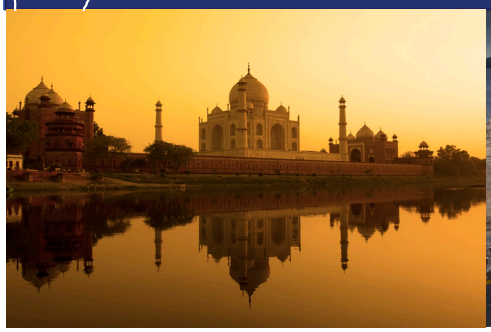
INDIA:
AN OVERLOOKED OPPORTUNITY FOR CANADIAN LNG



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ACRONYMS AND ABBREVIATIONS

AGCL	Assam Gas Company Limited
APM	Administered pricing mechanism
BJP	Bharatiya Janata Party
CAGR	Compound annual growth rate
CBM	Coalbed methane
DGH	Director General Hydrocarbons (India)
EIA	Energy Information Administration (United States)
IEA	International Energy Agency
IOCL	Indian Oil Corporation Limited
IGU	International Gas Union
IPI	Iran-Pakistan-India pipeline
JCC	Japanese customs-cleared crude
GAIL	Gas Authority of India Limited
GDP	Gross domestic product
GGCL	Gujarat Gas Company Limited
GSPL	Gujarat State Petronet Limited
KG-D6	Krishna Godavari-D6 basin
LNG	Liquefied natural gas
MBI	Myanmar-Bangladesh-India pipeline
MMBtu	million metric British thermal units
mmscmd	million metric standard cubic meters per day
mmtpa	million metric tonnes per annum
mtpa	million tonnes per annum
NELP	New Exploration Licensing Policy
OIL	Oil India Limited
ONGC	Oil and Natural Gas Corporation (India)
Private JV	Private joint venture
RGTIL	Reliance Gas Transportation Infrastructure Limited
RLNG	Regasified LNG
TAPI	Turkmenistan-Afghanistan-Pakistan-India pipeline
tcf	trillion cubic feet
tcm	trillion cubic meters
USGS	United States Geological Survey

EXECUTIVE SUMMARY

Economic growth in India is reviving following the slowdown of the past two years. The International Monetary Fund forecasts that the Indian economy will grow 5.4% in 2014 and 6.4% and 6.8% in 2015 and 2019 respectively.[1] This economic growth will be contingent on India having access to reliable sources of energy. Currently, India is highly dependent on coal and oil, which combined account for approximately 80% of India's fuel consumption.[2] With respect to natural gas, India consumed 131.79 million metric standard cubic meters per day (mmscmd) in 2013-2014,[3] of which 29% was imported in the form of liquefied natural gas (LNG).[4] In the first three quarters of 2012-2013, the largest consumers of imported LNG in India were refineries, fertilizer manufacturers, city gas distributors, and power generators, accounting for 20.8%, 20.2%, 17.5%, and 14.0% of total LNG consumption respectively.[5]

In order to enhance energy security, the Government of India is seeking to diversify India's energy mix and the countries from which it sources fossil fuels. While oil and coal will continue to dominate India's energy mix in the coming decades, the share of natural gas is projected to increase. However, there will be challenges in supplying this gas because domestic production is limited and there are uncertainties about the viability of transnational pipelines. Government and industry studies project that natural gas demand will reach 746 mmscmd in 2029-2030, while domestic production and imports from transnational pipelines will provide only 260 mmscmd.[6] This creates a shortfall of 486 mmscmd in natural gas supply in 2029-2030.

This disparity in supply and demand could be mitigated with increased imports of LNG. However, challenges exist in pursuing LNG imports. First, India has limited regasification capacity, which is projected to reach only 214 mmscmd by 2029-2030.[7] Second, the domestic pipeline network in 2029-2030 is unlikely to have sufficient capacity to handle projected natural gas demand, with especially weak coverage in most of the eastern and north eastern regions of the country. Third, India and the rest of Asia currently face high LNG prices, in part because prices of LNG provided to the region through long-term contracts are linked to the price of oil. Continued high LNG prices could reduce the size of the LNG market in India as cheaper sources of energy would be more attractive. Finally, the distorted domestic gas pricing regime in India reduced the desirability of the natural gas sector as an investment option, thereby further constricting natural gas supplies to the domestic fuel mix. However, recent changes to the pricing regime announced on October 18, 2014 are likely to partially address this situation.

In 2013, India imported LNG directly from Qatar, Nigeria, Yemen, Egypt, Algeria, Brunei, and Norway.[8] In recent years, Indian oil and gas companies have been investing in natural gas extraction and LNG export projects and/or concluding LNG offtake agreements[9] around the world. Canadian LNG projects, of which there are at least 23

[1] International Monetary Fund, World Economic Outlook: Recovery Strengthens, Remains Uneven (April 2014, p.184), http://www.imf.org/external/pubs/ft/weo/2014/01/pdf/text.pdf.

[2] Petroleum & Natural Gas Regulatory Board, Vision 2030: Natural Gas Infrastructure in India (May 2013, p.13), http://www.pngrb.gov.in/newsite/pdf/vision/vision-NGPV-2030-06092013.pdf.

[3] Most statistics in this paper are reported according to fiscal year. The Government of India's fiscal year begins April 1 and ends March 31.

[4] Ministry of Petroleum and Natural Gas, Ready Reckoner: Snapshot of India's Oil and Gas Data (August 2014, p.9), http://ppac.org.in/WriteReadData/Reports/201410011237291548210Snapshot_IOGD_Aug.pdf.

[5] Petroleum and Natural Gas Regulatory Board, Vision 2030: Natural Gas Infrastructure in India (May 2013, p. 16), http://www.pngrb.gov.in/newsite/pdf/vision/vision-NGPV-2030-06092013.pdf.

[6] Ibid. p. 8.

[7] Ibid. p. 9.

[8] International Gas Union, World LNG Report 2014 (March 2014, p.12), http://www.igu.org/news/igu-lng-report-2014-edition.

[9] In an offtake agreement, the buyer and seller of a natural resource agree to purchase/sell part of the seller's future

under consideration on the east and west coasts,[10] have a number of characteristics that are attractive to Indian LNG buyers. Canada has large quantities of available natural gas, is politically stable, and presents an opportunity for India to diversify its import sources.

Indian companies have already invested in Canada's nascent LNG export industry. Recently, the state-owned oil company Indian Oil Corporation Limited (IOCL) acquired a 10% stake in the Pacific NorthWest LNG project in British Columbia. As part of this deal, IOCL also acquired a stake in gas fields in British Columbia and is guaranteed 1.2 million tonnes of LNG per year for 20 years.[11] Another example is H-Energy, a part of the Mumbai-based construction group Hiranandani Group, which is planning to set up a 13.5 million metric tonnes per annum (mmtpa) natural gas liquefaction facility in Nova Scotia, which is located on Canada's east coast.[12]

However, Canadian projects also have some substantial weaknesses, most notably the slow development of necessary export infrastructure. Furthermore, the large transportation distance between Canada and India, especially from Canada's west coast, could be a barrier to moving large volumes of Canadian natural gas to India.

Swap agreements could make Canadian LNG more desirable to Indian buyers. A swap agreement arranges for natural gas destined for one market to be delivered elsewhere and for substitute gas to be supplied to the original intended destination. An Indian and a Japanese company, for example, could enter into an agreement whereby an Indian company buys Canadian LNG, but ships the gas to Japan for consumption. In return, the Japanese company's LNG cargo from Qatar or elsewhere would be sent to India. The benefit of this arrangement is that both Japanese and Indian companies can increase their bargaining power on price and contract terms by sourcing natural gas from multiple suppliers and still have gas delivered from locations that are relatively close geographically. Furthermore, the LNG project proponents in British Columbia are predominantly global energy conglomerates, such as Shell, Chevron, and Mitsubishi. If these project developers were strongly motivated to gain Indian investment, they could agree to redirect their cargoes from other projects (for example, in Africa) to India in exchange for Indian investment in either downstream or upstream facilities.

However, the India-Canada LNG relationship should not just be about India purchasing Canadian gas or investing in gas extraction projects. Canadian companies or multi-nationals with substantial Canadian operations can also consider investing in regasification capacity in India, as the Indian government allows 100% foreign direct investment in regasification facilities. Such investments would benefit both Canadian LNG project proponents and India by expanding India's ability to utilize LNG.

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production.

[10] For a list of proposed LNG export facilities in BC, see "FACTSHEET: LNG project proposals in British Columbia" http://www.newsroom.gov.bc.ca/ministries/natural-gas-development/factsheets/factsheet-lng-project-proposals-in-british-columbia.html. There are three proposed LNG export projects in Nova Scotia: Goldboro LNG, Bear Head LNG and a project proposed by India's H-Energy. Repsol SA is considering converting its Canaport LNG import facility in Saint John, New Brunswick into an export facility. Husky Energy is also considering a project.

[11] Progress Energy Canada Ltd., "Progress Energy Canada and Pacific NorthWest LNG welcome third partner to British Columbia LNG export project" (March 7, 2014), http://www.progressenergy.com/2014/03/07/progress-energy-canada-and-pacific-northwest-lng-welcome-third-partner-to-british-columbia-lng-export-project/.

[12] Government of Nova Scotia, "Government Welcomes Advancement of LNG plant in Guysborough County" (July 21, 2014), http://novascotia.ca/news/release/?id=20140721004.

INTRODUCTION

Economic growth in India is projected to revive after the slowdown of the past two years. The International Monetary Fund forecasts that the Indian economy will grow 5.4% in 2014 and 6.4% and 6.8% in 2015 and 2019, respectively.[13] These rates are much lower than India's robust economic growth from 2004 to 2008, but still higher than the growth rates in many other countries.[14]

This economic growth will be contingent on India having access to reliable sources of energy. Currently, coal and oil supply over 80% of India's fuel needs.[15] India is a net importer of oil, and also imports a large quantity of coal, despite having substantial coal reserves. This over-reliance on oil and coal is having a negative impact on India's current account deficit, foreign exchange management, industrial growth prospects, and climate change agenda.

While the primacy of oil and coal in India's energy mix is likely to continue in the coming decades, the share of natural gas is expected to increase for a number of reasons, including:

1) Energy security through diversification: The election manifesto of the Bharatiya Janata Party (BJP), which formed India's central government in May 2014, states: "Steps will be taken to avoid over-dependence on any one fuel and ensure supplier diversity… and develop indigenous capacities to meet emerging needs."[16]

2) Environmental attributes: When combusted, natural gas produces 45% less carbon dioxide (a greenhouse gas) than coal and 60-90% less emission of hydrocarbons than oil.[17]

3) High calorific value: Natural gas has a high calorific value and, therefore, is a productive and effective fuel.

As domestic production is unlikely to keep pace with demand, India will need to import substantial quantities of natural gas. India has two import options: cross-border pipeline and liquefied natural gas (LNG). Both transportation options have the drawback of requiring significant investment in infrastructure, including extensive networks of domestic pipeline to move imported gas to customers. Importing LNG requires specialized storage tanks at destination and regasification plants to return the liquid to its gaseous form so it can be pumped through pipelines. Sometimes, LNG needs to be moved by road or rail in specialized containers to regasification facilities close to industrial centres.

However, given India's immediate energy needs, LNG offers specific benefits relative to pipeline gas. First, LNG volumes of any size can be bought on the spot market when needed, providing flexibility of supply. This flexibility is especially important to Indian LNG importers as they often use LNG to cover unpredictable shortfalls in domestic natural gas production. In contrast, pipeline gas involves supply contracts that commit customers to a pre-specified and irreversible offtake. If buyers fail to comply, they have to pay a penalty (also known as a "take-or-pay" system).

Second, India experiences geopolitical tensions with its neighbours that make the building of cross-border pipelines challenging. India currently has no cross-border gas pipelines and only one—the Turkmenistan-Afghanistan-Pakistan-India (TAPI) pipeline—is currently under active consideration. While India will continue to pursue additional cross-border pipelines, LNG is currently the most viable natural gas import option.

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[13] International Monetary Fund, World Economic Outlook: Recovery Strengthens, Remains Uneven (April 2014, p.184), http://www.imf.org/external/pubs/ft/weo/2014/01/pdf/text.pdf.

[14] IMF data is calculated by calendar year and, unlike the Indian practice of using factor prices, uses market prices to arrive at growth estimates.

[15] Petroleum and Natural Gas Regulatory Board, Vision 2030: Natural Gas Infrastructure in India (May 2013, p.13), http://www.pngrb.gov.in/newsite/pdf/vision/vision-NGPV-2030-06092013.pdf.

[16] Bharatiya Janata Party, Election Manifesto (2014, p.34), www.bjp.org/images/pdf_2014/full_manifesto_english_07.04.2014.pdf.

[17] Kaustav Mukherjee and Rahool Panandiker, LNG: Global Challenges & Opportunities and Imperatives for India (Boston Consulting Group, January 2014, p.6), http://www.bcgindia.com/documents/file152473.pdf

This paper will examine current natural gas/LNG demand in India, as well as the future LNG opportunity that could be created by the gap between growing natural gas demand and insufficient supply from domestic production and transnational pipelines. This paper will then examine the factors that may impede growth of the Indian LNG market and assess Canada's prospects as a potential LNG supplier to India.

NATURAL GAS AND LNG SUPPLY AND DEMAND IN INDIA

CURRENT NATURAL GAS AND LNG CONSUMPTION

India has been a natural gas consumer since the Assam Gas Company was established in 1962. Over the years, the company has used a pipeline to deliver natural gas from its old gas fields in Dhuliajan (Assam) to a host of industries, such as fertilizer and petrochemical manufacturing and power production, and to over 30,000 households. India's domestic natural gas supply increased with the discovery of Bombay High in the 1970s, the South Bassein wells off India's west coast during the 1980s, and the Krishna-Godavari basin off the eastern coast during the 1990s.

In the fiscal year of 2013-2014, India's total natural gas consumption amounted to 131.79 mmscmd (million metric standard cubic meters per day), with LNG imports accounting for 38.5 mmscmd or 29% of total annual natural gas consumption.[18] Table 1 shows the breakdown of natural gas use by sector for the first three quarters of the fiscal year 2012-2013.

Table 1. Natural gas consumption in India by sector (first three quarters FY 2012-2013) (mmscmd)

Sector	Domestic Gas	Regasified LNG	Total Gas Consumption	% of Total Gas Supply
Power	30.36	5.80	36.20	28%
Fertilizer	31.02	8.37	39.40	31%
City Gas Distribution/ Compressed Natural Gas (CGD/CNG)	6.69	7.28	14.00	11%
Court-mandated customers	0.98	2.89	3.90	3%
Shrinkage for liquid extraction—LPG, etc	6.02	0.37	6.40	5%
Refineries	2.07	8.62	10.70	8%
Petrochemicals	3.50	1.37	4.90	4%
Sponge Iron/Steel	1.11	3.49	4.60	4%
Small Customers (<50,000 scmd)	2.38	0.01	2.40	2%
Other Users	0.75	3.29	4.00	3%
Internal Consumption in Pipeline	1.45	0	1.50	1%
Total	**86.33**	**41.49**	**127.80**	**100%**

Source: Petroleum and Natural Gas Regulatory Board[19]

[18] Ministry of Petroleum and Natural Gas, Ready Reckoner: Snapshot of India's Oil and Gas Data (August 2014, p.9), http://ppac.org.in/WriteReadData/Reports/20141001123729154821OSnapshot_IOGD_Aug.pdf.

[19] Petroleum and Natural Gas Regulatory Board, Vision 2030: Natural Gas Infrastructure in India (May 2013, p.14), http://www.pngrb.gov.in/newsite/pdf/vision/vision-NGPV-2030-06092013.pdf.

In the first three quarters of 2012-2013, the largest consumers of imported LNG in India were refineries, fertilizer manufacturers, city gas distributors, and power generators, accounting for 20.8%, 20.2%, 17.5%, and 14.0% of total LNG consumption respectively. [20]

While only starting to import LNG in 2004, India is now the world's fourth largest LNG importer—after Japan, South Korea, and China—with imports of 13 million tonnes in 2013.[21] India imported LNG from Qatar (83.3% of India's total LNG imports), Nigeria (7.0%), Yemen (4.7%), Egypt (2.5%), Algeria (0.9%), Brunei (0.5%), and Norway (0.5%). [22] The balance was made up by re-exports from countries, such as South Korea, that import LNG and then sell a portion of their cargoes to a third country.

FORECASTS FOR INDIA'S LNG FUTURE

Future LNG consumption in India will depend on a number of factors, including:

- Level of economic growth and the accompanying demand for energy
- Gap between demand for and domestic supply of natural gas
- Extent to which demand will be met by transnational pipelines and enhanced domestic production
- State of LNG storage and regasification capacity, and pipeline infrastructure

This report examines data from two documents in order to estimate the LNG market that will be created in India by the future shortfall of domestic production and pipeline gas imports relative to natural gas demand. These documents are a) *Vision 2030: Natural Gas Infrastructure in India* (Petroleum and Natural Gas Regulatory Board) and b) *Meeting Demand Challenges of an Emerging LNG Market: India* (Petronet LNG).

PROJECTED DEMAND FOR NATURAL GAS

Both reports come to similar conclusions about India's overall gas demand in 2029-2030.

a) Vision 2030: Natural Gas Infrastructure in India

The Vision 2030 report uses the Planning Commission's Twelfth Five Year Plan,[23] as well as other reports, as the basis for making natural gas demand projections for the period 2012-2013 to 2029-2030. The report refines the Plan's forecasted demand growth for different consumer categories for the period 2012-2013 to 2021-2022. The refined projections are then used to arrive at an estimate of demand up to 2029-2030 (Table 2). [24] The Vision 2030 report projects that natural gas demand will grow significantly at a compound annual growth rate (CAGR) of 6.8% from 242 mmscmd in 2012-2013 to 746 mmscmd in 2029-2030.

[20] Ibid, p. 9.
[21] International Gas Union, World LNG Report 2014 (March 2014, p.12), http://www.igu.org/news/igu-lng-report-2014-edition.
[22] Ibid.
[23] See Government of India, Twelfth Five Year Plan 2012-2017, http://planningcommission.nic.in/plans/planrel/12thplan/welcome.html.
[24] The report assumes an average 6.4% real growth rate for the economy between 2008 and 2035.

Table 2. Consolidated demand for natural gas by sector, 2012-2013 to 2029-2030 (mmscmd)

Sector	2012-13	2016-17	2021-22	2026-27	2029-30
Power	86.50	158.88	233.88	308.88	353.88
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
Petrochemical/Refineries/Internal Consumption	54.00	65.01	81.99	103.41	118.85
Sponge Iron/Steel	7.00	8.00	10.00	12.19	13.73
Total Demand	**242.66**	**378.06**	**516.97**	**654.55**	**746.03**

Source: Petroleum and Natural Gas Regulatory Board[25]

b) Meeting Demand Challenges of an Emerging LNG Market: India (Petronet LNG)

Compared to the Vision 2030 report, the report by Petronet LNG, a state-owned LNG import company, estimates a slightly lower demand of 714 mmscmd, on account of lower projected demand by the petrochemicals sector. The Petronet report projects that natural gas demand will grow at a compound annual growth rate (CAGR) of 7.0% from 226.7 mmscmd in 2012-2013 to 713.5 mmscmd in 2029-2030.[26]

The report also projects that power generating units will become the largest consumers of natural gas, accounting for 38-49% of the 713.5 mmscmd total demand in 2029-2030. The fertilizer industry's share of consumption is expected to drop from 26% in 2012-2013 to 15% in 2029-2030, although demand from city gas distributors is expected to jump from 7% to 12% during the same period.

Below is a table that compares projections of natural gas demand from the two reports. Our analysis will assume 746 mmscmd of natural gas demand in 2029-2030.

Table 3. Comparison of natural gas demand projections (mmscmd)

	2012-13	2016-17	2021-22	2026-27	2029-30
Vision 2030	242.66	378.06	516.97	654.55	746.03
Petronet LNG	226.70	358.06	492.88	625.49	713.49

WHERE DOES LNG FIT? DOMESTIC NATURAL GAS PRODUCTION AND PIPELINE GAS IMPORT SCENARIOS

To reach an estimate of how much LNG India will need to import through to 2029-2030, it is necessary to calculate the total availability of natural gas over the next 15 years from domestic natural gas production, including from domestic shale[27] and coalbed methane (CBM)[28] blocks, and from natural gas imports through transnational pipelines. The difference between this availability of natural gas and the projected total demand represents the shortfall that could be met through LNG imports.

[25] Petroleum and Natural Gas Regulatory Board, Vision 2030: Natural Gas Infrastructure in India (May 2013, p.9), http://www.pngrb.gov.in/newsite/pdf/vision/vision-NGPV-2030-06092013.pdf.

[26] The report assumes a GDP growth rate of 6.4% between 2008 and 2035.

[27] Shale gas refers to natural gas found in low permeability sedimentary rock.

[28] Coal bed methane, also known as coal seam gas, refers to natural gas found within coal beds or coal seams.

a) Projected Domestic Natural Gas Production

India's gas production is set to increase in the next five to six years, primarily led by discoveries made in the past 10 to 15 years by the public sector company Oil and Natural Gas Corporation Limited (ONGC), as well as private sector companies such as Reliance Industries Limited. Work is progressing on shale and coalbed methane (CBM) blocks, but outcomes to date have been limited. If approached and exploited properly, unconventional gas sources could contribute substantially to domestic availability of natural gas.[29]

Estimates for domestic production of natural gas to 2017 are provided by the Planning Commission's Twelfth Five Year Plan. However, beyond 2017, the Vision 2030 report uses a uniform annual growth rate of 3%, predominantly because gas production projections for the necessary period are not provided by major suppliers such as Oil and Natural Gas Corporation Limited (ONGC) and Oil India Limited (OIL), and government bodies such as the Director General of Hydrocarbons (DGH).

This type of modelling is problematic. All projections become inaccurate in the case of an unpredicted natural gas discovery or a substantial decrease in production. Continuing under-recovery from the Krishna Godavari (KG)-D6 basin, operated by Reliance Industries Limited, has already negatively impacted earlier projections of natural gas output in India, based on which large investments were made in power generating and steel manufacturing industries. Vision 2030 acknowledges this reality.

Vision 2030 has treated the Planning Commission's estimates of gas production with information obtained from DGH and ONGC (Table 4).[30]

Table 4. Projections of total domestic natural gas production in Vision 2030 report (mmscmd)

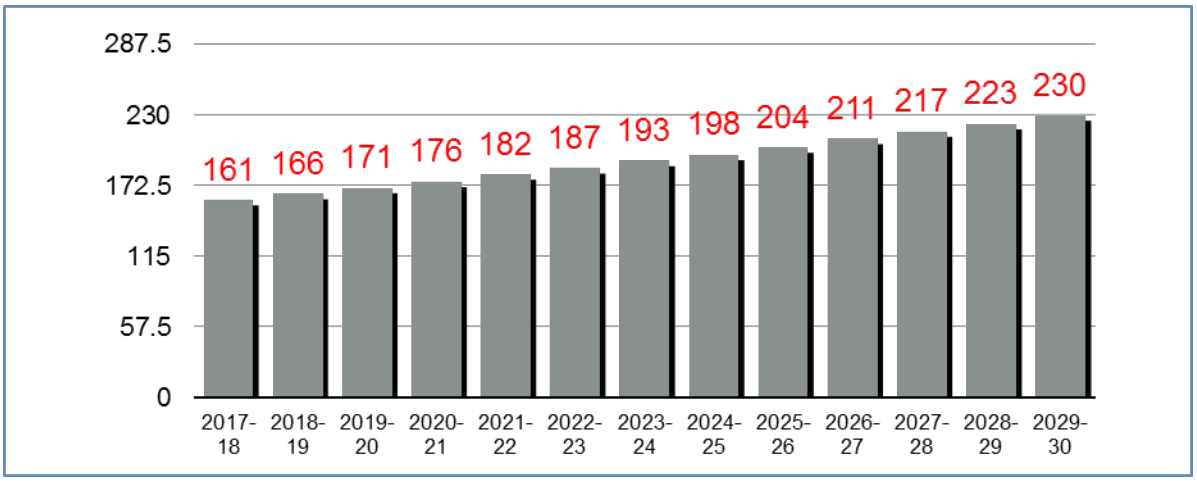
	2012-13	2013-14	2014-15	2015-16	2016-17
ONGC	54.0	55.0	57.6	61.8	91.1
OIL	7.6	9.4	9.9	10.1	10.4
Private JVs	39.5	38.1	43.4	48.5	55.2
Total	**101.1**	**102.5**	**110.9**	**120.4**	**156.7**

Source: Petroleum and Natural Gas Regulatory Board[31]

The Vision 2030 report estimates 2029-2030 natural gas production will reach 230 mmscmd (Figure 1). This paper will use this estimate.

[29] Petroleum and Natural Gas Regulatory Board, Vision 2030 : Natural Gas Infrastructure in India (May 2013, p.33), http://www.pngrb.gov.in/newsite/pdf/vision/vision-NGPV-2030-06092013.pdf.
[30] Ibid. p. 35.
[31] Ibid, p. 35.

Figure 1. Projections of total domestic natural gas production (mmscmd)



Source: Petroleum and Natural Gas Regulatory Board[32]

b) Projected Supply of Pipeline Gas

India's domestic production of natural gas will be supplemented by supplies from transnational pipelines. Until recently, India was a participant in three proposed transnational pipeline projects: Myanmar-Bangladesh-India (MBI), Iran-Pakistan-India (IPI), and Turkmenistan-Afghanistan-Pakistan-India (TAPI) pipelines. However, only TAPI remains under active consideration. If it remains on schedule, TAPI will be commissioned in 2017-2018. While there are various estimates of future availability of natural gas from transnational pipelines, Vision 2030 conservatively estimates that 30 mmscmd of natural gas will be supplied annually to 2029-2030 through the TAPI pipeline.

This estimate of available pipeline gas could change if additional pipelines are constructed, such as the US$30 billion pipeline under discussion with Russia,[33] or the deep-sea pipeline connecting Oman with Porbandar in western India.[34] The deep-sea pipeline could also consolidate gas supplies from Oman, Iran, and Qatar for onward transportation to India.

c) Adding Unconventional to the Mix

There is a wild card that could upset projections of future natural gas supply—large scale domestic production of shale gas and CBM. According to data from the Energy Information Administration (EIA), India's shale gas reserves total 96 trillion cubic feet (tcf), enough to meet the country's natural gas needs for the next 26 years.[35] However, ONGC has only recently started digging wells for shale gas and there is currently no commercial production.[36]

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[32] Ibid, p. 41.
[33] "$30 Billion Oil Pipeline to Be Built from Russia to India through Northwest China" (Global News Research, April 17, 2014), http://www.globalresearch.ca/30-billion-oil-pipeline-to-be-built-from-russia-to-india-through-northwest-china/5378160.
[34] Rajrishi Singhal, "Oman gas pipeline back in favour" (Gateway House, May 23 2014), http://www.gatewayhouse.in/oman-gas-pipeline-back-in-favour/
[35] Energy Information Administration (EIA), Technically Recoverable Shale Oil and Shale Gas Resources: An Assessment of 137 Shale Formations in 41 Countries Outside the United States (June 2013, p.6), http://www.eia.gov/analysis/studies/worldshalegas/pdf/overview.pdf.
[36] Mauli Pathak, "ONGC Begins Shale Gas Exploration in India" (Livemint, November 26, 2013), http://www.livemint.com/Industry/fYlQ5qBr4EXkoDEJHS0mXJ/ONGC-begins-shale-gas-exploration-in-India.html.

The government awarded various blocks for exploration of CBM in 2001. Currently, three private companies—Great Eastern Energy, Essar Oil, and Reliance Industries Limited—are developing blocks in West Bengal, but there is currently only 0.47 mmscmd of CBM production annually.[37] According to the EIA, "the Indian Ministry of Oil partnered with the United States Geological Survey (USGS) and ONGC to conduct a resource assessment and estimates anywhere between 9 and 92 tcf of CBM resources both onshore and offshore in India."[38]

Although the estimates of the reserves of unconventional gas are very large, the costs of extraction are daunting. The government will also need to expend a large amount of political capital to implement hydraulic fracturing, given the environmental issues and land-acquisition laws involved. Therefore, for the purposes of this paper, we will assume that both shale gas and CBM are unlikely to contribute substantially to India's energy security in the next few years.

THE LNG OPPORTUNITY

In summary, projections show a constant annual delivery of 30 mmscmd of natural gas through transnational pipelines from 2017-2018 to 2029-2030. When combined with the 230 mmscmd from domestic production, the total projected availability of natural gas from pipelines and domestic production in 2029-2030 is 260 mmscmd. Given an overall projected demand of between 713 and 746 mmscmd, this leaves an unmet gas need of 454-486 mmscmd that could be supplied through LNG imports (Table 5).

Table 5. India's projected natural gas supply and demand in 2029-2030 (mmscmd)

	Demand	Domestic Supply+ Transnational	LNG Opportunity
Vision 2030	746	260	**486**
Petronet LNG	714	260	**454**

[37] Ministry of Petroleum and Natural Gas, Energizing the Nation: Annual Report 2013-2014 (2014, p.11), http://petroleum.nic.in/docs/Annual_Report/AR13-14.pdf.

[38] Energy Information Administration (EIA), India: Overview (June 2014), http://www.eia.gov/countries/cab.cfm?fips=in

FACTORS IMPACTING INDIA'S FUTURE LNG CONSUMPTION

LNG imports are required to meet India's need for natural gas. However, any plans to increase LNG imports will be impacted by the following factors:

- Regasification capacity
- Pipeline infrastructure
- LNG pricing mechanisms and contract terms
- Domestic gas pricing regime

REGASIFICATION CAPACITY

The natural gas supply shortfall in India that could be met by LNG imports is projected to reach 454-486 mmscmd by 2029-2030. However, LNG imports will be restricted by the state of India's infrastructure to receive LNG and convert it back into its gaseous form.

India currently has four regasification terminals in operation. As Table 6 illustrates, the Vision 2030 report projects that storage and regasification capacity will only reach 214 mmscmd by 2029-2030, assuming an actual operating capacity of 70% of total regasification capacity (a global standard). As a result, the report further projects that LNG imports will be restricted to 214 mmscmd in 2029-30 (Table 7). This number is well below the projected unmet gas demand of 454-486 mmscmd.

Table 6. Current and planned regasification capacity (mtpa)

	2012-13	2016-17*	2021-22#	2022-23	2029-30
Dahej	10	15	15	15	15
HPL Hazira	3.6	10	10	10	10
Dabhol	1.2	5	5	5	5
Kochi	2.5	5	10	10	10
Ennore	0	5	5	5	5
Mundra	0	5	10	10	10
Kakinada (FSRU)	0	5	5	5	5
Gangavaram	0	3	3	3	3
East Coast Terminal (1)	0	2.5	5	10	10
West Coast Terminal (1)	0	0	5	10	10
Total Capacity (mtpa)	**17.3**	**55.5**	**73**	**83**	**83**
Total Capacity (converted to mmscmd)	**63.7**	**204.2**	**268.6**	**305.4**	**305.4**
Gas Availability (PLF at 70% capacity) (mmscmd)	**44.6**	**143**	**188**	**213.8**	**213.8**

Source: Petroleum and Natural Gas Regulatory Board[39]

[39] Petroleum and Natural Gas Regulatory Board, Vision 2030: Natural Gas Infrastructure in India (May 2013, p.37), http://www.pngrb.gov.in/newsite/pdf/vision/vision-NGPV-2030-06092013.pdf.

* Terminal Year of 12th Five Year Plan
# Terminal Year of 13th Five Year Plan
Note: The Dahej and Kochi facilities are owned by Petronet, the Hazira project is owned by Shell, and the Dabhol asset is owned by a joint venture between Gas Authority of India Limited (GAIL) and power producer National Thermal Power Corporation (NTPC).

Table 7. Consolidated supply of natural gas by source, 2012-2013 to 2029-2030 (mmscmd)

Sources	2012-13	2016-17*	2021-22	2026-27	2029-30
Domestic Sources	101.1	156.7	182.0	211.0	230.0
LNG Imports	44.6	143.0	188.0	214.0	214.0
Gas Imports (Cross-border pipelines)	0.0	0.0	30.0*	30.0	30.0
Total	**145.7**	**299.7**	**400.0**	**454.0**	**474.0**

*Note: The TAPI pipeline is expected to be completed by 2017-2018.

Source: Petroleum and Natural Gas Regulatory Board[40]

There are many reasons why the capacity of India's planned regasification and other natural gas infrastructure is lower than projected natural gas demand. In particular, natural gas infrastructure requires substantial investment, which has been difficult to acquire in recent years due to: the slowdown in the global economy; rising interest costs; erosion of confidence in the United Progressive Alliance (UPA) government, which was India's governing party until May 2014;[41] land acquisition challenges; tax uncertainty; and obstacles in the form of lengthy, multi-stage approvals processes, such as environmental clearances. Also, uncertainty over domestic gas pricing has deterred investment. Without any clarity on a pricing regime, investors lacked confidence to move forward with gas infrastructure projects. However, recent changes to the pricing regime are likely to partially alleviate this situation.

PIPELINE INFRASTRUCTURE

Even if regasification capacity increases substantially, there are still other infrastructure challenges that could impede growth of India's LNG market and gas consumption in general. Insufficient domestic pipeline capacity to move gas to customers is one such obstacle.

The natural gas and LNG Infrastructure in India is mainly owned by: GAIL (India) Limited, Gujarat State Petronet Limited (GSPL), Reliance Gas Transportation Infrastructure Limited (RGTIL), Gujarat Gas Company Limited (GGCL), Assam Gas Company Limited (AGCL), and Indian Oil Corporation Limited (IOCL) (Table 8).

[40] Ibid, p. 41.
[41] The UPA is a coalition of Indian centre-left political parties, of which the Indian National Congress party is the chief member.

Table 8. Natural gas pipeline network in India

Name of Pipeline	Owner	Length (km)	Design Capacity (mmscmd)
HVJ+ GREP +DVPL	GAIL	4222	53.0
DVPL - GREP Upradation	GAIL	1280	54.0
Dahej -Uran- Panvel-Dhabol	GAIL	815	19.9
Agartala P/L network	GAIL	61	2.3
Mumbai regional P/L network	GAIL	129	7.0
Assam regional P/L network	GAIL	8	2.5
KC Basin regional P/L network	GAIL	878	16.0
Gujrat regional P/L network	GAIL	760	3.9
Cauvery regional P/L network	GAIL	271	3.9
EWPL	RGTIL	1460	80.0
Gujrat Gas Grid network	GSPL	1950	43.0
Hazira -Ankleshwar	GGCL	73	5.0
Assam network	AGCL	105	6.0
Dadri-Panipat	IOCL	132	9.5
Dadri- Bawana -Nangal	GAIL	886	31.0
Total		**13030**	**337.0**

Source: Petroleum and Natural Gas Regulatory Board[42]

Note: HVJ stands for Hazira-Vijaipur-Jagdishpur Pipeline; GREP for Gas Rehabilitation and Expansion Project; DVPL for Dahej-Vijaipur Pipeline; EWPL for East West Pipeline.

India's current pipeline network of 13,000 km has a design capacity[43] of 337 mmscmd.[44] Over the next five to six years, the pipeline network is expected to expand to 28,000 km, with a total design capacity of 721 mmscmd, connecting the major demand and supply centres.[45]

[42] Petroleum and Natural Gas Regulatory Board, Vision 2030: Natural Gas Infrastructure in India, (May 2013, p. 44), http://www.pngrb.gov.in/newsite/pdf/vision/vision-NGPV-2030-06092013.pdf.

[43] "Design capacity" is the optimum pipeline capacity calculated on the drawing board through simulation and other exercises.

[44] Petroleum and Natural Gas Regulatory Board, Vision 2030 : Natural Gas Infrastructure in India (May 2013, p.10), http://www.pngrb.gov.in/newsite/pdf/vision/vision-NGPV-2030-06092013.pdf.

[45] Ibid. p. 10.

Table 9. Pipeline infrastructure by 2030

Pipelines	Design Capacity (mmscmd)	Length (km)
Existing before 2012	306	12,144
Expected Addition in 12th Plan	416	15,928
Expected Addition in 13th Plan	60	3,360
Incremental Capacity Addition in MBBVPL/MBPL/Surat Paradip pipelines beyond 13th Plan	33	1,295
Total	**815**	**32,727**

Source: Petroleum and Natural Gas Regulatory Board[46]

When projected natural gas demand reaches 746 mmscmd in 2029-2030, India is expected to have a 32,727 km natural gas pipeline network with a design capacity of 815 mmscmd.[47] However, based on "capacity at source",[48] the pipeline capacity by 2029-2030 will only be 582 mmscmd.[49]

Furthermore, large gaps in the national gas grid will continue to pose difficulties for delivering gas to some regions. The Indian natural gas market can be divided into six regions: north, west, south, east, central, and northeast. The western region is the most developed in terms of an existing pipeline network. In the next few years, the pipeline networks in the northern and southern regions are expected to catch up with the western region, leaving the eastern and northeastern regions lagging severely behind. According to the Saumitra Chaudhuri Committee, an inter-ministerial panel set up by India's Planning Commission: "States closer to the gas source or having pipeline infrastructure have had the benefits of higher availability of gas and local development of the gas market (e.g. Gujarat, Maharashtra, Northern markets, Andhra Pradesh, etc)."[50]

[46] Ibid, p. 51.
[47] Ibid, p. 11.
[48] "Capacity at source" is the receiving capacity at the consumer end—when the natural gas being transported moves from a larger diameter, higher pressure environment to a lower pressure, low diameter pipe—bringing down the actual overall capacity that can be moved through the pipelines.
[49] Petroleum and Natural Gas Regulatory Board, Vision 2030: Natural Gas Infrastructure in India (May 2013, p. 11), http://www.pngrb.gov.in/newsite/pdf/vision/vision-NGPV-2030-06092013.pdf.
[50] Ibid. p. 15.

Table 10. Natural gas pipeline infrastructure by region

Regional Gas Markets in India	Approximate % of Total Pipeline Network	% of Natural Gas Consumption	States with Infrastructure	States Lacking Pipeline Infrastructure
West	40%	53%	Gujrat, Maharashtra	Goa
North	20%	26%	Delhi, UP, Haryana, Rajasthan	Punjab, J&K, Himachal Pradesh, Uttarakhand
South	16%	14%	Tamil Nadu, Andhra Pradesh,	Kerala, Karnataka
Central	13%	3%	Madhya Pradesh	Chhattisgarh
North East	10%	4%	Assam, Tripura	Meghalaya, Sikkim, Arunachal Pradesh, Mizoram, Manipur, Nagaland
East	0%	NIL		Bihar, West Bengal, Jharkhand, Orissa

Source: Government of India[51]

Demand for natural gas from the eastern region is estimated to grow nearly six times by 2029-2030, while demand in the northeastern region is likely to more than quadruple over the same period (Table 11).[52] Unfortunately, despite this impressive growth, the combined grid capacity of the northern and western regions will be five times that of the eastern and southern regions put together. This reflects the lopsided regional industrial growth policy that has been pursued in India, which has disadvantaged the eastern and northeastern regions in particular.

Table 11. Regional natural gas demand distribution (mmscmd)

Region	2012-13	2016-17	2021-22	2026-27	2029-30*
West	102.80	165.13	191.78	207.50	236.50 (32%)
North	62.96	88.40	144.66	188.74	215.11 (29%)
South	48.20	81.28	116.71	151.89	173.11 (23%)
East	10.35	21.66	31.03	53.24	60.68 (8%)
Central	13.21	16.29	22.33	32.52	37.07 (5%)
North east	5.13	5.29	10.47	20.67	23.56 (3%)
Total	**242.66**	**378.06**	**516.97**	**654.55**	**746.00**

Source: Petroleum and Natural Gas Regulatory Board[53]

*Note: Figures in brackets are percentage of total.

[51] Government of India, Report of the Inter-Ministerial Committee on Policy for Pooling of Natural Gas Prices and Pool Operating Guidelines (August 2011, p.51), http://www.infraline.com/ong/naturalgas/pricing/gaspoolingreport-aug11.pdf.
[52] Petroleum and Natural Gas Regulatory Board, Vision 2030 : Natural Gas Infrastructure in India (May 2013, p.31), http://www.pngrb.gov.in/newsite/pdf/vision/vision-NGPV-2030-06092013.pdf.
[53] Ibid, p.51.

Unbalanced industrial activity and natural gas infrastructure distribution has the potential to be a drag on India's future economic growth and is a potential source for political turmoil. It is therefore necessary to improve the industrial base in the eastern and northeastern regions, a process that will increase demand for natural gas. This may require some redirection of investments in regasification and natural gas pipelines to these regions.

LNG PRICING MECHANISMS AND CONTRACT TERMS

A major challenge for LNG imports to India, and to Asia in general, is the absence of a mechanism for gas pricing that efficiently reflects the interplay between regional demand and supply. The price of LNG delivered on long-term contract to Asian destinations is often oil-indexed and, as such, is subject to the volatility experienced by crude oil prices.[54] LNG spot prices do depend on gas-on-gas competition, though not to the extent that it actually reflects demand-supply conditions in the Asian market. Rather, oil-indexed prices set a reference point that is modified by market conditions.[55]

In comparison, North America, and to some extent Europe, have developed gas markets that allow for gas price discovery, which becomes the benchmark for trading gas. Henry Hub in the United States and the National Balancing Point in the United Kingdom are two benchmarks determined by their local gas exchanges. As a paper from the think tank Gateway House succinctly described it, natural gas prices in the United States and in the United Kingdom "include not just the cost of raw material, production, distribution and marketing, but also the sophisticated inputs from the financial markets such as volume, speculation, hedging, currency risks, and geopolitical developments."[56]

At present, the prices of LNG in Asia are higher than prices of LNG and gas in the Atlantic market, a phenomenon referred to as the "Asian premium".[57] The price differentials have varied considerably in recent years. However, in August 2014, the Henry Hub spot price for natural gas in the United States was approximately US$3.91 per MMBtu,[58] while the estimated landed price of LNG in Spain was US$9.15/ MMBtu and US$10.10/MMBtu in Japan.[59] This price differential has persisted for a number of reasons, including high oil prices and rising demand for LNG in Asia following the Fukushima Daiichi nuclear accident; low gas prices in North America, caused in part by high shale gas production, has further widened the differential. Continued high and volatile prices could limit the growth of LNG imports to India, as cheaper sources of energy, such as coal, would become more attractive than LNG.

Over the past few years, India has obtained a larger proportion of its LNG requirements from the spot and short-term market, compared to many other LNG importing countries such as Japan and Korea. There are a number of reasons for this. Much of the current demand in India for LNG emanates from consuming capacity, such as gas-based power plants, built on the premise of increasing gas supplies from domestic production. Reliance Industries Limited's recent reduction in output has put these consumers in a quandary, forcing them to rely on imported LNG contracted on a spot or short-term basis.

In addition, as India only started importing LNG in 2004, it has not signed as many long-term contracts as other

[54] There is a historical reason for the indexation of gas prices to oil. In the 1960s, gas suppliers to Europe felt that the gap between oil and gas prices was too large, given that the investment and the processes involved in production of oil and gas were similar.

[55] Warner ten Kate, et al., Developing a Natural Gas Trading Hub in Asia: Obstacles and Opportunities (IEA, 2013, p.67), http://www.iea.org/media/freepublications/AsianGasHub_WEB.pdf.

[56] Akshay Mathur,"Decoding Natural Gas Pricing in India" (Gateway House, March 7, 2014), http://www.gatewayhouse.in/decoding-natural-gas-pricing-in-india/.

[57] Warner ten Kate, et al., Developing a Natural Gas Trading Hub in Asia: Obstacles and Opportunities (IEA, 2013, p.14), http://www.iea.org/media/freepublications/AsianGasHub_WEB.pdf.

[58] Energy Information Administration (EIA), "Henry Hub Natural Gas Spot Price", accessed October 1, 2014, http://www.eia.gov/dnav/ng/hist/rngwhhdd.htm.

[59] Federal Energy Regulatory Commission, "World LNG Estimated September 2014 Landed Prices" (September 2014), http://www.ferc.gov/market-oversight/mkt-gas/overview/ngas-ovr-lng-wld-pr-est.pdf.

countries that have longer LNG import histories. The long-term contracts signed by Indian companies recently have not yet come into effect. For example, Petronet's contract with Exxon for Australian LNG and Gujarat State Petroleum Corporation's (GSPC) contract with BG Group will not result in LNG deliveries until 2015. In the interim, the only recourse for meeting growing natural gas demand is to import LNG through the spot or short-term market.

However, in recent years, spot LNG cargoes have been more expensive than cargoes bought using long-term contracts in the Asia Pacific market.[60] India can only be assured of regular supplies of large quantities of LNG if it enters into more long-term contracts. As India continues to pursue LNG imports, the Government of India is increasingly eager to see reforms in oil-linked LNG pricing.

Currently, there are three large state-owned LNG importers in India have signed long-term contracts--Petronet LNG, GAIL, and Gujarat State Petroleum Corporation (Table 12). In the private sector, no company has so far entered into any long-term contracts.

Table 12. Selected long-term LNG import contracts

Importer	Exporter	Volume (mmpta)	Term (years)	Export Start Year
Gujarat State Petroleum Corporation	BG Group	2.5	20	2015
Gujarat State Petroleum Corporation	Gazprom (Singapore subsidiary)	2.5	20	2016
Petronet LNG	Ras. Laffan Liquefied Natural Gas Co. ltd (Qatar)	5	25	2004
Petronet LNG	Ras. Laffan Liquefied Natural Gas Co. ltd (Qatar)	2.5	25	2009
Petronet LNG	Exxon Mobile Corporation (Australia)	1.44	20	2015
Petronet LNG	Gazprom (Singapore subsidiary)	2.5	25	Unknown
Gail India	Ras. Laffan Liquefied Natural Gas Co. ltd (Qatar)	Unknown	Unknown	Unknown
Gail India	Sabine Pass Liquefaction Company	3.5	Unknown	2017/18
Gail India	Gazprom (Singapore subsidiary)	2.5	20	2018/19
Gail India	US Dominion Cove point (Maryland)	2.3	Unknown	2018/20

Source: Kaustav Mukherjee and Rahool Panandiker[61]

REFORM OF LNG PRICING: ASIA PROPOSES A BUYERS' CLUB

As Asian countries account for 70% of the LNG import market, India, Japan, South Korea, Taiwan, and China have proposed the creation of an LNG buyers' club in order to address the Asian Premium. [62]

[60] Warner ten Kate, et al., Developing a Natural Gas Trading Hub in Asia: Obstacles and Opportunities (IEA, 2013, p.14), http://www.iea.org/media/freepublications/AsianGasHub_WEB.pdf.

[61] Kaustav Mukherjee and Rahool Panandiker, LNG: Global Challenges and Opportunities and Imperatives for India (Boston Consulting Group, January 2014, p.32), http://www.bcgindia.com/documents/file152473.pdf.

[62] Joel Smith, "The Unlikelihood of an Asian LNG Buyers' Club" (Centre for New American Security, December 13, 2013), http://www.cnas.org/blog/unlikelihood-asian-lng-buyers%E2%80%99-club#.U3BnjKiSznk.

In a joint statement made in September 2013, Japan and India agreed to tackle higher LNG procurement prices in Asia.[63] They expressed concern that contracts included inflexible conditions, such as destination clauses, that exacerbate market illiquidity in the Asia Pacific region. Since the demand for LNG in Asia is projected to grow, LNG consumers in the region are seeking to develop a globally competitive LNG market that will result in price convergence between regions. In January 2014, while dedicating the Kochi LNG terminal, India's former Prime Minister Manmohan Singh said in a speech:

> Asia has been the driver of global LNG demand in recent times. It is therefore important that major buyers of LNG in Asia come together to demand a fair pricing mechanism for gas being imported from outside of Asia. I hope to see India contribute towards an effort of this kind in the future.[64]

In March 2014, GAIL signed a memorandum of understanding with Japan's Chubu Electric Power Company to collaborate in the area of joint LNG procurement and shipping optimization.[65] Chubu and GAIL are large LNG importers with considerable synergy between their LNG business profiles. Japan and India have also decided to launch a multilateral study group on LNG, including energy research institutes in LNG consuming countries.

Central to the idea of an Asian buyers' club is the emergence of an Asian gas market, which will allow for natural gas price discovery within Asia, depending on regional gas supply-demand dynamics. Some initial developments towards a hub have already taken place, with China launching a market in 2010 for LNG spot trading, and Japan planning to launch an LNG futures market in 2014. In addition, Singapore has expressed a desire to become the regional trading hub for LNG.[66]

Some analysts have suggested that India should also create a regional hub for trading natural gas.[67] India has a number of characteristics that make it well suited to this role, including its strategic location in the region and its large current and projected volumes of LNG imports. A beginning of sorts has been made with the new LNG partnership with Japan. This engagement could be widened to include a gas pricing hub in India.

However, there are several challenges facing the establishment of an LNG buyers' club. Asia's LNG market is expected to remain tight in the near term and the degree of relief will depend largely on the speed with which new LNG export projects are brought online.[68] LNG buyers have very little control over the speed of development, despite the fact that some of them have invested in LNG export projects. Furthermore, buyer countries have different needs and complex portfolios of energy sources. It may not be possible to bring such diverse economies into collective action.[69]

PRICING REGIME FOR DOMESTICALLY PRODUCED GAS

On October 18, 2014, the Government of India released a new domestic gas pricing policy, which seeks to improve the investment quotient of the natural gas/LNG sector. The new regime creates a single price for gas produced

[63] Government of India, "Joint Statement on the Japan and India LNG joint study on pricing in the Asia Pacific Market in Tokyo" (September 9, 2014), www.pib.nic.in/newsite/PrintRelease.aspx?relid=99206.
[64] Government of India, "PM's speech at the dedication of Kochi LNG Terminal to the Nation" (January 4 2014), www.pib.nic.in/newsite/PrintRelease.aspx?relid=102302.
[65] GAIL (India) Limited, "GAIL executes MoU with Chubu Electric of Japan for joint LNG procurement" (March 24, 2014), http://www.gail.nic.in/final_site/pressrelease_march24_14.html.
[66] Chou Hui Hong, "Singapore Sees LNG Trading Hub Ambition Fulfilled After 2018" (Bloomberg, April 6, 2014), http://www.bloomberg.com/news/2014-04-07/singapore-sees-lng-trading-hub-ambition-fulfilled-after-2018.html.
[67] Akshay Mathur, "Decoding Natural Gas Pricing in India" (Gateway House, March 7, 2014), http://www.gatewayhouse.in/decoding-natural-gas-pricing-in-india/.
[68] Joel Smith, "The Unlikelihood of an Asian LNG Buyers' Club" (Centre for New American Security, December 13, 2013), http://www.cnas.org/blog/unlikelihood-asian-lng-buyers%E2%80%99-club#.U3BnjKiSznk.
[69] Ibid.

in India. The way it is calculated is simple. The new formula adds the total value of gas consumed at four different locations (calculated by multiplying the benchmark price of that location by total volume consumed); the sum is then divided by the total volume consumed in these four locations.[70] The pricing benchmarks to be utilized are: Henry Hub for US and Mexico consumption, Alberta Gas Reference Price for Canada, National Balancing Point for EU and Former Soviet Union countries, and Russian prices.[71] The new system will come into effect on November 1, 2014 and prices will be reviewed every six months.

This single price is certainly an improvement over the existing system, which generated two overarching categories of gas pricing with multiple subcategories:

1. Administered Pricing Mechanism (APM): Applies to natural gas produced from existing oil and gas fields managed by the state-owned oil companies ONGC and Oil India Limited. This gas is supplied to fertilizer, power plants, and some customers mandated by courts at a controlled price of $4.2 MMBtu. For customers in the northeast of the country, the price is $2.52 MMBtu. The difference between the mandated price and the cost of production is paid to producers by the government.

2. Non-APM: Applies to three types of gas that may be sold at rates based on the free market— 1) LNG imports (prices are determined by the free market); 2) New Exploration Licensing Policy (NELP) gas (prices are based on the free market and approved by the Indian government); and 3) pre-NELP gas (prices are specified in product-sharing contracts).[72]

This system was confusing for investors and led to intense government lobbying by gas sellers and consumers, resulting in price distortions. In addition, the policy kept prices of domestically produced gas low, reducing the incentive for companies to invest in natural gas exploration, production, and infrastructure. As LNG prices were not controlled, the pricing regime also put LNG at a price disadvantage in the market.

In order to reform this system, the UPA government had agreed to follow the recommendations of the 'Rangarajan Committee' that was established to develop a formula for uniform gas pricing.[73] The committee's pricing formula for natural gas sold in India assigned a large weight to Japan Custom Cleared (JCC) gas prices,[74] which are linked to crude oil prices. The pricing regime was scheduled to come into effect on April 1, 2014, but was deferred due the Indian national elections, which took place in April and May 2014.

The newly elected government under the leadership of Prime Minister Narendra Modi decided to revisit the Rangarajan Committee methodology, primarily because it felt that inclusion of JCC in the pricing formula inflated gas prices. Significantly, the newly approved formula now excludes JCC completely from the equation. All consumers will now have to pay the new single price, with exceptions made for some consumers and for the output from certain wells.

[70]Cabinet Committee on Economic Affairs, "Revision of Domestic Gas Prices" (Government of India, October 18 2014), http://pib.nic.in/newsite/PrintRelease.aspx?relid=110696.

[71] Ibid.

[72] The pre-NELP gas output, all of which is sold to GAIL, is governed by the original production sharing contracts. The price range works out to $3.5-5.7 per mmbtu. The pre-NELP fields are Panna-Mukta, Tapti and Ravva fields. The price of the gas from NELP fields is determined on the basis of market forces, but needs government approval. NELP gas is currently priced at between $4.2-4.7 per mmbtu. This includes the gas produced by the offshore fields owned by Reliance Industries Ltd at Krishna-Godavari basin.

[73] Government of India, Report of the Committee on the Production Sharing Contract Mechanism in Petroleum Industry (December 2012), http://eac.gov.in/reports/rep_psc0201.pdf.

[74] Japanese Customs Cleared Crude Oil (JCC) price is the average price of customs-cleared oil imports into Japan. JCC price is often used as an index in long-term LNG contracts in Japan, South Korea, and Taiwan.

However, it is too early to conclude that the new pricing system will increase investment into natural gas exploration, production, and infrastructure or, by extension, increase domestic gas production. While a single price point — determined on the basis of global consumption and pricing trends — should provide greater certainty to investors, the government's gas pricing policy is still evolving. For instance, the new policy states that gas sold from new discoveries in "ultra deep water areas", "deep water areas" and "high pressure-high temperature" areas can command a premium over the new single gas price.[75] While the policy design seems to be incentivizing deep sea exploration, there is no clarity yet on what qualifies as "ultra deep water".

Therefore, the attraction of the Indian natural gas/LNG sector as an investment destination will depend on some more policy clarity. This is a rapidly transforming sector that will need to be watched closely over the next few months.

[75] Cabinet Committee on Economic Affairs, "Revision of Domestic Gas Prices" (Government of India, October 18 2014), http://pib.nic.in/newsite/PrintRelease.aspx?relid=110696.

ENTER ALTERNATIVE MARKETS: CANADA AS A POTENTIAL SOURCE OF LNG

India is exploring many alternative markets for sourcing oil and natural gas in order to enhance its energy security. Indian oil and gas companies are buying stakes in exploration companies as well as investing in or signing off-take agreements with LNG export facilities around the world. The strategy is to take a financial interest in projects that can provide committed parcels of natural gas at a later date.

Canada is among the markets that Indian companies are considering for investment and offtake agreements. Canada currently has at least 23 LNG export facilities under consideration on its east and west coasts. None of these projects has yet to reach a final investment decision. However, if these projects materialize, Canada has many advantages as a potential LNG exporter to India, including:

- Large quantities of available natural gas: Canada is the fifth largest natural gas producer in the world, according to BP.[76]
- Low risk market: Canada offers political stability, low operating risks, and respect for contract sanctity.
- Pricing: Canadian LNG might be available at reasonable prices (at least cheaper than the spot and short-term rates paid by Indian companies for recent cargoes).
- Geographic diversification of natural gas sources.

Indian companies have started to participate in Canada's nascent LNG export industry. State-owned oil company Indian Oil Corporation Limited (IOCL) acquired a 10% stake in Pacific NorthWest LNG in British Columbia, a project that is being developed by Progress Energy Canada Ltd, a subsidiary of the Malaysian company Petronas. As part of the deal, IOCL acquired a stake in gas fields in British Columbia and will offtake 1.2 million tonnes of LNG annually for 20 years.[77]Another example is H-Energy, a part of the Mumbai-based construction group Hiranandani Group, which is planning to set up a 13.5 mmtpa natural gas liquefaction facility in Nova Scotia, on Canada's east coast.[78]

However, Canada's proposed LNG projects face some challenges that need to be addressed:

- Canadian LNG export facilities must undergo a multi-stage government approval process, involving both provincial and federal governments. These processes can be time-consuming. However, a number of projects have already received export permission from the National Energy Board (NEB).
- The need to export gas to non-U.S. markets due to increased U.S. unconventional gas production caught Canada unprepared in terms of infrastructure. Canada will need to make large capital investments in storage and liquefaction facilities as well as pipelines to enable exports to Asia.
- Securing these investments, as well as final investment decisions, will require Canadian LNG export projects to conclude contracts with buyers, preferably on a long-term basis. The LNG price these projects offer will play a large role in determining their success in obtaining these contracts. A competitive price may require Canadian projects to move away from oil-indexed gas prices to a Henry Hub benchmark, as some U.S. LNG export project

[76] BP, BP Statistical Review of World Energy 2013 (BP, 2013, p.22).

[77] Progress Energy Canada Ltd., "Progress Energy Canada and Pacific NorthWest LNG welcome third partner to British Columbia LNG export project" (March 7, 2014), http://www.progressenergy.com/2014/03/07/progress-energy-canada-and-pacific-northwest-lng-welcome-third-partner-to-british-columbia-lng-export-project/.

[78] Government of Nova Scotia, "Government Welcomes Advancement of LNG plant in Guysborough County" (July 21, 2014), http://novascotia.ca/news/release/?id=20140721004.

have done. GAIL has signed an agreement with Cheniere Energy Partners to source Sabine Pass LNG at Henry Hub indexed prices.[79]

- While most of Canada's proposed LNG projects are on the west coast, federal and provincial authorities should also develop Canada's east coast natural gas supply chain. As mentioned above, Indian company H-Energy is exploring the possibility of importing gas from a facility in Nova Scotia.
- Obtaining permissions and constructing necessary pipelines from the wellhead to the port can be burdensome, in part due to community concerns.
- Labour costs will likely be another big hurdle for Canadian LNG export projects. In the absence of a large pool of trained workers, labour costs tend to balloon, rendering projects economically unviable.
- The large transportation distance between Canada and India could be a significant barrier to large volumes of Canadian gas reaching India. Canadian gas could become more desirable to Indian buyers if it is swapped.

A swap agreement arranges for natural gas destined for one market to be delivered elsewhere and for substitute gas to be supplied to the original destination. An Indian and a Japanese company, for example, could enter into an agreement whereby the Indian company buys Canadian LNG, but ships the gas to Japan for consumption. In return, the Japanese company's LNG cargo from Qatar or elsewhere would be sent to India. The benefit of this arrangement is that both Japanese and Indian buyers can increase their bargaining power with respect to price and contract terms by obtaining natural gas from multiple suppliers, and still have gas supplied from sources that are relatively close geographically. Furthermore, the LNG project proponents in British Columbia are predominantly global energy conglomerates, such as Shell, Chevron, and Mitsubishi. If these project developers were motivated to gain Indian investment, they could agree to re-direct their cargoes from other projects (for example, in Africa) to India in exchange for Indian investment in Canadian downstream or upstream facilities.

However, the India-Canada LNG relationship should not just be about India purchasing Canadian LNG or investing in gas extraction projects. Canadian companies or multi-national proponents of Canadian LNG projects can invest in India's LNG and natural gas infrastructure to encourage reciprocal investments. The Indian government allows 100% foreign direct investment in regasification facilities. This investment, if undertaken in India's eastern and northeastern regions, could have the dual benefit of helping to correct India's lopsided gas and LNG infrastructure, while facilitating additional LNG imports. Furthermore, by investing in LNG regasification facilities, Canadian companies or multi-nationals can lock in a secure, long-term off-take solution.

[79] Cheniere Energy Partners, L.P., "Cheniere and GAIL India Sign 20-Year LNG Sale and Purchase Agreement" (Dec 11, 2011), http://www.prnewswire.com/news-releases/cheniere-and-gail-india-sign-20-year-lng-sale-and-purchase-agreement-135404888.html.

CONCLUSION

India's LNG outlook can be summarized as follows:

- Natural gas demand is growing quickly, driven by power generating companies, fertilizer and steel manufacturers, petrochemical companies, city gas distributors, and other consumers.
- India can source natural gas from domestic production, transnational pipelines, and LNG imports.
- Natural gas supply has fallen short of projections due to decreased domestic production from Reliance Industries. Future estimates of available pipeline gas also need to be recalibrated due to uncertainty about the viability of some proposed transnational pipelines.
- Meeting India's gas demand will rely heavily on increased LNG imports. However, imports can only be increased if the attendant infrastructure (storage tanks, regasification plants, pipelines to consumers) also expands.
- As a late entrant into the global LNG market, India has fewer long-term contracts with LNG suppliers than Japan or South Korea. Consequently, India imports LNG at spot or short-term market rates, which are higher than rates in long-term contracts.
- LNG prices in Asia are currently high because the mechanism used for setting LNG prices in long-term contracts is oil-indexed. GAIL has entered into some medium and long-term contracts based on gas market prices, but these will not come into effect immediately.
- Continued high and volatile LNG prices could create a challenge for the growth of LNG imports to India, as cheaper sources of energy, such as coal, would become more attractive.
- In the meantime, India still needs to import larger amounts of LNG to meet internal demand from a variety of consumers.

As a fuel-starved economy, India must find ways to increase access to different kinds of fuel, from different source countries, at reasonable rates. As a result, Indian companies are seeking to invest in and secure offtake agreements from LNG export facilities around the globe. Canada as a potential LNG exporter has a lot to offer India, such as low market risk and large reserves of natural gas. However, Canada's distance from India could be a barrier to gas trade between the two countries. Canadian projects will need to offer gas at competitive prices, perhaps benchmarked to Henry Hub, in order to attract Indian buyers.