

Expanding Horizons of Liquefied Natural Gas-LNG on India's Energy Landscape

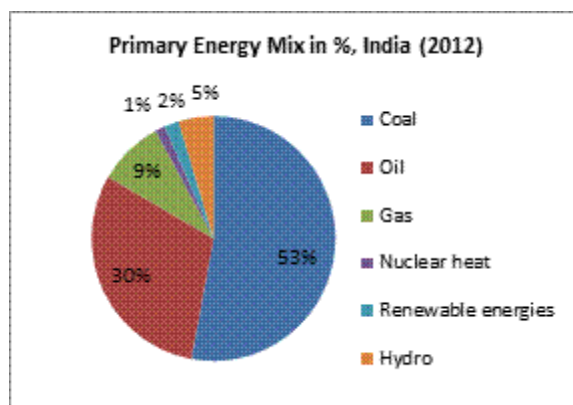
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Abstract: India's economy has undergone dramatic transformation since a range of structural reforms were undertaken in the 1990s. These reforms included opening the economy to more international trade and investment, abolishing industrial licensing, floating the exchange rate, and increasing domestic and foreign private participation in financial markets. The reform process has stimulated strong economic growth in India. The expansion in economic output, supported by a large and growing population, has led to a strong rise in energy consumption in India. Primary energy consumption (excluding combustible renewable and waste) has increased at an average annual rate of nearly 7.0 % since 1990, and India now ranks fifth in the world in terms of energy consumption. India's energy mix is currently dominated by coal and oil, although the role of natural gas has been steadily increasing. Consumption of natural gas in India has the potential to rise dramatically, on the basis of robust economic growth, an expanding population and recent large domestic gas discoveries. So, what can mitigate this effect? The answer is new natural gas supply and its reliable transportation to consuming markets. Although the answer appears simple, the process of getting to a viable solution requires intensive study of supply alternatives. Ofcourse, One source is liquefied natural gas, or LNG.

I. INTRODUCTION

LNG is the bedrock on which India's efforts to enhance the use of natural gas rests. By 2020, natural gas consumption is envisioned to meet 20% of the country's requirements as against 7% as on today. January 2004 marked a paradigm shift in the country's energy history when petronet LNG Ltd set up the first LNG Import terminal. Indian market traditionally dependent on the domestic source of gas supply during last three decades. A segregated market development has taken place during this period near the source of gas production. It is during the last three decade when the gas supplies became short of natural gas allocation in the country and the Government of India decided to import natural gas through LNG route. Import of liquefied natural gas (LNG) to India commenced in 2004, after more than a decade in planning. In 2005, LNG imports accounted for around a fifth of natural gas consumption in India. The advantage of liquefying the gas for transportation is that the gas volume can be decreased by 600th times compared to gas. So, huge amount of gas can be transported in liquid form compared to gas. The recent activities in the field of liquefied natural gas (LNG) have induced considerable interest in the possibility of piping natural gas in its liquid rather than gaseous form. Many national and International LNG projects are already commercially established. These plants are presently piping LNG within the plant and to and from loading terminals. Expansion of these facilities including piping LNG between widely separated storage depots is an anticipated future step in the advance of the LNG industry.

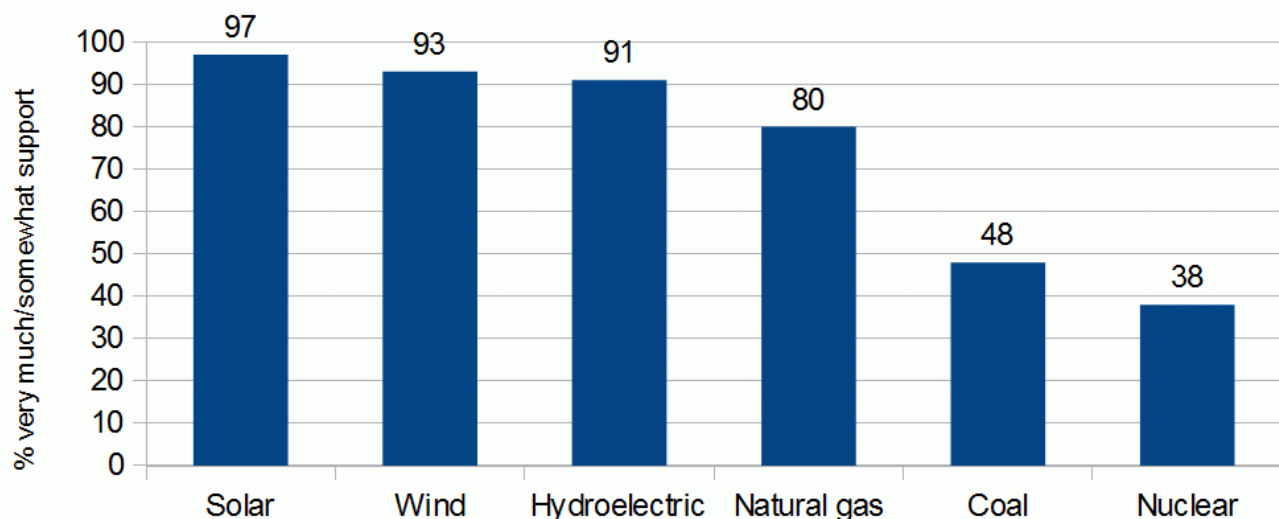


II. NATURAL GAS

While demand for natural gas in India is strong, actual consumption has been constrained by the availability of natural gas supplies. India has relatively large natural gas reserves and prospects for further discoveries are good. However, the natural gas market has been dominated by government owned companies selling gas at heavily subsidized prices, reducing incentives for private investment in production facilities. Production of gas from mature domestic fields is dwindling, and has resulted in the Indian Government restricting gas supplies to mainly the priority sectors. However, private sector participation in India's gas market is increasing, which should lead to an increase in domestic gas production. Imports of liquefied natural gas (LNG) to India commenced in 2004, after more than a decade of planning. In 2005, LNG imports accounted for around a fifth of natural gas consumption in India. Two LNG import terminals are operational on the west coast of India, and a third is near completion, although imports are still well under capacity. To date, LNG imports have mainly been sourced from Qatar under a long term contract. But with high natural gas demand, India has also imported a number of spot cargoes of LNG, including from Australia. In 2006, India accounted for 6 per cent of Asia's total LNG imports. 80% of people are supporting the use of natural gas among all the available energy sources.

Global public support for energy sources

"Please indicate whether you strongly support, somewhat support, somewhat oppose, or strongly oppose each way of producing energy"

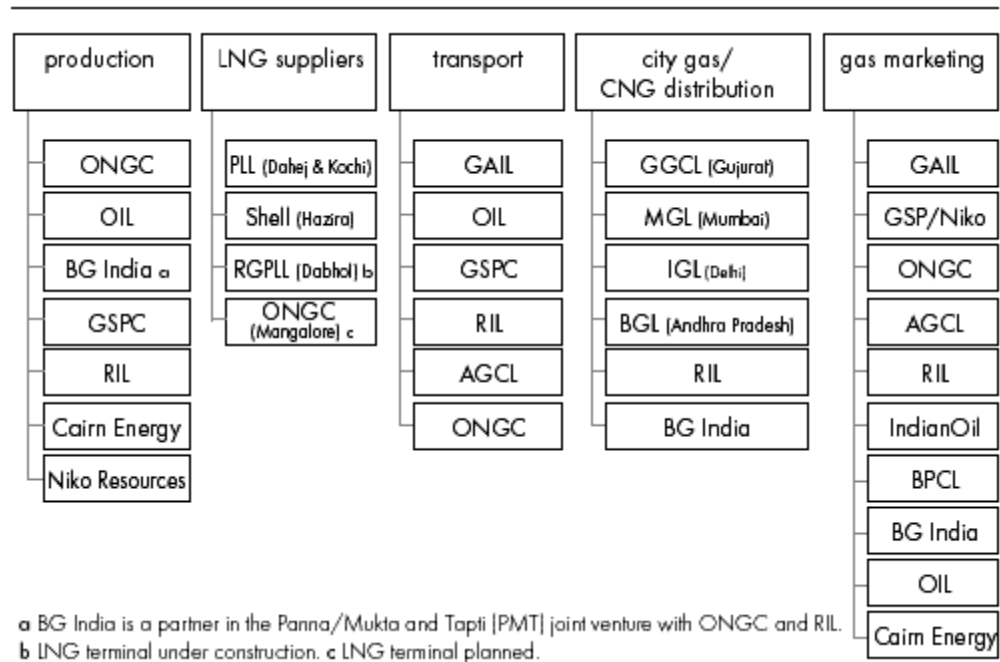


Source: Ipsos, May 2011

III. STRUCTURE OF THE NATURAL GAS SECTOR IN INDIA

Until recently, the exploration and production of natural gas in India was undertaken exclusively by the state owned Oil and Natural Gas Corporation Ltd (ONGC) and Oil India Ltd (OIL). As a result of government initiatives to encourage private sector investment in exploration and production activities and to deregulate the oil and gas sector, several private sector participants are also now engaged in exploration and production (figure ; PETROTECH Society and PwC 2007; GAIL 2007). Reliance Industries Ltd (RIL) is the largest oil and gas acreage holder among the private sector companies in the country. It is also India's first private sector company in the exploration and production sector to have discovered large natural gas reserves in the eastern offshore Krishna-Godavari basin in late 2002. Other private sector participants in exploration and production activities include BG India, Niko Resources and Cairn Energy. Pipeline gas transport is primarily undertaken by state owned GAIL (India) Ltd, formerly the Gas Authority of India Ltd. GAIL is India's largest gas transmission and marketing company, with a high pressure pipeline network of around 5600 kilometers. The largest pipeline network, Hazira-Vijaipur-Jagdishpur, with a total length of more than 2800 kilometers, covers the states of Gujarat,

Rajasthan, Madhya Pradesh, Uttar Pradesh, Haryana and Delhi in the north west of the country. The 610 kilometer long Dahej-Vijaipur pipeline owned by GAIL transports re-gasified LNG received at the Dahej terminal operated by Petronet LNG Ltd (PLL).



Structure of the Natural gas supply

GAIL also has regional gas distribution grids, totaling around 1 800 kilometers of varying length and diameter in Ahmedabad, Assam, Baroda, Cauvery basin, Hazira, Krishna-Godavari basin, Mumbai, Rajasthan and Tripura. Other regional natural gas pipeline operators include Gujarat Gas Company Ltd (GGCL) and Gujarat State Petronet Ltd (GSPL) in Gujarat, Assam Gas Company Ltd (AGCL) and Tripura Natural Gas Company Ltd (TNGCL) in Assam and Tripura respectively. Indraprastha Gas Ltd (IGL) in Delhi, Mahanagar Gas Ltd (MGL) in Mumbai and GGCL in Gujarat are also developing city gas distribution networks for the supply of compressed natural gas (CNG) and city gas in their respective areas.

IV. EXISTING LNG TERMINALS IN INDIA

In India following LNG Terminals are operating and planning to expand in near future.

Table 1. India's LNG import terminals					
Terminal	Operator	Capacity (million tpy)	Start year	Expansions (million tpy)	Total new capacity (million tpy)
Operating					
Dahej	Petronet LNG	10	2004	5	15
Hazira	Shell/Total	3.6	2005	6.4	10
Dabhol	GAIL (India)	5	2013	-	-
Kochi	Petronet LNG	2.5	2013	2.5	5
Planned					
Ennore	Indian Oil Corp.	5	by 2017	-	-
Mundra	GSPC	5	by 2017	-	-
Kakinada (FSRU)	GAIL (India)	5	by 2017	-	-
Gangavaram	Petronet	3	by 2017	-	-
(Source: The Economist Intelligence Unit research, Boston Consulting Group, International Group of LNG Importers)					

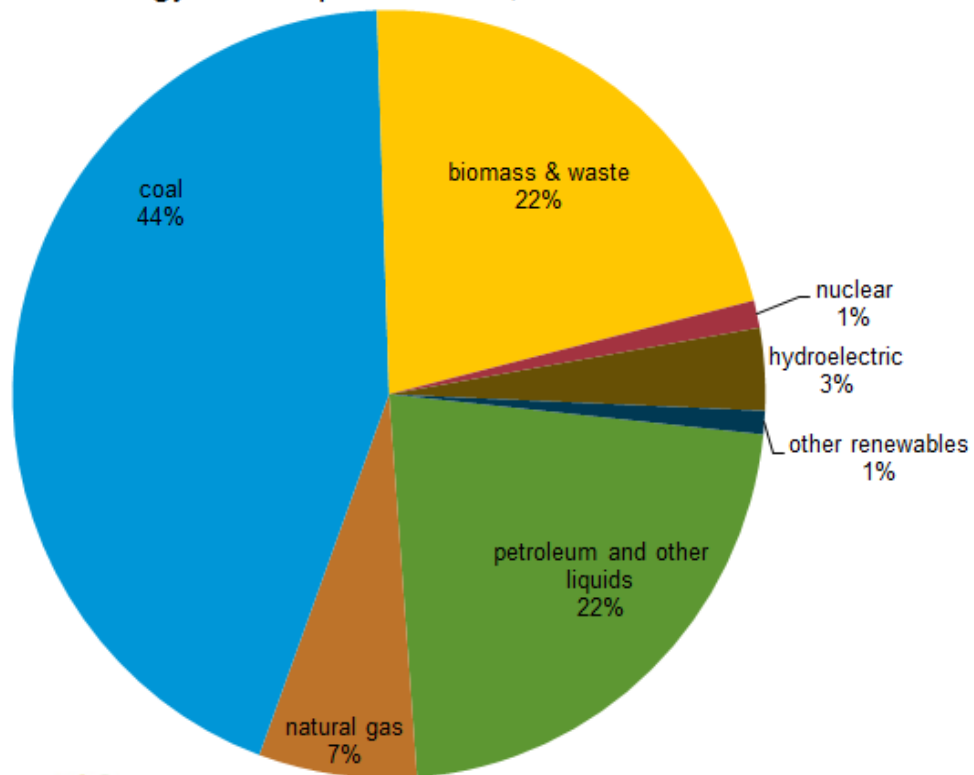
V. ENERGY & NATURAL GAS CONSUMPTION IN INDIA

The outlook is for increasing natural gas demand in India, given an expected Combination of high economic growth, an expanding population and recent large domestic gas finds.

Natural gas consumption is projected to rise... Reasons for the increase include:

- Utilities realize advantages by using natural gas fired generators to create electricity (lower capital costs, higher fuel efficiency, shorter construction lead times, and lower emissions).
- The residential sector benefits from the higher fuel efficiency and lower emissions of gas appliances.
- The industrial sector relies on natural gas as a feedstock or fuel for manufacturing many of the products we rely on today, including pulp and paper, metals (for computers, automobiles, and telecommunications), chemicals, fertilizers, fabrics, pharmaceuticals, and plastics.
- The transportation sector is beginning to see natural gas as a clean and readily available alternative to other fossil fuels.

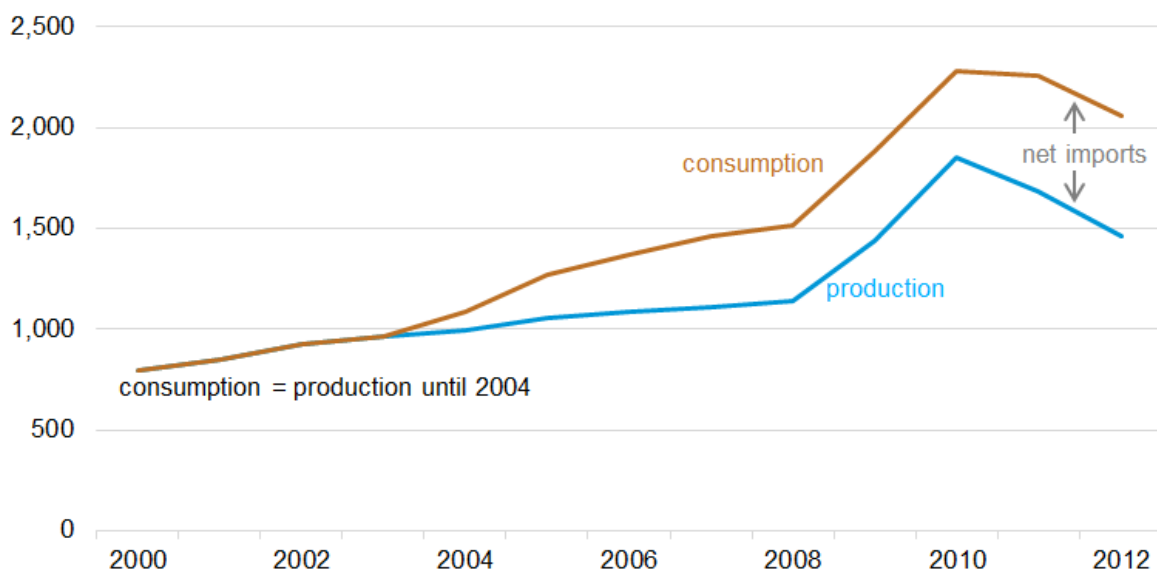
Total energy consumption in India, 2012



Source: U.S. Energy Information Administration, International Energy Agency, BP Statistical Review.

India dry natural gas production and consumption, 2000-12

billion cubic feet



Source: U.S. Energy Information Administration.

VI LNG PROSPECTS IN INDIA

India is the 4th largest Energy consumption country after US, China and Russia. The grown of primary energy consumption is twofold between 1990 and 2010. The Indian gas market is projected to be the fastest growing in the next 15-20 yrs. The power sector is the fastest sector of energy consumption in India from 20% to 40% of total energy consumption between 2000 to 2010..India and China both represent a combined share of 13% LNG share of the market in 2012. The growing scope for LNG in China and India resulted in 8% to 13% in LNG import in 2012. Natural gas consumption occupies pie of 8% of total energy consumption and is projected to grow up to 20% by 2030 in India.

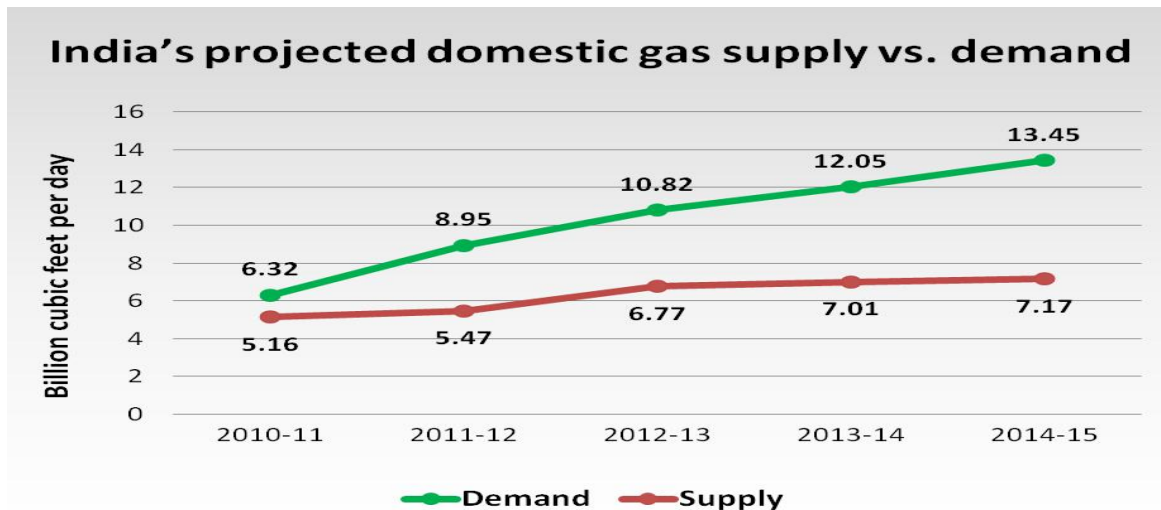
India's natural gas demand is forecast to more than double to 516.97 million cubic meters/day in fiscal 2021-22, according to a report commissioned by an oil ministry regulatory body. Demand in fiscal 2016-17 is forecast at 378.06 million cu m/day, up 55% from estimated demand of 242.66 million cu m/day in fiscal 2012-13 (April-March), the report said.

Vision 2030: Natural Gas Infrastructure in India by downstream regulator Petroleum and Natural Gas Regulatory Board was prepared a year ago and made public in recent days.

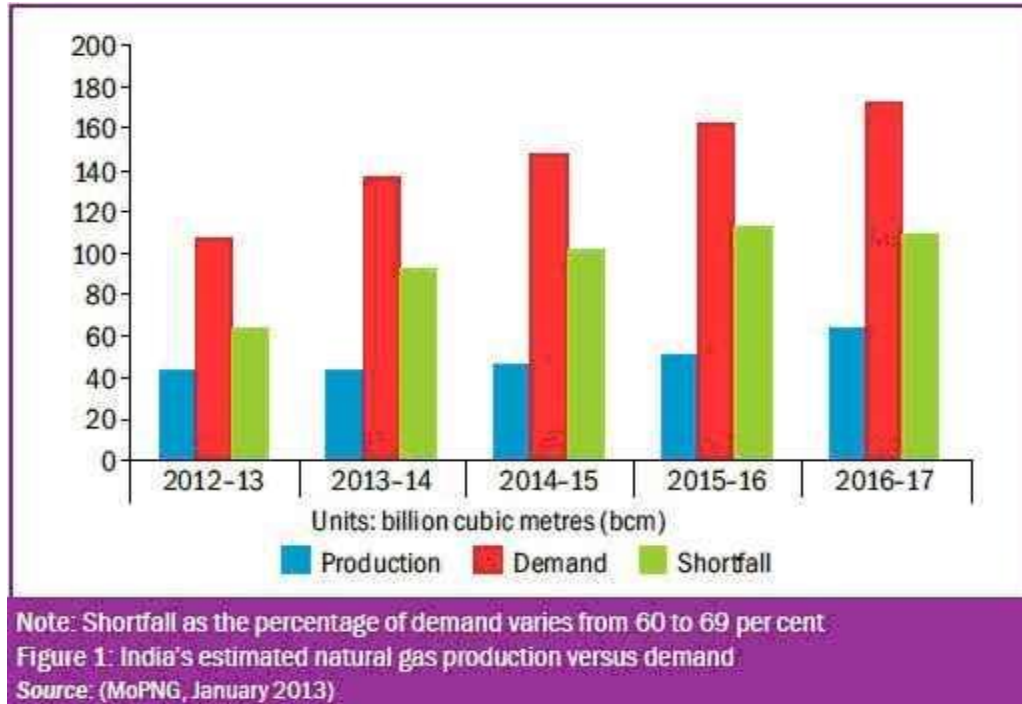
It forecasts natural gas demand in India to grow at an average of 6.8%/year from 242.66 million cu m/day in fiscal 2012-13 to 746 million cu m/day in fiscal 2029-30 due to increases in demand for power generation, fertilizer production and city gas distribution.

	High	Medium-high	Medium-low	Low	Reference case (2010)
LNG price (\$/million Btu)	13-15	10-13	10-11	6-7	6.00-8.00*
Total gas demand (billion cm)	84	101	114	141	62.00*
Incremental LNG demand (billion cm)	11	18	31	62	12.15*

Source: Gail; Petronet LNG; *Cedigaz; *Petroleum Economist



The Shortfall is growing day by day to cope up with the demand of our Indian energy sector. To fulfill the shortfall as shown in the Graph, we have to open up newer and newer avenues of energy.



VII. CONCLUSION

As LNG is the sole source of India's gas imports – given the absence of cross-border pipelines – the further development of LNG capacity is crucial to bridging India's projected growing gap between domestic natural gas supply and demand. Since the opening of the LNG terminal at Dahej in 2004, imports have taken up a greater share of India's gas supply as growth in demand has outstripped growth in supply. This trend is expected to continue. According to a report prepared for India's Petroleum and Natural Gas Regulatory Board, India's gas demand will triple from 46.7 billion m³ in 2012 - 2013 to 189 billion m³ by 2021 - 2022. Although this forecast may prove to be on the bullish side, it does reflect that demand for natural gas in India will continue to grow rapidly.

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