

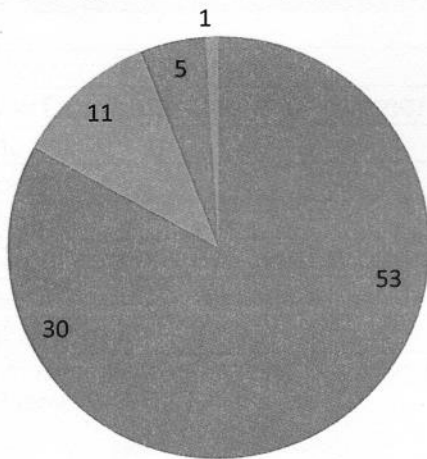
Chapter 1

Introduction

1.1: Demand Supply Scenario for Natural Gas in India

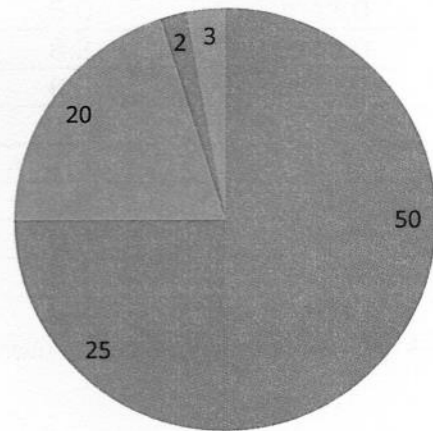
The Indian economy has been able to withstand the global financial crisis and remains on a trajectory of high growth rates, although lower than the high rates of over 9% growth witnessed before the global crisis set in. The International Energy Agency has projected average real GDP growth rate of 6.4% for India during 2008-2035, which is the highest among all countries in the world¹. Primary energy demand growth CAGR in India is forecasted to be 3.1% per annum, and CAGR for gas demand in India will be 5.4% against 3.6% for oil. High growth in demand for gas is expected to alter the primary energy mix. Charts 1.1² and 1.2³ indicate this alteration:

Chart 1.1: Primary Commercial Energy Mix of India (%) 2010



■ Coal ■ Oil ■ Gas ■ Hydro ■ Nuclear

Chart 1.2: Primary Commercial Energy Mix of India (%) 2025



■ Coal ■ Oil ■ Gas ■ Hydro ■ Nuclear

¹ International Energy Agency (2010) *World Energy Outlook, 2010*

² Source: *British Petroleum Statistical Review of World Energy, June 2012*

³ Source: *Indian Hydrocarbon Vision, 2025*

Total sector-wise consumption of gas, including domestic and imported sources, is shown in Table 1.1, taken from the *Report of the Working Group on Petroleum & Natural Gas Sector for the Twelfth Five Year Plan (2012-17)*.

Sector	Supply (MMSCMD)	Supply (%)
Power	61.4	37.0
Fertilizer	37.7	22.7
CGD – Domestic (PNG) & transport (CNG)	7.9	4.8
CGD Commercial & Industrial	6.0	3.7
Court orders	1.0	0.7
Shrinkage for liquid extraction- LPG etc.	7.2	4.3
Refineries	19.8	11.9
Petrochemicals	5.7	3.4
Sponge Iron	7.0	4.2
Small consumers like glass works etc.	5.8	3.5
Others	4.5	2.7
Internal consumption- Pipeline system	2.1	1.2
Total Supply	166.2	100

Note: CGD = City Gas Distribution, for domestic use as Piped Natural Gas (PNG) and for transport/ industrial/ commercial applications as Compressed Natural Gas (CNG).

Power and fertilizer sectors account for almost 60% of total consumption of gas, although they together consume only 29% of the 46.2 MMSCMD⁴ RLNG⁵ that is imported into the country as shown in Table 1.2.

Sector	Supply MMSCMD)	Supply (%)
Power	5.0	11.0
Fertilizer	8.2	18.0
CGD + Court mandated Consumers	6.9	15.0
Refineries	16.7	36.0
Petrochemicals	1.3	3.0
Sponge Iron	4.1	9.0
Small consumers like glass works etc.	0.9	2.0
Others	3.1	7.0
Total Supply	46.2	100.0

Source: *Report of the Working Group on Petroleum & Natural Gas Sector for the Twelfth Five Year Plan (2012-17)*

⁴ MMSCMD = Million Metric Standard Cubic Metres per Day. 1 SCM = 1 metre cube of gas at 1 atmospheric pressure and 15.56 °C.

⁵ RLNG: Regasified Liquefied Natural Gas. For facilitating transport of Gas, it is compressed into Liquefied Natural Gas (LNG) at liquefaction facilities. After being transported by sea, LNG is regasified at LNG terminals and is fed into pipelines for transportation and is known as RLNG.

It may be noted that all these consumers represent derived demand. Gas taken by them is further supplied to final consumers or consumed as intermediate product.

There is a proposal to convert all the fertilizer plants in the country to gas based plants and also to revive old plants which have been closed down⁶. This would push up demand for gas in this sector from about 45 MMSCMD to nearly 100 MMSCMD in the next five years. An additional capacity of 25000 MW of gas based power generation has been proposed in the Twelfth Five Year Plan, which would require roughly 100 MMSCMD gas⁷. As per Integrated Energy Policy⁸, gas consumption in India is projected to exceed 600 MMSCMD by 2030. Some recent estimates⁹ show that the demand for Natural Gas in the country may reach the level of 606 MMSCMD by the end of the Thirteenth Five Year Plan, i.e. 2022-23 itself (307, 113, 57, 37, 82 and 10 MMSCMD respectively for Power, Fertilizer, City Gas, Industrial, Petrochemical, and Sponge Iron/ Steel sectors).

Table 1.3 shows the sources of natural gas being supplied in the country. Gas production in India is mainly from the nominated fields awarded to ONGC and Oil India Ltd. (OIL), and from Joint Venture Companies' fields such as Panna Mukta Tapti (PMT) and KG Basin under Production Sharing Contracts (PSCs). Total availability of gas in the country in June 2011 was 166.2 MMSCMD.

⁶ Planning Commission, Government of India (2012) *Report of the Working Group on Fertilizer Industry for the Twelfth Plan (2012-13 to 2016-17)*

⁷ Gas required for 1000 MW power generation = 4.128 MMSCMD @ 50% efficiency of combined cycle operation, at a station heat rate of 860 Kcal/KWh @ 50% heat efficiency.
Power generation from 1 MMSCMD of gas = 242 MW at the same assumptions.

⁸ Planning Commission, Government of India (2006) *Integrated Energy Policy*

⁹ Planning Commission, Government of India (November 2011) *Report of the Working Group on Petroleum and Natural Gas Sector for the Twelfth Five Year Plan (2012-17)*

Table 1.3: Daily Availability of Gas by Source, June 2011 (MMSCMD)

Classification	Source	Average daily gas availability (June 2011)	Percentage
Govt. Companies	ONGC	50.8	30.6%
	OIL	6.6	4.0%
PSC JVs	Panna Mukta Tapti JV	11.9	7.2%
	RIL KG-D6	47.2	28.3%
	Other JVs	3.4	2.0%
Imports	Long term RLNG	25.1	15.1%
	Spot RLNG	21.2	12.8%
	Total	166.2	100.0%

Source: Report of the Working Group on Petroleum and Natural Gas Sector for the Twelfth Five Year Plan (2012-17)

ONGC, OIL and DGH (Directorate General of Hydrocarbons) estimates expect the total domestic availability of natural gas to go up to 209 MMSCMD by 2016-17, which would still be inadequate to cater to total demand. Shortage of cheap domestic gas on the supply side has already impacted growth in major segments of the economy. The *Working Group Report on Fertilizer Industry for the 12th Plan* has mentioned about the New Investment Policy for Urea that:

The Policy resulted in increase in capacity by approx. 23 LMT¹⁰ due to revamp of few existing plants but failed to attract any investments in the expansion, Greenfield¹¹ or Brownfield¹² projects in the Urea sector due to uncertainty in availability and pricing of gas.

Similarly, the 12th Plan Working Group on Power¹³ has said that:

The Working Group opines that if gas availability to projects already under construction is not ensured, they may become stranded assets

¹⁰ LMT = Lakh Metric Tonnes

¹¹ Greenfield is a project that lacks any constraints imposed by prior work. The analogy is to that of construction on greenfield land where there is no need to remodel or demolish an existing structure.

¹² Brownfield is a project based on prior work or to engineer a product from an existing one.

¹³ Planning Commission, Government of India (January 2012) *Report of The Working Group on Power for Twelfth Plan (2012-17)*

and should be avoided. Some concrete policy decision towards increasing the gas availability to power plants either by increasing the production of domestic gas or increasing the share of RLNG by pooling with domestic gas is required.

In response, LNG imports have been projected to grow to 150 MMSCMD by 2016-17 and further to 258 MMSCMD by 2021-22 by the Petroleum and Natural Gas Sector Working Group for the 12th Plan. This Working Group has also estimated the total investment required to ensure these levels of supply and demand. Over the next ten years (2012-2022), these estimates show an investment of Rs. 50,750 crores in LNG terminals, Rs 1,25,884 crores in gas pipelines, Rs. 94,279 crores in CGD infrastructure, Rs. 22,500 crores in fertilizer plants; and Rs. 2,27,687 crores in the power sector (gas based). Total gas dependent investment thus amounts to Rs. 5,20,800 crores or nearly \$ 95 billion at today's prices and exchange rates.

Investments of such magnitude require that bulk consumers in the power and fertilizer sectors must have long term assurance about the financial viability of their investments. This in turn requires that *adequate* natural gas supply has to be assured at *reasonable* rates. Since international market prices of gas make investments unviable in major consuming sectors, there seems to be a case for leveraging of domestic gas supply through the mechanism of pooling of gas prices in order to stimulate growth of fresh investment in major consuming sectors like power and fertilizer.

1.2 Evolution of Natural Gas sector in India

ONGC and OIL were the major oil exploration companies in India before the advent of economic reforms in 1991. There was no open market competition

and these National Oil Companies (NOCs) were granted licenses for prospecting in any area that interested them. Although the major focus was on discovery of oil, production of natural gas also began after the Bombay High oilfields commenced production in 1974.

Gas Authority of India Limited (GAIL) was set up in 1984 to focus on development of gas infrastructure in the country. Apart from laying gas pipelines, GAIL gradually ventured into all segments of the gas value chain, from exploration and production (E&P), to production of LPG and polyethylene through a gas cracker unit.

After opening up of the economy began in the early 1990s, there were major changes in the scheme of E&P activities in India. Nationalized Oil Companies (NOCs) like ONGC and OIL were not able to make significant new discoveries and production of oil began stagnating. Government of India auctioned areas which had not been fully explored by NOCs and handed them over to joint ventures between private companies and NOCs under production sharing contracts. The Directorate General of Hydrocarbons (DGH) was set up in 1993 as an upstream¹⁴ oil sector regulator.

The process of involving the private sector got further streamlined with introduction of New Exploration and Licensing Policy (NELP) in 1998 with signing of Production Sharing Contracts (PSCs) with much greater international and domestic participation and increased transparency. Nine

¹⁴ The oil and gas industry is usually divided into three major components: Upstream, midstream and downstream. The *upstream* oil sector is a term commonly used to refer to the searching for and the recovery and production of crude oil and natural gas. It is also known as the exploration and production (E&P) sector. The *midstream* sector involves the transportation, storage and marketing of the various oil and gas products. The *downstream* sector commonly refers to the refining of petroleum crude oil and the processing and purifying of raw natural gas, as well as the marketing and distribution of products derived from crude oil and natural gas.

rounds of auctions have taken place so far under NELP. PSCs were signed for 235 exploration blocks upto the eighth NELP round and 102 oil and gas discoveries have been made so far in 33 of these blocks¹⁵. Bids were received for 33 more blocks in the ninth round of NELP, out of which 16 more blocks were awarded in 2012 while the other bids are still under examination.

A separate company, Petronet LNG Limited (PLL) was set up in 1998 as a joint venture between public sector companies ONGC, GAIL (India) Limited, Bharat Petroleum Corporation Ltd. (BPCL), and Indian Oil Corporation Ltd. (IOCL) to focus on import of gas and setting up of LNG terminals, although it was not granted any exclusive rights to be the only agency to import gas. Actual import of natural gas in the form of RLNG began in 2004. PLL is currently operating one LNG terminal of 10 MMTPA¹⁶ capacity at Dahej in Gujarat and is about to commission another LNG terminal at Kochi in Kerala with 5 MMTPA capacity.

Public and private sector companies are working today in all spheres of activity related to natural gas, ranging from E&P, to trading and transportation, LPG production, gas cracker units and end use of natural gas to produce power and other goods. Even after the advent of NELP, areas licensed before NELP continue to be governed by old production sharing contracts signed between Government of India and the prospecting JVs.

Government has now decided to build up a National Data Repository (NDR) containing seismic data about all exploration areas in the country and switch

¹⁵ Planning Commission, Government of India (November 2011) *Report of the Working Group on Petroleum and Natural Gas Sector for the Twelfth Five Year Plan (2012-17)*, p. 9

¹⁶ MMTPA = Million Metric Tonnes Per Annum of gas.

1 MT of LNG = 1314 SCM

1 MMTPA of LNG = 3.60 MMSCMD for 365 days

over to an Open Acreage Licensing Policy (OALP) wherein bidders would be free to express interest throughout the year. Introduction of OALP is expected to increase the pace of exploration of oil and gas in the country. Shale gas¹⁷ blocks are also being identified by DGH and are expected to be auctioned in the near future.

Prices of RLNG in the Asia Pacific region are still linked to the price of crude oil on the basis of energy equivalence. Commercial production of Shale gas on a large scale has led to comparatively low and stable prices in the US markets (Henry Hub¹⁸). The difference in prices is large enough to allow movement of liquefied natural gas from USA to Asia Pacific region. Recently GAIL has signed a long term contract to source RLNG from USA at prices lower than those being offered by major traditionally gas exporting countries like Qatar and Australia. India has also sought technological help from the USA to exploit Indian reserves of shale gas. These initiatives are expected to augment the availability of gas in the years to come.

1.3 Pricing of Natural Gas in India

Price of gas produced by ONGC and OIL is fixed by Government of India under Administered Price Mechanism (APM). Prices for gas produced by various JV producers like PMT JV, Cairn Energy are fixed as per the Production Sharing Contracts (PSCs) signed by them with Gol. However, for

¹⁷ Shale Gas is natural gas formed from being trapped within shale formations. Advances in hydraulic fracturing and horizontal completions have made shale-gas wells profitable, leading to large volumes of production in USA.

¹⁸ The North American market system features open trading in gas as a commodity and in pipeline capacity to move the gas to market. The gas hubs in North America were created by industry at appropriate places, with Henry Hub in Louisiana being the most prominent and important of these. This is the basis both of spot market trading and in futures trading on the New York Mercantile Exchange (NYMEX).

gas produced from fields allotted under the New Exploration and Licensing Policy (NELP), a pricing formula is approved by Gol.

Table 1.4 shows current prices of gas in India, which vary from source to source and also from consumer to consumer. It can be seen that gas rates vary from \$ 2.52 to \$ 17 per MMBTU¹⁹. We can also see complications from the footnotes to the table. Different rates of tax imposed by State governments further add to variation in rates.

Table 1.4: Current Price of Gas from different sources in India

(all prices in US \$ per MMBTU)

Nature	Source	Customers	Gas Price
Fields nominated by Gol (APM)	ONGC & OIL (APM)	Customer outside North East	4.20
	ONGC & OIL (Non APM)	Customer outside North East	4.50-5.25
	ONGC & OIL (APM)	Power & Fertiliser Customers in North East	2.52
Production Sharing Contracts (PSCs)	Panna Mukta & Tapti JV (PMT)	Weighted average price of PMT except RRVUNL & Torrent	5.65
	Ravva	GAIL	3.50
	Ravva Satellite	GAIL	4.30
	KG-D6 (RIL)	All Consumers	4.20
	Amguri Fields (Canero)	GAIL	2.52
RLNG	Term R-LNG	For all (vary on monthly basis)	9.00-10.50
	Spot-R-LNG	Vary on cargo to cargo	12.00-17.00

Note:

Term RLNG price is excluding Regasification charges & Marketing margin. The price changes every month on the basis of a formula agreed between seller & buyer.

Spot RLNG prices vary from cargo to cargo. The prices of spot RLNG supplied in 2012 varied from \$12.0 per MMBTU to \$17.0 per MMBTU (ex-terminal).

Panna Mukta gas price is \$ 5.73 per MMBTU & Mid Tapti gas price is \$ 5.57 per MMBTU

Administered Price Mechanism (APM) Prices Include Royalty & Exclude marketing margin

Source: Web-site of GAIL (India) Limited www.gailonline.com, accessed on 15.9.12 at 3.25 pm. Nature of gas has been added to the content on the web-site for the purpose of classification.

¹⁹ MMBTU = 1 thousand thousand British Thermal Units or 1 Million British Thermal Units.

1 MMBTU = 252,000 Kcal = 25.2 SCM of Natural Gas, assuming that Gross Calorific Value GCV of Natural Gas = 10,000 Kcal/SCM.

The gas sources mentioned in Table 1.4 may be divided into three broad categories: Administered Price Mechanism (APM) gas, Production Sharing Contracts (PSCs) gas, and Re-gasified Liquefied Natural Gas (RLNG). APM gas, the first category, is produced from old gas fields that were licensed on nomination basis to ONGC Limited and Oil India Limited by Gol.

The second category is gas obtained from gas fields for which PSCs have been signed by exploration companies like ONGC, OIL, Reliance India Ltd. (RIL), Shell, Cairn India Ltd. etc. with Gol. These include blocks that were allotted prior to the New Exploration and Licensing Policy (NELP) launched in 1998, as well as blocks allotted under various NELP rounds. The largest discovery so far has been made in KG Basin by Reliance India Limited (RIL). Production by RIL from KG Basin had gone up to 61.5 MMSCMD during March 2010, but has been steadily declining since then, apparently due to technical problems and came down to less than 30 MMSCMD in 2012.

Price of gas from PSC fields is fixed by Gol through an arms-length market price discovery process. The price for KG-D6 block gas is fixed at \$ 4.20 per MMBTU. For other fields like Panna-Mukta-Tapti, prices are determined as per PSC provisions and are, generally, slightly higher than for RIL gas.

The third category is of imported gas. Gas may be imported through trans-national pipelines, but this is not happening at present. The proposed Turkmenistan-Afghanistan-Pakistan-India (TAPI) pipeline is expected to supply 38 MMSCMD of gas to India starting from the year 2018 onwards. Other sources of imported gas are through long term contracts for RLNG (like

the one between Ras Gas and Petronet LNG Ltd.) and spot RLNG which is purchased on the high seas at prices which fluctuate daily.

Initial fixation of natural gas prices was on the basis of replacement of alternative fuel, mainly coal. In the year 1987, pricing began on a cost plus basis. There was a gradual movement towards market determined prices, which culminated in pricing APM gas also at \$ 4.20 per MMBTU after this price was fixed for KG-D6 basin gas produced by RIL.

Long term contracts for RLNG have been signed to source gas from countries like Qatar and Australia. These contracts have well defined formulae to ascertain the price at which gas is supplied. The general approach has been to link prices with the price of crude oil as per the gross calorific value (GCV) of both fuels. However, most contracts stipulate a floor and cap for crude oil prices and thus natural gas enjoys a discount if prices of crude oil climb above the cap provided in a contract. Apart from long term contracts, demand is met in the short term by purchasing natural gas shipments from the spot market. This is the most expensive source of gas and has been mentioned as ranging from \$ 12 to \$ 17 per MMBTU in Table 1.4.

Volume of gas available from APM sources is limited and is expected to decline in the years to come. NELP exploration blocks may yield substantial amounts of gas in future, but gas supply projections made by the Directorate General of Hydrocarbons and estimates of demand for natural gas tend to show that demand supply gap shall continue to widen. It is, then, clear that India has to plan for augmenting supplies of natural gas in the form of RLNG.

However, prices of gas in this segment are most volatile and have a wide spread; so future planning by prospective customers becomes difficult.

Over 60% of the gas consumed in India today goes to the fertilizer and power sector. Both these sectors are subject to direct or indirect regulation by Gol, limiting their ability to consume spot RLNG at high prices. Prices of fertilizer are directly controlled by government and the loss incurred ^{by} fertilizer units is provided to them as subsidy. This subsidy exceeded Rs. 50,000 crores during the year 2011-12. Expensive feedstock in the form of costly RLNG would further increase the subsidy burden on Gol, worsening the budgetary deficit and leading to inflationary pressure on the economy.

Almost 55% of the total power generation in the country is coal based. Prices of domestic coal have traditionally been kept very low in India (allowing Coal India Ltd. to recover only the cost of mining along with a low profit margin) with the intention of providing for primary energy needs of the poor at low rates. Since power generated from coal based plants is comparatively cheap, new plants based solely on RLNG would suffer a major handicap in being able to sell their power and would be rendered financially unviable.

In order to import more RLNG in future, the country has to make investments in LNG terminals as well as gas pipelines. Such investments cannot be made only on the strength of small industrial customers who can afford to consume RLNG at market rates. Gas networks have to cater to both, bulk consumers like power and fertilizer sectors who cannot pay high rates on the one hand and smaller customers like Oil Refineries, Sponge Iron units, City Gas Distribution networks etc. which are free to pass on high prices of fuel to end

users on the other. Anchor loads²⁰ from bulk customers are essential to ensure viability of investments in gas infrastructure.

1.4 Past Studies

GAIL (India) Limited had commissioned a study by Mercados Energy Markets Private Limited to examine the issue of pooling of natural gas prices. The report submitted by the consultant²¹ in January 2010 was forwarded by GAIL (India) Limited to the MoPNG, Government of India. The report recommended limited pooling of natural gas prices for the power and fertilizer sectors only. This report is available on the web site of MoPNG.

MoPNG then constituted an Inter-Ministerial Committee under the chairmanship of Member, Planning Commission of India Sri Saumitra Chaudhuri to study the proposal. This Committee's report²² submitted in August 2011 is also available on MoPNG's web site. This report did not recommend pooling of natural gas prices, although no reasons are mentioned in the report for not doing so. The report focusses mainly on priorities for allocation of natural gas available in the country from domestic as well as imported sources.

Detailed review of literature available has been taken up in each chapter as and when the context arose.

²⁰ Anchor loads are required to ensure minimum capacity utilization levels of gas infrastructure that are required to make investments in infrastructure viable. In fully developed gas markets like USA where **transportation capacity is also traded, infrastructure project sponsors usually hold an 'open season'** for potential shippers who provide ship-or-pay obligations to cover fixed charges on the investment required. However, in under developed markets like India, prior tie-ups with bulk consumers in power and fertilizer sectors are arrived at to provide comfort to gas infrastructure investors like GAIL.

²¹ Mercados Energy Markets International Pvt. Ltd.(January 2010), *Study on Common Pool Price Mechanism for Natural Gas in the country*, New Delhi, India

²² Planning Commission, Government of India (August 2011), *Report of the Inter-Ministerial Committee on Policy for Pooling of Natural Gas Prices and Pool Operating Guidelines*

1.5 Objectives of the Study

The proposed objectives of this study are:

- To study whether pooling of natural gas prices is a viable and desirable option from the economic point of view in India.
- To study the taxation and legal issues involved in the process of pooling of natural gas prices.

1.6 Research Questions

A number of issues arise from a study of the literature available on the subject. Research questions which we wish to explore are given below:

1. Is it economically beneficial to import natural gas as compared to importing coal and crude oil?
2. Can open bidding based common price of gas be introduced in the country immediately?
3. What are the pooling of natural gas prices alternatives available?
4. What other steps regarding Central and State taxes are required to enhance off-take of gas?
5. What is the legal position with respect to pooling of natural gas prices?

1.7 Research Method

The broad approach and methodology followed in this study was to begin with a study of demand and supply of natural gas and the economics of importing gas from abroad. The second stage was to analyse the price at which gas can be absorbed in different sectors, and to look at domestic and international pricing mechanisms along with our experience with pooling in coal and crude oil markets. The final stage comprises of enumerating gas pooling models, looking at legal and taxation issues, and consulting key policy makers to

validate assumptions and make final recommendations. The recommendations would be arrived at keeping in mind the desired outcomes of expanding gas markets, ensuring reasonable prices and facilitating development of gas infrastructure in the country.

The methodology adopted is depicted below in pictorial form:

