

MEETING DEMAND CHALLENGES OF AN EMERGING LNG MARKET: INDIA

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ABSTRACT

Over the last decade, steep economical growth has positioned India as one of the major developing economies in the world. To match up the CAGR of 7-8% p.a. with similar increase in energy consumption, India needs uninterrupted, economical viable & clean fuel supplies. Over next years, there will be substantial increase in natural gas demand from power, fertilizer and industrial sectors. In view of lack of sufficient indigenous supply options to mitigate the growing demand-supply gap, LNG is bound to play pivotal role. Presently, India is 6th largest LNG importer, importing 13.5 MMTPA. Ongoing development of required infrastructure such as LNG regasification terminals and natural gas pipeline in the country is further strengthening the development of LNG market in India. India's regasification capacity of 13.5 MMTPA is expected to go up to 47.50 MMTPA by 2015-16 whereas gas transmission pipeline of 9000 KM is also expected to reach around 15000 by 2016. This growing demand is constrained by a major challenge in terms of price acceptability of LNG by various sectors. While at a price point, there is enormous demand of LNG, it vanishes at very fast pace with increase in LNG prices. The major challenge lies in structuring and tying up LNG which can meet the Suppliers expectation on one side and also meet Customers price expectations on other side. India is undoubtedly emerging as a major LNG market of the future to attain the desired sustainable growth of Indian economy and is likely to be 3rd largest importer of LNG by 2020.

India is the 5th largest energy consumer¹ at present accounting for more than 4% of world consumption. By 2025, it is expected that China and India will emerge as biggest energy consumers after US. The average would primary energy consumption growth rate in last decade has been 2.4%. For Asia the growth has been around 5.61%, while for India was around 5.88%.

As per Exxon Mobil's Energy Outlook², the world population is expected to grow from 7bn to 9bn by 2040. Increased population would naturally result in increased energy requirement and India is likely to be the most populous country post 2030. While the per-capita Energy Consumption of India at present is almost half the global average i.e. 0.8 mtoe vis-a vis 1.8 mtoe, with the rising income levels along with growth in Indian Economy, the per capita energy consumption is likely to see a two-fold increase in next 10 years.

PRIMARY ENERGY CONSUMPTION PATTERN

The Indian economy has been projected to achieve an average real GDP growth of 6.4% during 2008-2035. Energy availability is a key parameter to economic growth and therefore, going forward high economic growth would lead to increase in the energy consumption of the country. The primary energy mix of India is also set to alter on account of increased substitution of oil and coal by natural gas. The share of natural gas in the energy mix is expected to increase to 20% in 2025 and beyond as compared to 9% in 2005 & 11% in 2010 respectively. In a recent report³, the expected change in the primary energy basket for India in 2005, 2010 and 2025 has been presented in following *Table-1* based on the plans for expansion in natural gas supply in the country with the help of additional RLNG terminals, nation-wide transmission pipeline network and transnational pipelines expected to materialize in next 5 to 10 years.

Table 1: Primary Energy Mix

Source	2005	2010	2025
Coal	51%	53%	50%
Oil	33%	30%	25%
Gas	9%	11%	20%
Hydro	6%	5%	2%
Nuclear	1%	1%	3%
	100%	100%	100%

ROLE OF NATURAL GAS

The world natural gas consumption growth rate in the last decade was over 2.76%, while in the Asia Pacific region it was 6.92% and for India 9%. This clearly indicates that the growth rate of primary energy consumption as well as natural gas consumption in India is higher compared to the World and Asia Pacific averages, consistent with the energy needs of growing economy. India needs to increase its energy supply by 3-4 times within the next two decades.

Historically, natural gas was significantly cheaper than alternate fuels like motor spirit, naphtha, diesel and LSHS/FO. Although the price of natural gas is steadily increasing (especially of imported gas), newer technology and higher capacity installations have led to higher efficiency and economy of scale enabling increase in usage of natural gas. Therefore natural gas's availability, environment friendly nature, clean management and uninterrupted supply make it the preferred fuel for fertilizers, petrochemicals and also into power generation segment. Further, planned investments in the power, fertilizer, petrochemical and other areas including City Gas Distribution (CGD) suggest a sustained increase in the level of natural gas consumption in the country.

DOMESTIC GAS PRODUCTION

There have been several initiatives by Government of India (GOI) to augment the domestic production of natural gas, including introduction of National Exploration Licensing Policy (NELP) and possibly Open Acreage Licensing Policy regimes. Despite, the East Coast Offshore (KGD6) discovery adding significantly to the domestic gas production, the demand for natural gas has continuously been outstripping supply. With the projected economic growth and the envisaged growth in the gas infrastructure, market demand is likely to grow. Despite all the efforts by the Indian Exploration & Production (E&P) Industry there are still major challenges for domestic natural gas production. Existing fields are witnessing declining production and will require redevelopment investments. The new finds by Oil & Natural Gas Corporation (ONGC), Reliance Industries Limited (RIL) and Gujarat State Petroleum Corporation (GSPC) gas finds will take time to develop.

NATURAL GAS DEMAND, SUPPLY AND GAP

In recent years the demand for natural gas in India has increased significantly due to its higher availability, development of transmission and distribution infrastructure, the savings from the usage of natural gas in place of alternate fuels, the environment friendly characteristics of natural gas as a fuel and the overall favorable economics of supplying gas at reasonable prices to end consumers. Power and Fertilizer sector remain the two biggest contributors to natural gas demand in India and continue to account for more than 50% of gas consumption. India can be divided into six major regional natural gas markets namely Northern, Western, Central, Southern, Eastern and North-Eastern market, out of which the Western and Northern markets currently have the highest consumption due to better pipeline connectivity. However, with the

increasing coverage and reach of natural gas infrastructure in India, this regional imbalance is expected to get corrected. ***In future, the natural gas demand is all set to grow significantly at a CAGR of 7% from 226.7 MMSCMD in 2012-13 to 713.5 MMSCMD in 2029-30.*** This demand represents the Realistic Demand for natural gas in India. Gas based power generation is expected to contribute the highest, in the range of 38% to 49%, to this demand in the projected period (2012-13 to 2029-30). The share of fertilizer sector in the overall gas consumption in the country is expected to go down from 26% in FY 2013 to 15% in FY 2030 owing to higher growth in other sectors. The contribution to the overall demand from the CGD sector is set to increase from 7% to 12% during the projected period. The consolidated demand for natural gas from 2012-13 to 2029-30 have been summarized in *Table 2* below.

Table 2: Natural Gas Demand Projections (MMSCMD)

SECTOR	2012-13	2016-17	2021-22	2026-27	2029-30
Power	86.17	157.26	232.26	307.26	352.26
Fertilizer	59.86	96.85	107.85	110.05	110.05
City Gas	15.30	22.32	46.25	67.96	85.61
Industrial	20.00	27.00	37.00	52.06	63.91
Petchem/Refineries/Internal Cons.	38.37	46.64	59.52	75.96	87.94
Sponge Iron/Steel	7.00	8.00	10.00	12.19	13.73
Total Realistic Demand	226.70	358.06	492.88	625.49	713.49

The supply of natural gas is also likely to increase in future with the help of increase in domestic gas production and imported LNG. However, the expected increase in domestic production at present is significantly lower than earlier projections due to a steady reduction in gas output from the KG D6 field. The capacity of RLNG terminals in India is expected to increase from 13.60 MMTPA in 2012-13 to 73 MMTPA in 2029-30 assuming all the existing and planned terminals in India would materialize. Natural gas availability through non-conventional sources like Coal Bed Methane (CBM), Shale gas and gas Hydrates has not been considered in gas supply projections in the absence of clarity on key variables like data as most of India remains unexplored/underexplored, regulatory policy and lack of domestic infrastructure. **The total supply of natural gas is expected to grow at a CAGR of 7.1% from 2012 to 2030 reaching 375 MMSCMD by 2021-22 and 448 MMSCMD by 2029-30. The supply growth profile for the projected period has been provided in *Table -3* below.**

Table 3: Natural Gas Supply Projection (MMSCMD)

SOURCE	2012-13	2016-17	2021-22	2026-27	2029-30
Domestic Sources	101.1	156.7	181.6	210.6	230.1
LNG Imports	44.6	143.0	175.2	188.0	188.0
Gas Imports (Cross border Pipelines)	0.0	0.0	30.0*	30.0	30.0
Total	145.7	299.7	386.8	428.6	448.2

* TAPI pipeline projected to get commissioned in 2017-18

The availability of natural gas in India is expected to fall short of the total natural gas demand by around 81 MMSCMD in 2012-13. However, this shortfall will reduce by 2017-18 due to substantial addition in regasification capacity and natural gas supply through cross border pipeline (TAPI). The demand-supply gap is likely to again increase post 2017-18 and reach about 265 MMSCMD by 2029-30 as increase in supply lag behind a steady increase in demand. The demand-supply gap that is likely to prevail over the projected period has been depicted in the *Figure 1* below.

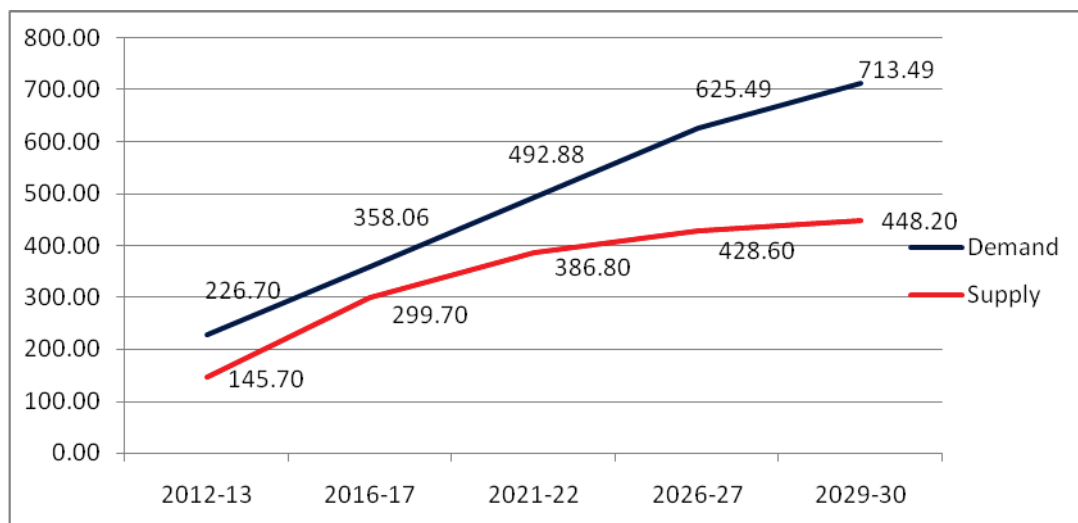


Figure 1: Demand Supply Gap Projection (MMSCMD)

Overall the gas sector in India has shown modest growth in the past. Substantial investment in infrastructure relating to import of LNG and transportation of domestic gas across India is planned for the next 5-6 years. The current planned investments along with incremental investments in future would be sufficient to meet the significant part of demand for gas from various consumers. To ensure the time bound implementation of this, Gol and PNGRB need to take various policy and regulatory measures such as infrastructure status to gas pipeline, rational tax structure etc. This would ensure higher investments in complete gas chain leading to a sustained and healthy growth of the sector.

ROLE OF LIQUEFIED NATURAL GAS

With limited growth in domestic gas supplies, LNG import of which started in 2004 has seen a significant increase in the imported quantity at the two operating terminals at Dahej and Hazira in the State of Gujarat. Imported natural gas is meeting around 30% of total natural gas consumption in the country.

The strong LNG demand growth is likely to be driven by substitution of liquid fuels in emerging economies like India, mainly in the industrial, commercial and residential sectors.

COMPLEXITY OF NATURAL GAS PRICING & CONSUMPTION

Gas and its policies administer the production as well as price of domestic gas and other fuels such as coal, crude oil products etc, whereas imported gas has altogether different globally driven price structure. In view of limited growth in the domestic fuels production including natural gas along with growing energy requirements, the demand of imported natural gas is likely to accentuate sharply in the coming years, however the price acceptability and affordability of imported natural gas is going to play a very vital role. In India, many natural gas consumers especially in power, CGD, industrial sectors are blending domestic and imported gas to fulfill their energy requirements.

Currently the natural gas demand far exceeds domestic supply in India and the situation is likely to prevail in foreseeable future as well. In view of limited growth in domestic supply, new demand is likely to be met through RLNG in future or through transnational pipelines.

A Price Sensitive Analysis ⁴ carried out some time back depicting gas demand from various sectors at different price levels indicating increment in the LNG import quantities and emergency of latent demand is shown in below *Figure -2*.

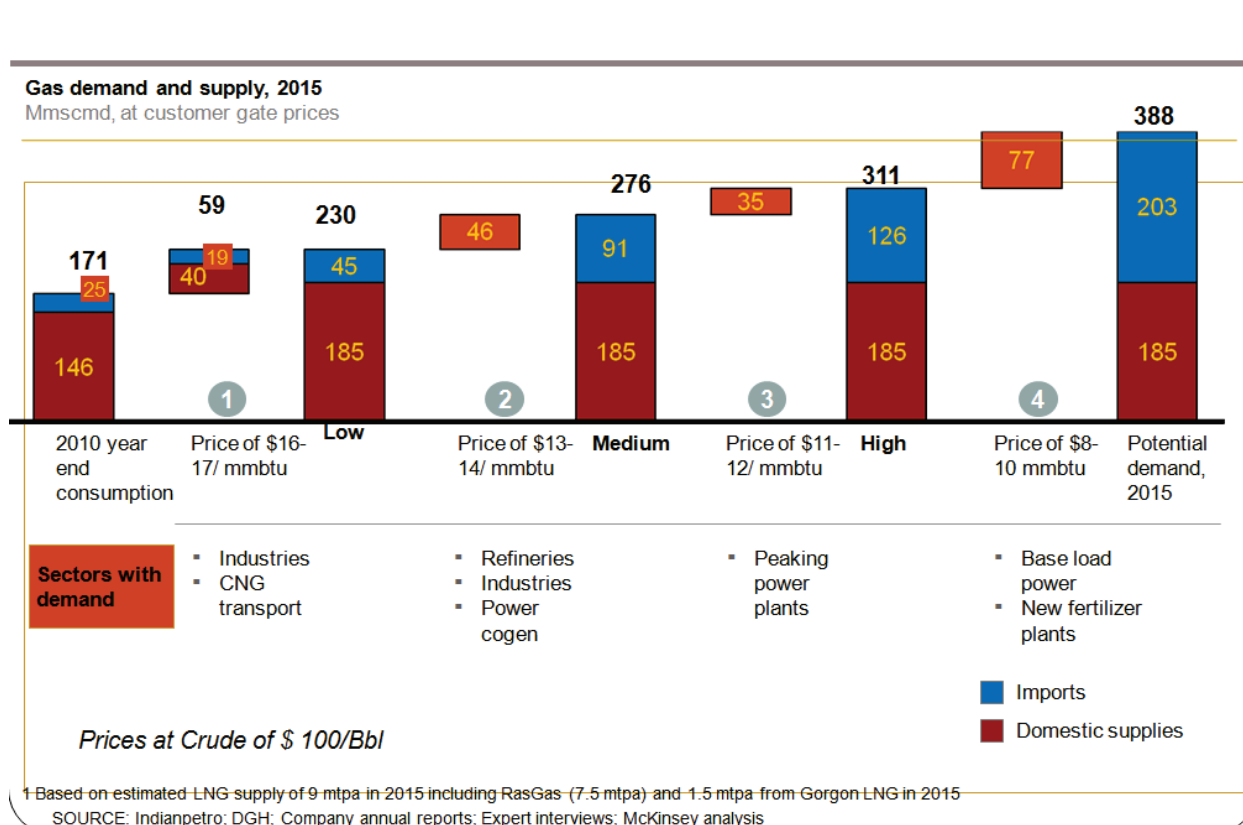


Figure 2: Large Demand but Sensitive to Price

LNG Regasification Capacity

As on date, India's LNG re-gasification capacity is 13.60 MMTPA (10 MMTPA at Petronet LNG Limited terminal at Dahej, 3.60 MMTPA at Shell's terminal at Hazira, both in the State of Gujarat). An additional capacity of 1.2 MMTPA may be added shortly post commissioning of Dhabol terminal. Capacity of Dahej is expected to increase to 12.5 MMTPA by 2013-14 and 15.0 MMTPA by 2015-16 after expansion. The capacity of Shell's Hazira terminal is also likely to be expanded to 5.0 MMTPA by 2013-14 and 10.0 MMTPA by 2016-17. In addition to these terminals, PLL is adding another 5.0 MMTPA terminal at Kochi in the State of Kerala, which is mechanically completed and expected to start operations in the 1st quarter of 2013. The initial capacity of Dhabol terminal is expected to stand at 1.2 MMTPA however, after completion of breakwater facilities by 2013-14, the terminal will be in a position to handle 5.0 MMTPA of natural gas. Further into future, GSPC-Adani plans to add a 5.0 MMTPA terminal at Mundra, and Indian Oil Corporation Limited plans to add a 5.0 MMTPA terminal at Ennore in the State of Tamil Nadu by the end of the 12th five year plan period in 2016-17. An Floating Storage & Regasification Unit (FSRU) based terminal at Kakinada and another terminal at Gangavaram, both on the east coast of the country, are also expected to become operational in the second half of the 12th five year plan.

In addition to the existing and planned RLNG terminals mentioned above, regasification capacity addition of 5.0 MMTPA each on the east and the west coast of the country post 13th five year plan period is also likely to

commission. A snapshot of existing LNG terminals and likely regas capacity addition is given in the *Table - 4* below :

Table 4: LNG Terminals in India — Likely Regas Capacity Addition

TABLE - 4 LNG TERMINALS IN INDIA - LIKELY REGAS CAPACITY ADDITION				
LOCATION	Capacity MMTPA			Owned by
	2012-13	2015-16	2019-20	
Existing				
Dahej	10.00	13.00	18.00	Petronet LNG
Hazira	3.60	3.50	5.00	Shell & Total
Dabhol				
TOTAL	13.60	16.50	23.00	
Under Construction				
Kochi	-	5.00	5.00	Petronet LNG
Dabhol (revival)	-	5.00	5.00	RGPL (GAIL & NTPC)
TOTAL		10.00	10.00	
Proposed				
Gangavaram	-	5.00	5.00	Petronet LNG
Mundra	-	5.00	5.00	Adani - GSPC
TOTAL	-	10.00	10.00	
Possible				
Ennore	-	5.00	5.00	IOCL
West Coast	-	-	2.50	Hiranandani
Jamnagar/Kakinada	-	-	5.00	RIL-BP
Pipevav (FSRU)	-	2.50	5.00	Swarn Energy
TOTAL	-	7.50	17.50	
Grand Total	13.60	44.50	60.50	

Gas Transportation Infrastructure

India, currently, has a network of more than 13,000 km of natural gas transmission pipelines with a design capacity of around 330 MMSCMD. This pipeline network is expected to expand to around 28,000 Kms with a total design capacity of around 731 MMSCMD in next 5-6 years, putting in place most of the National Gas Grid that would connect all major demand and supply centers in India. Current India's Gas Infrastructure including existing / under construction LNG terminals & pipeline network is given in *Figure - 3*

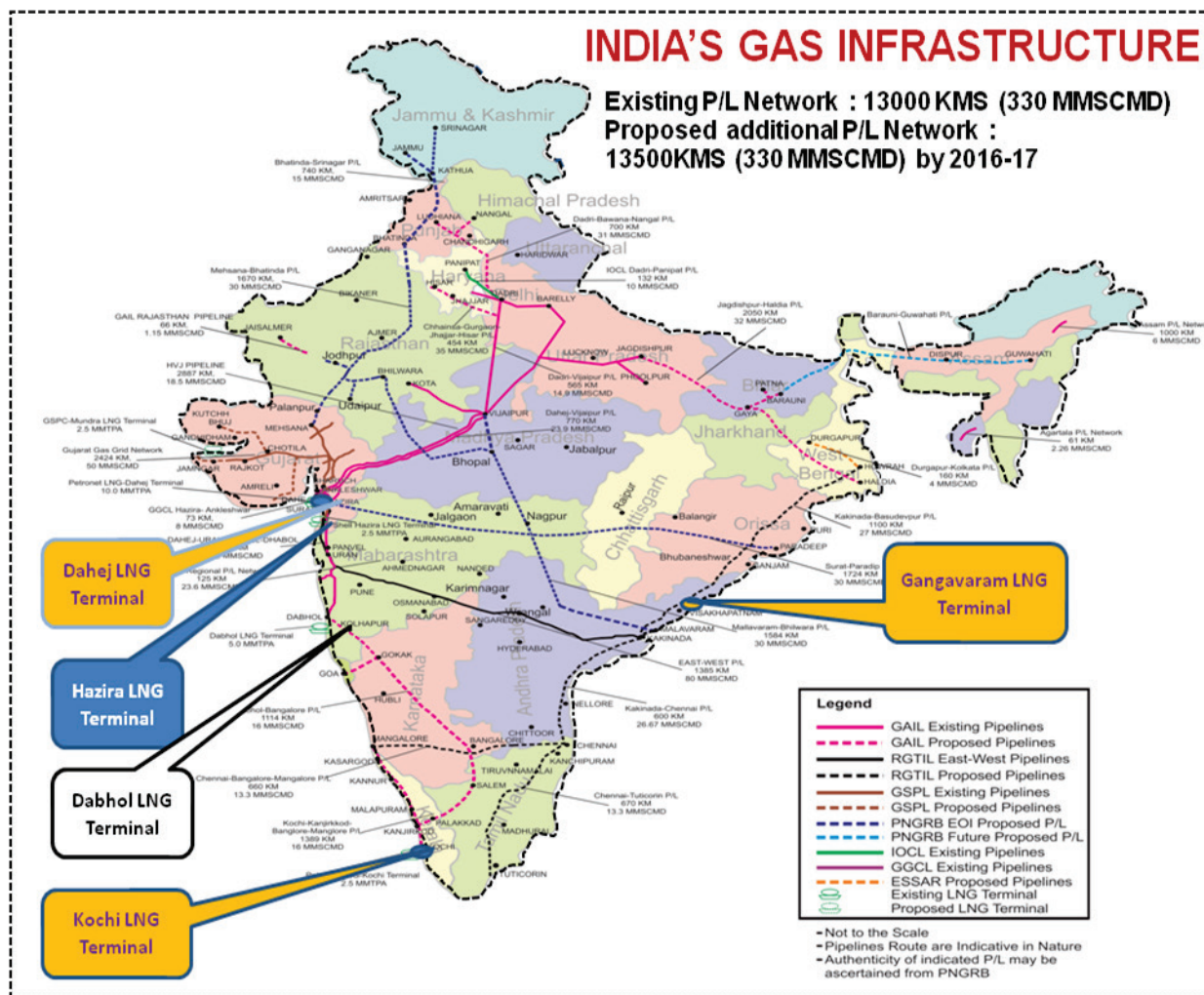


Figure 3: India Gas Infrastructure

The design capacity of pipeline network in India is expected to reach 763 MMSCMD in 2029-30. However, considering the addition of capacity directly linked to the existing/planned sources of natural gas in the country, the gas grid capacity in India (pipeline emanating from source) is expected to reach 533 MMSCMD in 2029-30. In addition to the trunk lines regional gas pipelines, similar to the intra-state network of Gujarat, are recommended for highly industrialized states.

Today, the natural gas sector is at the threshold of rapid growth in India supported by ever increasing demand for natural gas in the country, increased exploration efforts under NELP, commissioning of the LNG import terminals in the West Coast, projected upcoming LNG terminals and the Government's initiatives in the direction of development of a nation-wide natural gas pipeline grid. However, there is a need to provide a proactive enabling environment to support the fast-paced development of natural gas infrastructure. An enabling environment includes providing desired policy support and the correct pricing signals for investment in the sector, reforming the present set of regulations to adopt to changing needs and making them more robust and addressing the distortions in the fiscal regime applicable for natural gas.

LNG Sourcing

Currently, LNG is imported in India through mix of long term, short term and spot basis. India currently has long term contracts between Petronet LNG and RasGas, Qatar for 7.5 MMTA and Petronet LNG and Mobil Australia Resources Limited for 1.44 MMTA from Gorgon Project, Australia, GAIL and Cheniere Energy, USA for 3.5 MMTA and GAIL and Gazprom, Russia for 2.5 MMTA. In addition LNG is imported on

medium and short term basis under various contracts between Indian Buyers and global LNG suppliers. India over the recent years has become a major spot buyer with demand varying based on prevailing prices, clearly depicting India as price elastic market. With the growing demand supply gap, India is expected to be one of the major LNG importers in next 10-15 years and is on lookout for new long term deals.

The new liquefaction projects being planned in Russia, North America, East Africa, Australia are definitely focus areas for meeting India's growing demand. Indian companies are looking at diversifying their portfolio in terms of source and pricing as well.

Challenges before India in meeting its demand

While there is no doubt that India will emerge as a major LNG buyer in this decade, the key challenges can be summarized as follows:

- Price of LNG and competition from alternate fuels and sector level price challenges

Currently coal meets more than 50% of energy demand in India and with fifth largest coal reserves in the world, competition from Coal is one of the major challenges and more so in case of power sector. With average power prices of around USD 0.70/Kwh, power produced from LNG is likely to be around 1.50 to 2 times of that produced from coal both domestic and imported. While there has been focus for reducing emissions and use cleaner forms of energy, high production price and low sale price of electricity has been a deterrent both before Government on one side and meeting consumer expectations on other side. A holistic approach to review pricing of all energy sources needs to be undertaken for creating an investment environment for sustainable growth.

In the Fertilizer sector, while most of the gas used is supplied through domestic sources, a key challenge lies in importing incremental required through imports or producing them indigenously using LNG. It has been noted that beyond a delivered gas price of USD 14/MMBtu, it is economical to import fertilizers directly rather than producing domestically.

Other sectors like industries, city gas, refineries face competition with alternate liquid fuels like fuel oil, naphtha and diesel. While naphtha has already been replaced with natural gas in majority of sectors, diesel which is capped and fuel oil poses major pricing challenge for substitution with LNG in these sectors.

- LNG regasification and Gas transportation infrastructure

Another major challenge which poses threat is the keeping up the pace of development of LNG regasification and gas transportation infrastructure. Currently with regasification capacity of 13.60 MMTPA and gas pipeline network of around 13000 KM, approximate 30% of total natural gas is being supplied by RLNG. To bridge the growing gas demand supply gap, robust development of regasification terminal and gas pipeline network connecting various part of India is required to be developed at very fast pace.

- Competition from Far East and China

Far East Countries such as Japan, South Korea, Taiwan, are the major and traditional LNG importing countries which import around 50% of total LNG traded in the world. India and China are relatively new entrants in comparison to these established players, has to travel a long way to meet its energy requirements. Also China, has been very aggressive in securing LNG, India faces stiff competition from these markets.

WAY FORWARD

While India is emerging as major LNG market of future with all round development in LNG terminals, gas pipelines to attain desired sustainable growth, a comprehensive approach which can meet suppliers expectation on one side and meet consumers price expectation on other side needs to be firmed up.

India would also need to take strategic decisions like upstream participation in integrated liquefaction projects, tax efficient structures, and a consumer friendly regulatory environment to make this dream a reality.

Sources

1. Global LNG Database (InfraInsights)
2. Exxon Mobil's latest Outlook for Energy : A view to 2040
3. "Vision 2030" Natural Gas Infrastructure in India
4. Price Sensitive Report by Mckinsey

Definitions	
11th Five Year Plan	2007-12
12th Five Year Plan	2012-17
13th Five Year Plan	2017-21
Bn	Billion
CAGR	Compound Annual Growth Rate
CBM	Coal Bed Methane
CGD	City Gas Distribution
E&P	Exploration & Production
FO	Furnace Oil
FSRU	Floating Storage & Regasification Unit
FY	Financial Year
GDP	Gross Domestic Product
GOI	Government of India
GSPC	Gujarat State Petroleum Corporation
IOCL	Indian Oil Corporation Limited
KG	Krishna Godavari
Kwh	Kilowatt per hour
LNG	Liquefied Natural Gas
LSHS	Los Sulfur Heavy Stock
MMBTU	Million Metric British Thermal Unit
MMSCMD	Million Metric Standard Cubic Meter per day
MMTPA	Million Metric Tons Per Annum
Mtoe	Million tons oil equivalent
NELP	National Exploration Licensing Policy
ONGC	Oil & Natural Gas Corporation
PNGRB	Petroleum & Natural Gas Regulatory Board
RLNG	Regasified LNG
TAPI	Turkmenistan Afghanistan Pakistan India
USD	United State Dollar