Pipelines%20Lim-r-07062012.pdf

IGU (International Gas Union). 2015. **World LNG Report 2015**. Oslo: IGU

IOCL (Indian Oil Corporation Ltd). 2014. Annual Report 2013-14. New Delhi: IOCL

IOCL (Indian Oil Corporation Ltd). 2015. **Sustainability Report 2014-15**. New Delhi: IOCL

Jayaswal, R. 2013. Gail India struggles to find buyers for imported LNG. Details available at http://articles.economictimes.indiatimes.com/2013-05-13/news/39228860_1_bc-tripathi-gorgon-Ing-d6-gas

LokSabha. 2015. Starred Question No 82: Revision of Domestic Natural Gas Prices. Details available at <http://164.100.47.132/LssNew/psearch/QResult16.aspx?qref=19822>

MoPNG (Ministry of Petroleum and Natural Gas). 2014a. **Indian Petroleum and Natural Gas Statistics 2013-14**. New Delhi: MoPNG

MoPNG (Ministry of Petroleum and Natural Gas). 2014b. Pricing of CNG (Transport) and ONG (domestic) by CGD entities. Details available at [http://petroleum.nic.in/docs/gp/Revised%20guidelines%20for%20allocation%20supply%20of%20domestic%20natural%20gas%20to%20CGD%20entities%20for%20CNG%20\(Tpt\)%20&%20PNG\(Domestic\)%20dt14.11.2013.pdf](http://petroleum.nic.in/docs/gp/Revised%20guidelines%20for%20allocation%20supply%20of%20domestic%20natural%20gas%20to%20CGD%20entities%20for%20CNG%20(Tpt)%20&%20PNG(Domestic)%20dt14.11.2013.pdf)

MRPL (Mangalore Refinery and Petrochemicals Ltd). 2014. **Annual Report 2013-14**. Mumbai: MRPL

Mukherjee, K. and R. Panandiker. 2014. **LNG-Global Challenges and Opportunities and Imperatives for India**. New Delhi: BCG, ONGC

NRL (Numaligarh Refinery Ltd). 2014. **Annual Report 2013-14**. Golaghat: NRL

ONGC (Oil and Natural Gas Corporation). 2013. Sustainability report 2012-13. Details available at www.ongcindia.com/wps/wcm/connect/23a4b0d0-50b6-423f-b48d-8cb0300d1590/SustainabilityReport_13.pdf?MOD=AJPERES&CACHEID=23a4b0d0-50b6-423f-b48d-8cb0300d1590

- Petronet LNG. 2014. *Annual Report 2013-14*. New Delhi: Petronet LNG
- PIB (Press Information Bureau). 2014a. Mechanism for procurement of ethanol by Public Sector Oil-Marketing Companies (OMCs) to carry out the Ethanol Blended Petrol programme. Details available at <http://pib.nic.in/newsite/PrintRelease.aspx?relid=113063>
- PIB (Press Information Bureau). 2014b. Memorandum of Understanding between India and United States for cooperation in gas hydrates. Details available at <http://pib.nic.in/newsite/PrintRelease.aspx?relid=109979>
- PNGRB (Petroleum and Natural Gas Regulatory Board). 2013. *"Vision 2030" Natural Gas Infrastructure in India*. New Delhi: PNGRB
- PPAC (Petroleum Planning and Analysis Cell). 2014a. *Production of Petroleum Products*. New Delhi: PPAC
- PPAC (Petroleum Planning and Analysis Cell). 2014b. *Consumption of Petroleum Products*. New Delhi: PPAC
- PPAC (Petroleum Planning and Analysis Cell). 2014c. *Import/Export of Crude Oil and Petroleum Products 2014*. New Delhi: PPAC
- PPAC (Petroleum Planning and Analysis Cell). 2014d. Petroleum subsidies. Details available at http://ppac.org.in/content/150_1_Subsidy.aspx
- PPAC (Petroleum Planning and Analysis Cell). 2014e. Natural gas imports. Details available at http://ppac.org.in/content/4_1_NaturalGas.aspx
- PPAC (Petroleum Planning and Analysis Cell). 2014f. Pipeline and CGD structure. Details available at http://ppac.org.in/content/154_1_PipelineandCGDStructure.aspx
- PPAC (Petroleum Planning and Analysis Cell). 2014g. Domestic gas price November, 2014–March, 2015. Details available at http://ppac.org.in/WriteReadData/userfiles/file/NG_Price%20Notification%20November14-March2015.pdf
- Rajya Sabha. 2014. *Starred Question No. 132*. New Delhi: Rajya Sabha
- Rao, V. 2014. An overview of Indian shale gas potential and G&G techniques to delineate potential layers. In *Infraline Energy's 2nd Annual Conference on "Shale Gas: Critical Technologies for Successful Projects"*, 19 September 2014, New Delhi
- RBI (Reserve Bank of India). 2014. Table 132: Imports of principal commodities–Rupees. Details available at www.rbi.org.in/scripts/PublicationsView.aspx?id=15922
- Reuters. 2014. Table: Gross refining margins of Indian state-run, private companies. Details available at <http://in.reuters.com/article/2014/09/25/india-diesel-idINL3NOR02TA20140925>
- RIL (Reliance Industries Ltd). 2014. *Annual Report 2013-14*. Mumbai: RIL
- TERI (The Energy and Resources Institute). 2014. *Evaluation of the Pilot Project on Direct Transfer of Kerosene Subsidies in Kotkasim, Alwar*. New Delhi: TERI, Global Subsidies Initiative, and International Institute of Sustainable Development
- The Hindu. 2014. ONGC scripts turnaround, plans to ramp up oil output by 23%. Details available at www.thehindu.com/business/Industry/ongc-scripts-turnaround-plans-to-ramp-up-oil-output-by-23/article6541342.ece
- World Bank. 2004. Regulation of associated gas flaring and venting: A global overview and lessons from international experience. Details available at www-wds.worldbank.org/external/default/WDSPContentServer/WDSP/IB/2004/07/16/000012009_20040716133951/Rendered/PDF/295540RegulatingOno10301public1.pdf