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Centre-staging Natural Gas: International trends and their relevance for India – A Status Note

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Abstract

What does the advent of shale gas as a 'game-changer' imply for natural gas markets, particularly the pricing of gas? The project team will seek to answer this question. The project will specifically look to understand the movement of natural gas prices vis-à-vis oil prices. Since India's reliance on natural gas imports is set to increase, the project will conduct an assessment of possible natural gas suppliers for India and the impact of changes in pricing regimes internationally.

Centre-staging Natural Gas: International trends and their relevance for India

Introduction

Over the last decade, especially after the shale gas bonanza in the United States, natural gas has often been referred to as a "bridge fuel" – a more environment-friendly fossil fuel than coal or oil that can reduce pollution in the near future and facilitate the gradual transition towards renewable sources of energy. The share of natural gas in world energy production has increased significantly in the recent past and it will undoubtedly play a greater role in world energy production in the future (IEA, 2011). In the context of this changing global scenario, India needs to make sure that it does not lag behind in taking this opportunity to explore the options offered by natural gas by having a long term strategy in place to ensure optimal utilization of this source of energy. Unfortunately, India's domestic gas production has declined since 2009-10, while demand has increased. Therefore, natural gas imports would play a major role in this transition. This paper aims to assess the potential sources of natural gas imports for India and the impact of changes in international demand-supply conditions and pricing regimes.

Natural gas accounted for 23.94% of world primary energy consumption in 2012 (BP, 2013) and 21.4% of total primary energy supply in 2010 (IEA, 2012a). The world production of natural gas has increased over the last four decades, as shown in Figure 1 below.

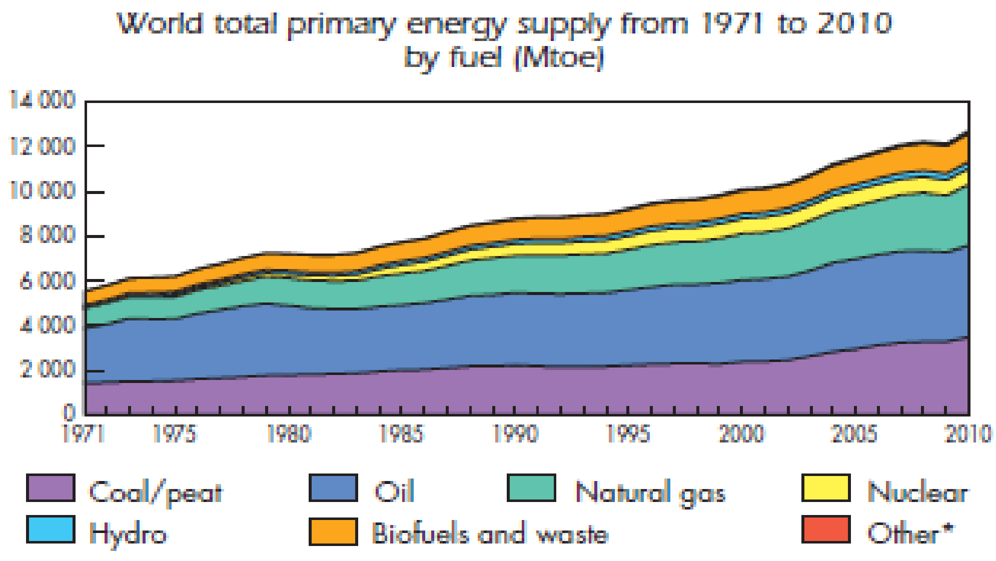

Figure 1: World total primary energy supply by fuel type from 1971 to 2010
Source: (IEA, 2012a)

In comparison to this, in 2009-10, natural gas accounted for about 14.13% of total primary energy production in India, and total domestic gas production in the country has declined since then (TERI, 2013). Although domestic production has been falling, the Government of India plans to increase consumption of natural gas in the country by boosting domestic production and increasing import capacity (MoPNG, 2011). A large number of new Liquefied Natural Gas (LNG) terminals have been planned on the East coast (Kakinada, Ennore etc.), as well as on the West coast (Kochi, Dabhol expansion, Hazira expansion etc).

Just like in the case of any other resource, natural gas pricing is a critical factor affecting the development of this fuel across the world. Pricing regimes of internationally traded natural gas can be broadly classified into one of the four regimes – the US spot markets, UK spot markets, European long term contracts and the Asia-Pacific market (largely comprising long term contracts). In both the long term contract regimes, natural gas prices are closely linked to crude oil prices, while the spot markets in the US and UK dissociate gas price from crude oil price. A snapshot of the trends in natural gas prices in some of these regimes is shown in Figure 2 below.

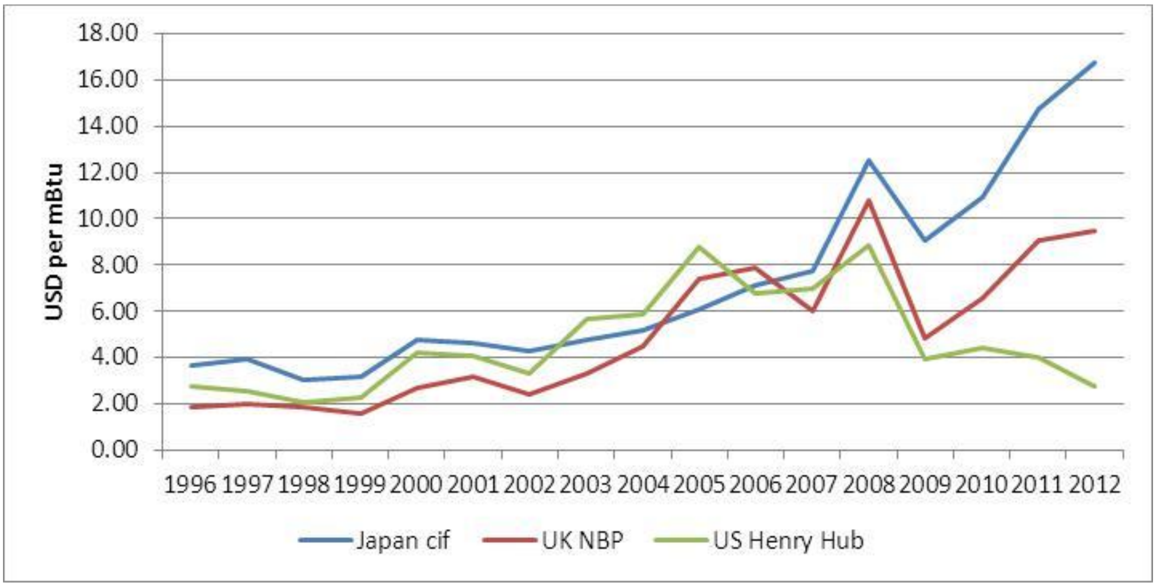

Figure 2: Price trends of natural gas in US, UK, and Asian markets
Source: British Petroleum

The shale gas "revolution" in the United States explains why the US Henry Hub prices broke away from the general trend after 2009. US Henry Hub price declined from around USD 9 per million British thermal units (mBtu) in 2008 to around USD 3 per mBtu in 2012. However, the increasing supply of natural gas globally has had no discernible effect on Japanese LNG (an indicator of Asian LNG prices). Japanese LNG price has consistently increased since 2008, marking a stark deviation from the trend of US Henry Hub prices. This is due to the linkage of Japanese LNG with crude oil prices, specifically the Japanese Customs-cleared Crude Cocktail (JCC) price. The linkage between Japanese crude import price and price of LNG is very strong, with a linear correlation of 92.64% (Figure 3).

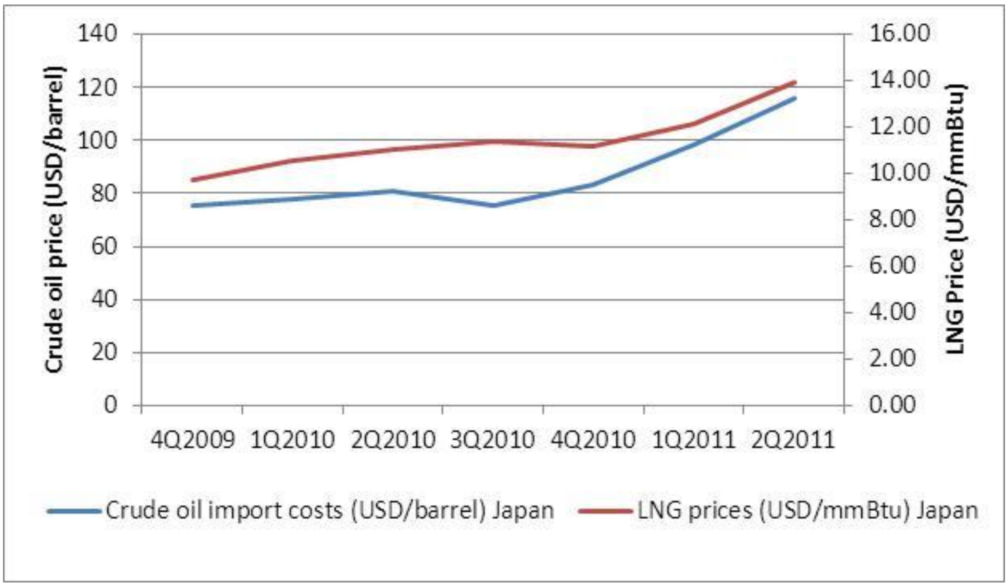

Figure 3: Crude oil import price and LNG import price trend in Japan
Source: (IEA, 2012b)
Note: The horizontal axis denotes quarters of various years (for example "4Q2009" refers to the period October to December, 2009)

Changing global gas markets

Global natural gas production has followed an almost linear trend- increasing from just over 2500 billion cubic metres (bcm) in 2002 to 3300 bcm in 2012 (Figure 4). Of this, 1,033 bcm were traded during the year, both in the form of pipelines as well as Liquefied Natural Gas (LNG). At more than 700 bcm in 2012, pipelines accounted for nearly 70% of the global gas trade (Figure 5).

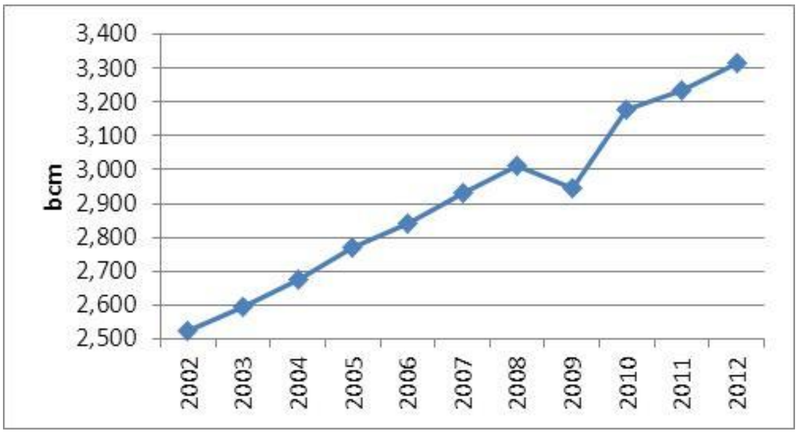

Figure 4: Global production of natural gas
Source: (BP, 2013)

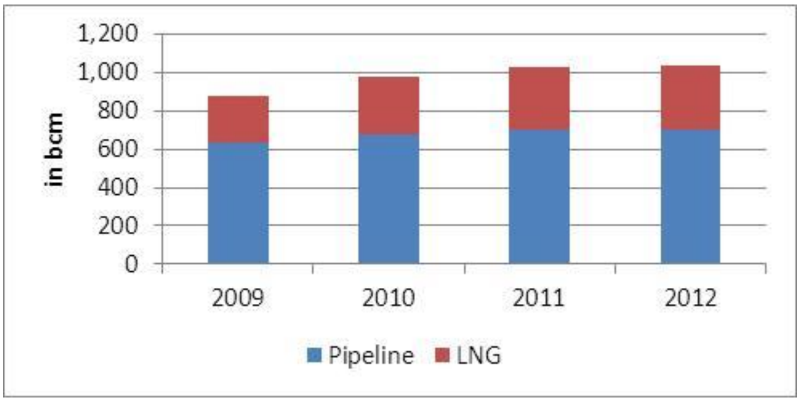

Figure 5: Global gas trade through pipelines and LNG
Source: Various issues of the BP statistical review of world energy

Most of the pipeline trade of natural gas takes place in Europe and North America whereas LNG dominates gas trade in the Asia Pacific markets.

Looking at net imports/exports of gas, the major exporters in the global gas market include Norway, Russian Federation, Qatar, Canada and Algeria while the large importers are Japan, Italy and Germany.[1] USA is also a major player in the global gas markets – it is both the largest producer as well as consumer of natural gas. With the production of gas from shale, the total gas production in the country increased from a little over 550 bcm in 2001 to more than 680 bcm in 2012, recording an annual growth of nearly 2% in the eleven year period. This increase in production has also led to a decline in the gap between gas consumption and production from domestic sources (Figure 6).

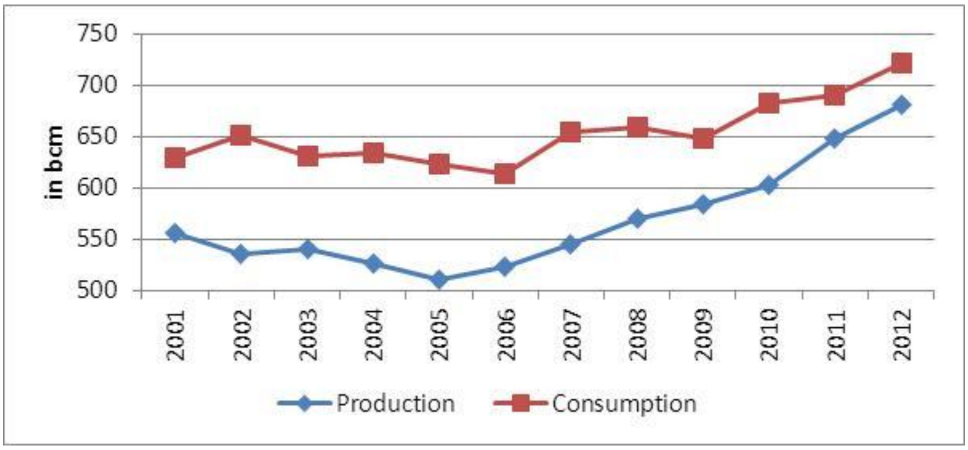

Figure 6: Gas production and consumption in USA
Source: BP (2013)

Figure 7 represents the share of different categories of gas in the total gas production mix of USA. As can be noted, the overall production of gas which started increasing after 2005 corresponds to the production of shale gas.

[1] The term major here refers to those countries that import/export more than 50 bcm of natural gas

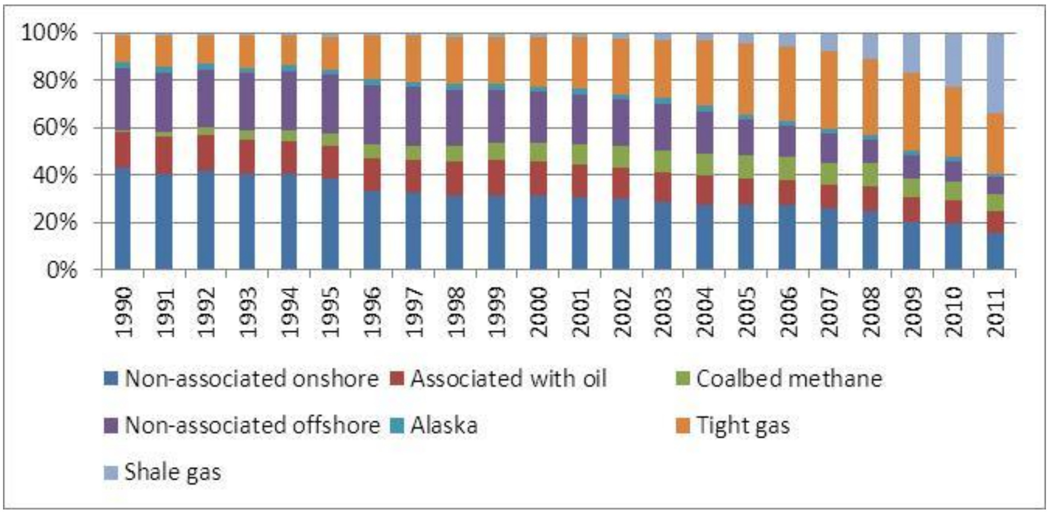

Figure 7: Category-wise Natural Gas Production in USA
Source: US Energy Information Administration (EIA) (2012)

In fact, this rise in production of natural gas has led to a decline in imports of gas. Among pipelines and LNG, there has been a larger decline in the imports through LNG which declined by 19% between 2009 and 2011. Pipeline imports (from Mexico and Canada) declined by 5% in the same period.

Shale gas: The techno-commercial breakthrough

The United States has led the revolution in unconventional gas production in the past decade. However, shale gas is not a new "discovery". Small amounts of shale gas were first produced in Fredonia, New York in 1821. Small amounts of shale gas were produced from the Appalachian and Illinois basins between the 1860s and 1920s for use in nearby cities (Green, 2011). It was the commercially feasible combination of two existing technologies, namely hydraulic fracturing and horizontal drilling, which was the major driver of the unprecedented boom in shale gas production after 2005. The world total of the technically recoverable shale gas reserves have been estimated at 7299 trillion cubic feet (TCF) (EIA, 2013a). Table 1 shows the potential of the top ten countries.

Table 1 Top 10 Countries with Technically Recoverable Shale Gas Resources

Country	Technically Recoverable Shale Gas Resources (TCF)	
China	1115	
Argentina	802	
Algeria	707	
USA	665	1161*
Canada	573	
Mexico	545	
Australia	437	
South Africa	390	
Russia	285	
Brazil	245	
World Total	7299	

*ARI estimates in parentheses

Source: US Energy Information Administration (EIA) (EIA, 2013a)

Hydraulic fracturing and horizontal drilling: A Brief Background

Shale is a type of sedimentary rock formed from deposits of mud, silt, clay and organic matter. Shale gas consists of methane and/or other gases trapped in shale rock deposits which characteristically have very low permeability. Unlike conventional sources of natural gas, unconventional gas deposits (shale gas and tight gas) do not readily generate gas flows. Moreover, shale gas deposits are usually spread out over a larger area than conventional gas deposits

Hydraulic fracturing

Unconventional gas deposits have to be additionally stimulated through hydraulic fracturing or "fracking", a process in which pumps are used to inject fracturing fluids, consisting of water, sand[2] and chemicals, under high pressure into a well. The pressure at which the fracking fluids are injected generates stresses in the rock that exceeds its strength, opening up existing fractures and creating new ones. The fractures extend a few hundred meters into the rock and the newly created fractures are propped open by sand in the fracking fluid. Thereafter, additional fluids are pumped into the well to maintain the pressure in the well.

After fracturing, the well is depressurized to create a pressure gradient that allows gas to flow out of the shale rock. Fracturing fluid flows back to the surface and is now called 'flowback water' which also contains saline water with dissolved minerals from the shale formation. Fracturing fluids and formation water returns to the surface over the lifetime of the well as it continues to produce shale gas.

Horizontal drilling

Shale gas deposits are spread over a much larger area than conventional deposits, with a lower resource concentration. Finding shale gas involves lesser risk than conventional gas but commercial extraction is more difficult since commercially extractible gas from each well is lower. In the horizontal drilling process, a vertical well can be drilled down to depths of around 6,000 metres and then slanted directional drilling can be done at a 90 degree angle to the vertical well. The schematic below shows how horizontal drilling and fracking are combined in the shale gas production process.

[2] Sand is used as a "proppant" to prop open the fractures, preventing them from collapsing.

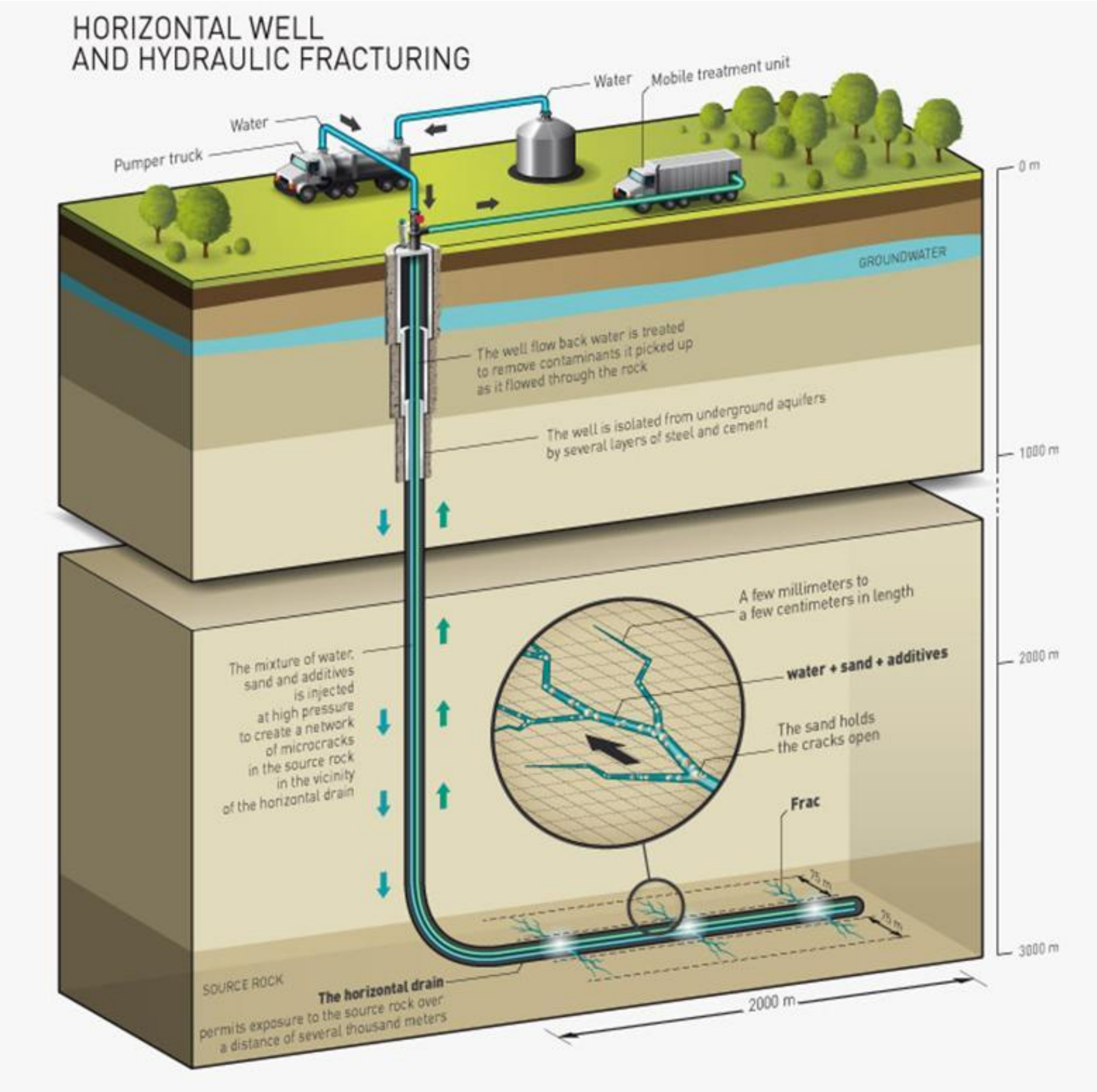

Figure 8: Horizontal drilling and hydraulic fracturing
Source:http://www.total.com/en/special-reports/shale-gas/appropriate-production-techniques/horizontal-drilling-hydraulic-fracturing-201957.html

What are the environmental concerns regarding shale gas extraction?

However, it should be kept in mind that this process has heavy environmental risks associated with it. Fracking fluids contain harmful chemicals which can potentially cause groundwater contamination and/or soil contamination. Moreover, the process is much more water intensive than conventional hydrocarbon extraction. Thirdly, the exploration stage necessitates drilling of multiple exploratory wells to judge resource potential in a particular area. Therefore, in densely populated regions, this puts additional pressure on already constrained land resources. The technological "revolution" in the United States was made actionable by lax environment laws, which many refer to as the "Halliburton loophole"[3] (Enqdahl, 2013). In the face of these concerns, many experts are skeptical about the extent to which shale gas exploration and production using similar technology should be expanded in other countries. France and Bulgaria have temporarily banned extraction of shale gas using hydraulic fracturing, citing environmental concerns (Linehan, 2012).

Having said that, there is no doubt that shale gas production in the United States has had a significant impact on international natural gas markets. The following section examines the major trends in international gas markets post the shale gas boom.

Trends in international gas markets

The trends in various international gas markets are becoming increasingly relevant to countries like India which are planning to increase natural gas imports. In this context, this section examines international gas market trends to identify information which would help in analyzing India's options in terms of natural gas imports.

Currently only two countries have substantial commercial production of shale gas, the United States of America and Canada. Already, the shale gas forms 39% (Figure 9) of the total natural gas production in the US; this percentage is expected to increase further. While countries in Europe and in Asia-Pacific with potential reserves are still debating whether or not to undertake shale gas exploration, given its resource intensity, its contribution to US domestic production and the resultant decrease in its imports has had a definite impact on the international gas markets.

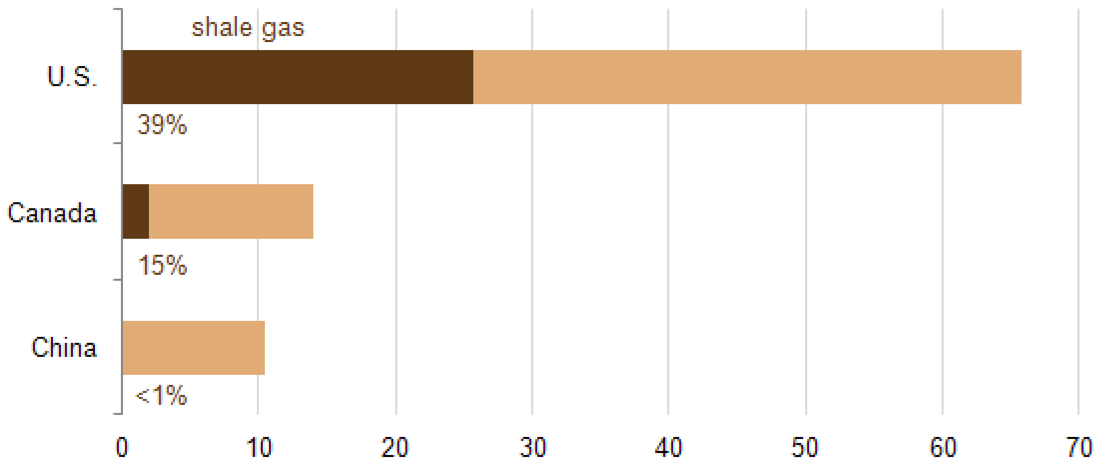

Figure 9 Shale Gas as Share of Total Dry Natural Gas Production in 2012 (Billion Cubic Feet per day)
Source: EIA (2013b)

[3] A US Congress legislation passed in 2005 exempted the oil and gas industry's use of hydraulic fracturing techniques from any regulation by the US Environmental Protection Agency (EPA).

United States riding the shale gas boom

The most direct impact of the shale gas boom was an excess supply of natural gas which brought about a drastic reduction in US natural gas prices from mid-2008 onwards, as indicated by the Henry Hub spot price trend. From a high of USD 12.69 per million British thermal units (mBtu) in June, 2008, Henry Hub prices dropped to as low as USD 1.95 per mBtu in April, 2012. Since then, prices have somewhat recovered, touching the USD 4 per mBtu mark in March, 2013.

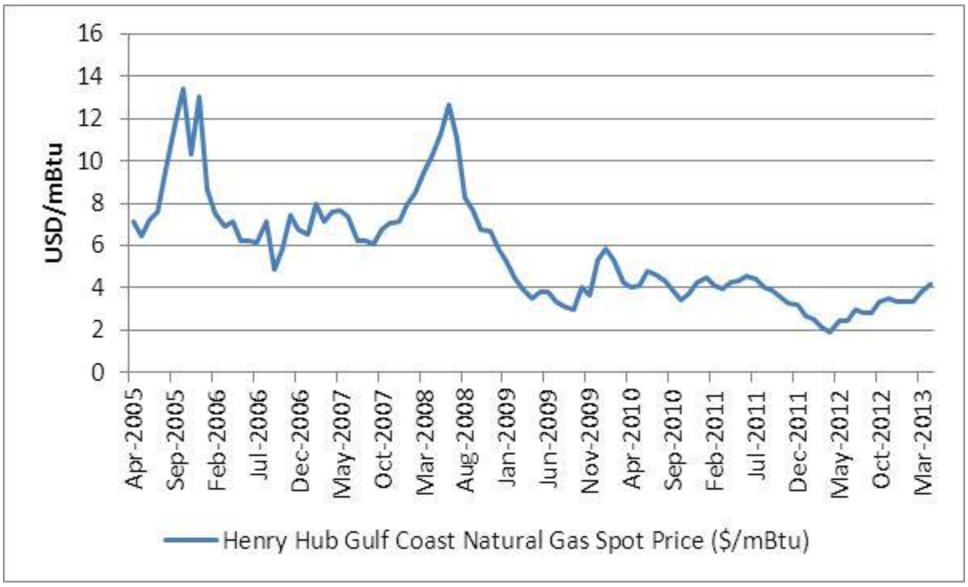

Figure 10: Henry Hub Gulf Coast Natural Gas Spot Price (in USD per mBtu) from April, 2005 to March, 2013
Source: US Energy Information Administration (EIA) (2012)

Such a dramatic increase in US domestic supply and the resultant decrease in prices have had numerous effects. In the domestic gas markets, some analyses conclude that shale gas extraction will not be viable at the current price levels and Henry Hub prices would go up in the near future (Enqdahl, 2013). In the international gas market, the United States is now being considered as a potential source of natural gas exports. Table 2 shows the country-wise exports of natural gas from the United States in 2012.

Table 2: US natural gas exports by country in 2012 (in BCM)

US natural gas exports by country in 2012 (in BCM)		
Country	**Pipeline exports**	**LNG exports**
Canada	27.5	
Mexico	17.6	
Other Europe and Eurasia*		0.1
Japan		0.4
India		0.1
Brazil		0.2
Total	**45.1**	**0.8**

* Excluding Belgium, France, Italy, Spain, Turkey and United Kingdom
Source: BP (2013)

Total exports of natural gas from the United States was, therefore, at 45.90 BCM in 2012, as opposed to 23.19 BCM in 2007 (BP, 2008).

Canada developing as a new source for LNG

Canada has been losing its single largest market for natural gas exports. Over the period between 2007 and 2012, total exports of natural gas from Canada declined by about 19.2%, from 107.47 BCM in 2007 to 86.80 BCM in 2012 (NEB Canada, 2013). Net exports from Canada have also declined over this period, as shown in Figure 11. All of Canada's exports of natural gas have been in the form of piped natural gas exported to the United States.

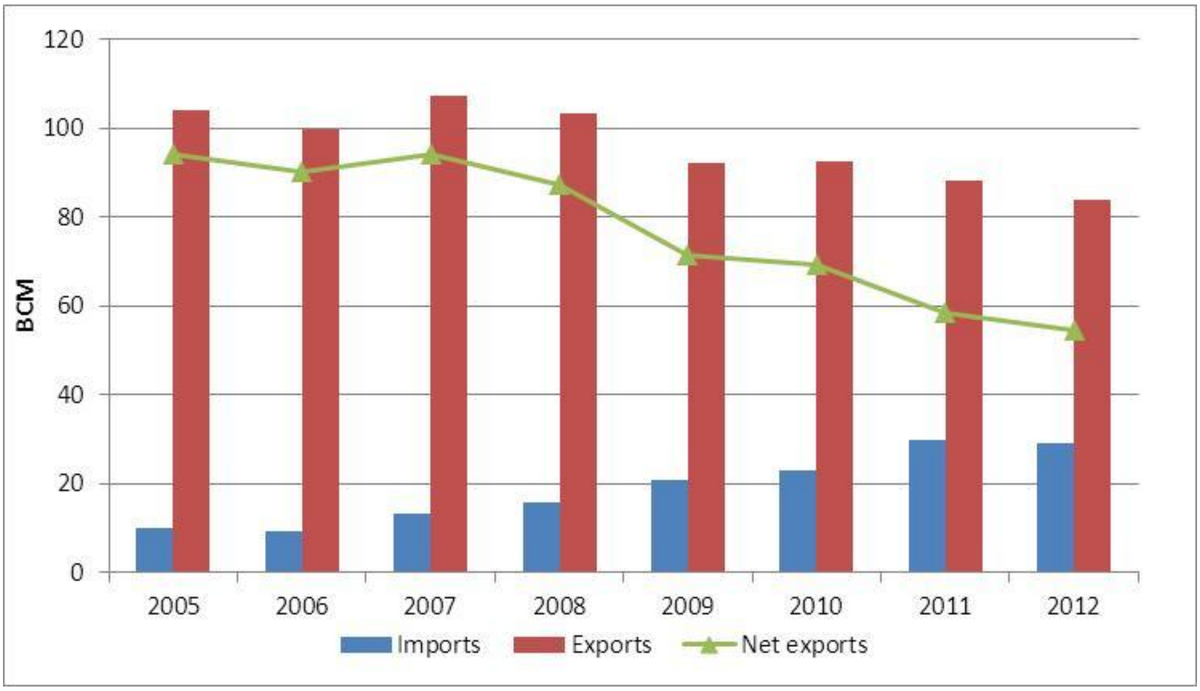

Figure 11: Natural Gas Imports and Exports for Canada (2005 to 2012)
Source: BP's Statistical Reviews of World Energy from 2005 to 2013

However, after the developments on shale gas in the US, Canada has started investing in building LNG export terminals. Three such terminals, which were in advanced stages of construction as of 2012, are located in the province of British Columbia on the West Coast. Through these terminals, Canada would seek to sell LNG in the lucrative Asian market. The Kitimat LNG project (being developed by Apache Canada Limited and Chevron Energy) has a planned export capacity of 11 MTPA and is expected to be operational in 2018-19 (Fesharaki, 2013).

Massive investments in LNG export capacity in Australia

With the LNG export capacity in the Middle East (especially Qatar) reaching its saturation point, growth in global LNG liquefaction capacity has now shifted to Australia. This country has seen investments of around $200 billion in new liquefaction terminals and hosted 73% of the projects currently under construction across the world in 2011, with around 61 MTPA of new export capacity (IGU, 2011). The growth in LNG export capacity has been driven by both conventional gas supplies as well as coal bed methane (CBM) gas.

Australia has definitely emerged as a significant source of LNG for importers, especially those in Asia, who are looking for less expensive import options. The only hindrance to developing the LNG export market in Australia is the relatively high cost of labour, despite which large companies like Chevron have entered into the Australian LNG sector (Reuters, 2013).

Emerging LNG suppliers in East Africa – Mozambique and Tanzania

New gas discoveries and rising reserve estimates in East Africa, especially in Mozambique and Tanzania, have put this region on the radar as potential LNG suppliers in the future (Ledesma, 2013). International oil companies have invested heavily in the upstream sector of both these countries over the past five years. Tanzania has a relatively high level of political stability in the region, although infrastructure is still perceived to be ill-equipped to handle the demands of the extractive industries. The provision of basic services such as electricity is temperamental at best, while facilities at the port of Dar es Salaam are struggling to keep up with growing activities. Mozambique is ideally positioned to take advantage of the growing market for imported natural gas in South Africa as well as the significant demand from Asian LNG importers. However, infrastructure constraints are hindering development of resources as well as export terminals in this country as well (Control Risk, 2012).

Assuming that the existing issues and concerns around development of natural gas resources and export capacity are somewhat mitigated in the near future, East Africa can potentially act as a competitor to the North American LNG exporters, especially in the Asian markets.

United Kingdom increasing its gas imports

Natural gas is the single biggest source of primary energy consumption in the United Kingdom (UK), contributing 34.63% in the energy mix in 2012 (BP, 2013). Although natural gas-fired power stations were replacing coal as the principle source of power supply in the UK for a number of years, this trend seems to be reversing. Coal use for electric power generation increased in 2012 (EIA, 2013c). The UK’s domestic production of conventional natural gas has been on a long term declining trend. However, the government’s plans on climate change mitigation actions include a shift towards natural gas. Therefore, if the government is to follow through on its plan, it will have to increase the share of natural gas in the country’s energy mix, implying an increase in natural gas import dependence, at least in the short term (Bassi, Rydge, Khor, Fankhauser, Hirst, & Ward, 2013). Net import of natural gas in the UK was 37.1 BCM in 2012, increasing from 36.8 BCM in 2011. The lion’s share of natural gas imports into the UK is through pipelines from Norway. Qatar is the primary source of LNG imports into the UK (BP, 2013). In importing LNG, the UK faces stiff competition from the big Asian LNG importers, thus making it more vulnerable to shocks in natural gas supplies from Norway (Hung, 2013).

European countries have less LNG export capacity; trading mainly through pipelines

Russia, Norway and Netherlands are significant exporters of natural gas in Europe. However, most of the natural gas exports in the European markets occur through pipelines, with relatively little exports of LNG. For instance, while Russia and Norway exported 185.90 BCM and 106.64 BCM of natural gas, respectively, through pipelines their LNG exports were far lower, at 14.79 BCM and 4.71 BCM, respectively. Understandably, most of the pipeline exports are to other countries in Europe, while some of it is exported to countries which belonged to the erstwhile Soviet Union. Since India has no plans to construct natural gas pipelines connecting it with either Norway or Russia (on account of the prohibitive capital costs), supplies from these countries would not directly affect Indian natural gas markets.

Natural Gas in the Indian Energy Basket

Natural gas contributes nearly 10% of the country's total commercial energy mix. In the past decade, the share of natural gas has remained nearly constant (Figure12).

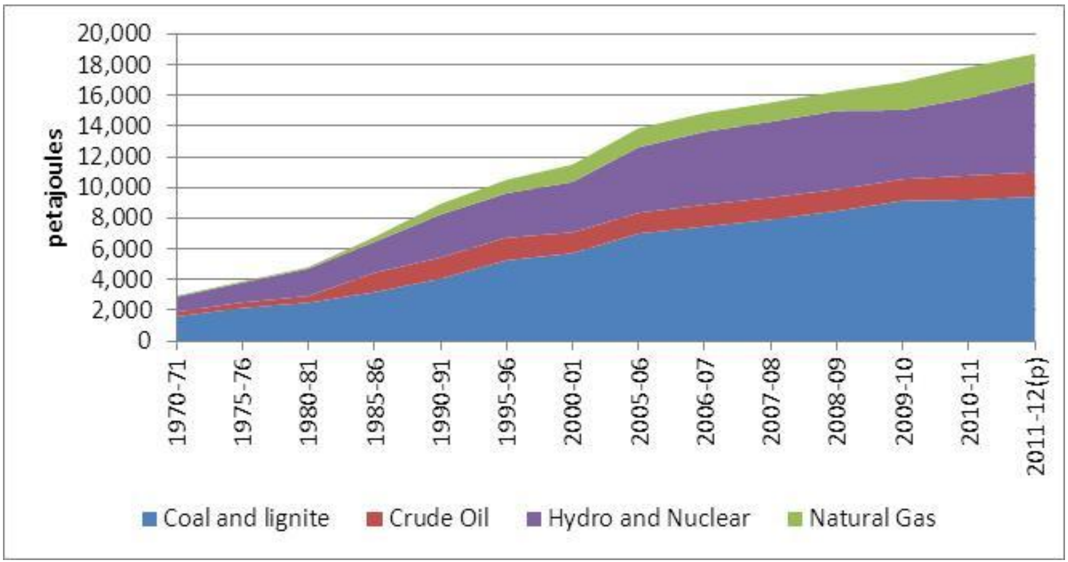

Figure 12: Composition of primary energy basket
Source: (CSO, 2013)
"P" refers to provisional data

Domestic production of gas for 2011-12 stood at 47.55 billion cubic metres (bcm). Gas production has increased from less than 30 bcm to nearly 50 bcm in nearly a decade. Particularly in 2009-10, the domestic production of gas increased as the D6 block operated by Reliance Industries Limited (RIL) in the Krishna Godavari (KG) basin commenced production. However, in the year 2011-12, the production from this block started declining reportedly due to technical issues of fall in pressure and water and sand ingress. Imports of natural gas in India commenced in the year 2003-04 and in the past decade, these have increased from less than 1 bcm to nearly 14 bcm (Figure 13). As the domestic production is declining drastically, the share of imported gas is expected to form a major share of total gas availability.

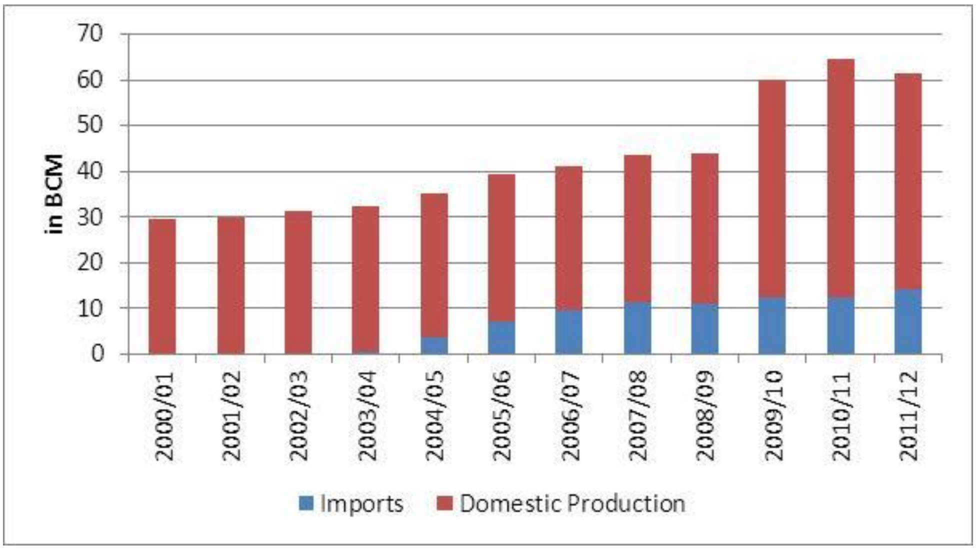

Figure 13: Share of domestic production and imports in natural gas
Source: (TERI, 2013); (PPAC, 2013)

The ability to access imported gas hinges on the availability of adequate infrastructure for importing gas through LNG terminals and liquefaction facilities. The progress on this account has, however, been slow. The Kochi and Dabhol terminals are a case in point. Construction and commissioning of both these terminals has been extremely delayed.

Notwithstanding, the increasing domestic requirement of gas coupled with falling domestic production has encouraged many market players to announce the construction of LNG terminals. These include Ennore, Kakinada and Gangavaram on the east coast and Mundra and Mangalore on the west coast.

In addition to enhancing the import facilities, domestic gas infrastructure such as pipelines, CNG filling stations and city networks will also need to be expanded. A City Gas Distribution (CGD) programme was introduced in

Consumption of natural gas

The power sector (44%), followed by the fertilizer industry (25%), are the largest consumers of natural gas in the country. Consumption for energy purposes, which includes power generation, use as industrial fuel, captive usage/LPG shrinkage, tea plantation and usage as domestic fuel, accounts for nearly 60% of the total natural gas consumption in the country (Figure 14).

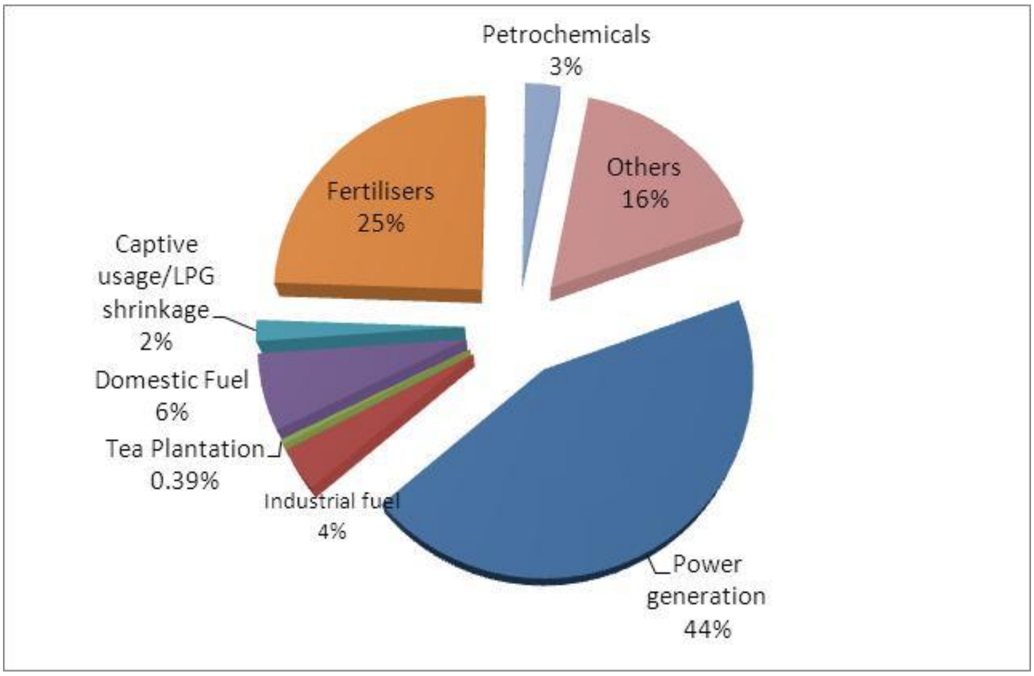

Figure 14: Consumption of natural Gas by sectors
Source: CSO (2013)
"Others" includes both energy and non-energy uses

Among the major consuming sectors, the sensitivity to changes in natural gas prices varies depending on the extent to which these sectors can pass through any price rise to their final product prices. In the power sector for instance, since the final prices at which power is sold to key consuming sectors is not fully market determined, the absorption of gas at higher prices is limited. Similarly, in the fertilizer sector too, as the final prices of key fertilizers are subsidized, any increase in gas prices adversely affects the economics of the fertilizer manufacturing companies.

On the other hand, in sectors where the final prices are market determined, the ability to absorb higher costs of natural gas is dependent on the relative economics compared to other substitute fuels. As a result most of these sectors, i.e. LPG shrinkage, captive usage, industries have higher switch-over prices[4].

In a paper in 2011, Sreenivas (2011) calculated the following switchover prices for different alternative fuels.

Table 3: Switchover prices of gas

Switchover gas price	USD/mBtu
Base load power	5.82
Peak load power	8.59
Unsubsidized MS /HSD	17.06
Subsidized HSD	11.55
LPG	15.46
Subsidized LPG	9.42
Industrial fuel	17.06

[4] Switch-over prices here refer to the level of price of natural gas at which the user shifts to an alternative fuel

Source: (Sreenivas, 2011)

As can be noted, the switchover prices for unsubsidized automotive and industrial fuels are the highest. This is followed by subsidized diesel and LPG clearly outlining the order of areas that can absorb high natural gas prices.

India's Natural Gas Import Strategy in a Changing World

Trans-national gas pipelines

Over the years, India has explored the possibility trans-national pipelines with its neighbours in the east as well as west. The key projects which have been under consideration at various points of time have been the Myanmar-Bangladesh-India pipeline, Iran-Pakistan-India Pipeline, Turkmenistan-Afghanistan-Pakistan-India pipeline, and the Oman-India subsea pipeline. However, despite pursuing these projects and after years of negotiations, the progress has been incremental.

The Myanmar-Bangladesh India Pipeline

This project was mooted in 1997, and the 900 km was expected to bring gas from Myanmar's Rakhine basin to Kolkata India while passing through the Indian states of Mizoram and Tripura, and Bangladesh (Mehdudia, 2013a). However, the certain demands made by Bangladesh, in negotiations with India and the difficulty and time it took in resolving them led to substantial delays. India even considered alternate routes to bypass Bangladesh (Lama, 2013). However, the delays in reaching a decision cost India the pipeline. In 2008, Myanmar decided to sell the available gas to China. While Myanmar has the potential for increasing its natural gas production, the current capacity will be unable to meet both India and China's demands. The lack of convergence in the energy security policies of India and Bangladesh led to the failure of Myanmar-Bangladesh-India (MBI) pipeline project (Mahajan, Joshi, Nanda, & Mini, 2014).

The Iran-Pakistan-India (IPI) gas pipeline

The idea for this pipeline was first conceived in 1989. The 2700 km, USD 7 billion pipeline would supply gas from Iran's South Pars field and would pass through Assaluyah in Iran to the Pakistan border and a further to reach the Indian border. It would further travel within India to get connected to the Indian gas markets. However, despite protracted consultations, India pulled out of the project citing security reasons and issues with the pricing of natural gas.

Iran and Pakistan continued with the project and in March 2013, the two Presidents inaugurated the final construction phase with the construction in Iran completed (Kiani, 2013). There are still some financial constraints for the construction of the pipeline on the Pakistani side, to compound this problem, Iran suspended the USD 250 million loan to Pakistan to build part of the Iran-Pakistan pipeline.[5] While negotiations were still on to finalise the completion of this pipeline, the future looks tumultuous for this project.

[5] See http://www.gulfoilandgas.com/webpro1/projects/3dreport.asp?id=100730 for a timeline on the developments on the IPI pipeline

Turkmenistan-Afghanistan-Pakistan-India Pipeline

The plans for this project have been in the pipeline for since the 80s but were suspended due to conflict in the regions it was to pass through. They were taken up once again 2008, and despite a troubled past, the project gained considerable momentum since then. The 1680 km pipeline would bring natural gas from Turkmenistan's South Yolotan-Osman field, through Helmand and Kandahar in Turkmenistan, passing through Quetta and Multan in Pakistan ending in Fazilka in India, and would supply 90 million cubic metres per day (mscmd) of gas to the three countries (38 to India and Pakistan, and 14 to Afghanistan) (Joshi, 2011). It is estimated that the pipeline would cost around USD 7.6 billion. ADB is the financial advisor for the project. The Gas Sale Price Agreement between Turkmenistan-Afghanistan, Turkmenistan-Pakistan, and Turkmenistan-India were signed between 2012 and 2013. The consortium will consist of companies and representatives of four nations and a company will be set up (Mehdudia, 2013b). The consortium leader would be someone from outside (companies from the US, Russia and China are in competition) with experience in building such a transnational pipeline (Natural Gas Asia, 2013). Despite these developments, the challenges of financing, and constructing the pipeline remain significant due to the unrest in the regions it would pass through and it is doubtful id the pipeline will be completed by its planned year of 2017/18.

Sub-sea pipeline

Another alternative which is gathering steam is the Oman-India subsea pipeline, considered infeasible in the 1990s. Recently, even Iran has demonstrated an interest in being a part of the project (Aneja, 2013; Bagchi, 2014). South Asia Gas Enterprise Pvt. Ltd. (SAGE) had conducted a feasibility study to help deliver natural gas from South Pars gas field in Iran to India's west coast. The pipeline is estimated to cost around USD 4-5 billion and could deliver around 31 mscmd of gas (Aneja, 2013).

LNG: The need of the hour

With an increasing gap between demand and domestic supply of natural gas and slow progress on cross-country pipelines, India would need to import more LNG to meet its gas demand and reduce its dependence on coal and petroleum products.

Relaxing infrastructure constraints – LNG terminals and domestic pipeline connectivity

Currently, India has two fully operational LNG terminals (Dahej and Hazira), while the third one at Dabhol has not yet reached full capacity. The import capacities of these terminals are currently 10 MTPA (Dahej), 3.6 MTPA (Hazira) and 1.2 MTPA (Dabhol). There are no terminals on the East coast yet, although there are plans to construct terminals at Ennore, Kakinada and Gangavaram (TERI, 2013). In order to relax the infrastructural constraint on LNG imports, construction of new terminals and expansion of existing ones would need to be expedited.

Apart from import terminals, India also needs to build up its domestic gas pipeline network to ensure connectivity of natural gas supply sources (terminals or gas fields) to end-consumers. End consumers include not only the power and fertilizer sectors (which are price sensitive) but also the relatively price inelastic City Gas Distribution (CGD), refineries, petrochemicals, sponge iron and steel plants, captive power plants etc., which can potentially afford more expensive natural gas.

Currently, India's pipeline network is well connected only in a few regions in Northwest India (especially Gujarat). While only the East-West Pipeline has been constructed in the South, the Eastern region remains poorly connected. Work on constructing the proposed trunk-lines and spur-lines needs to be expedited.

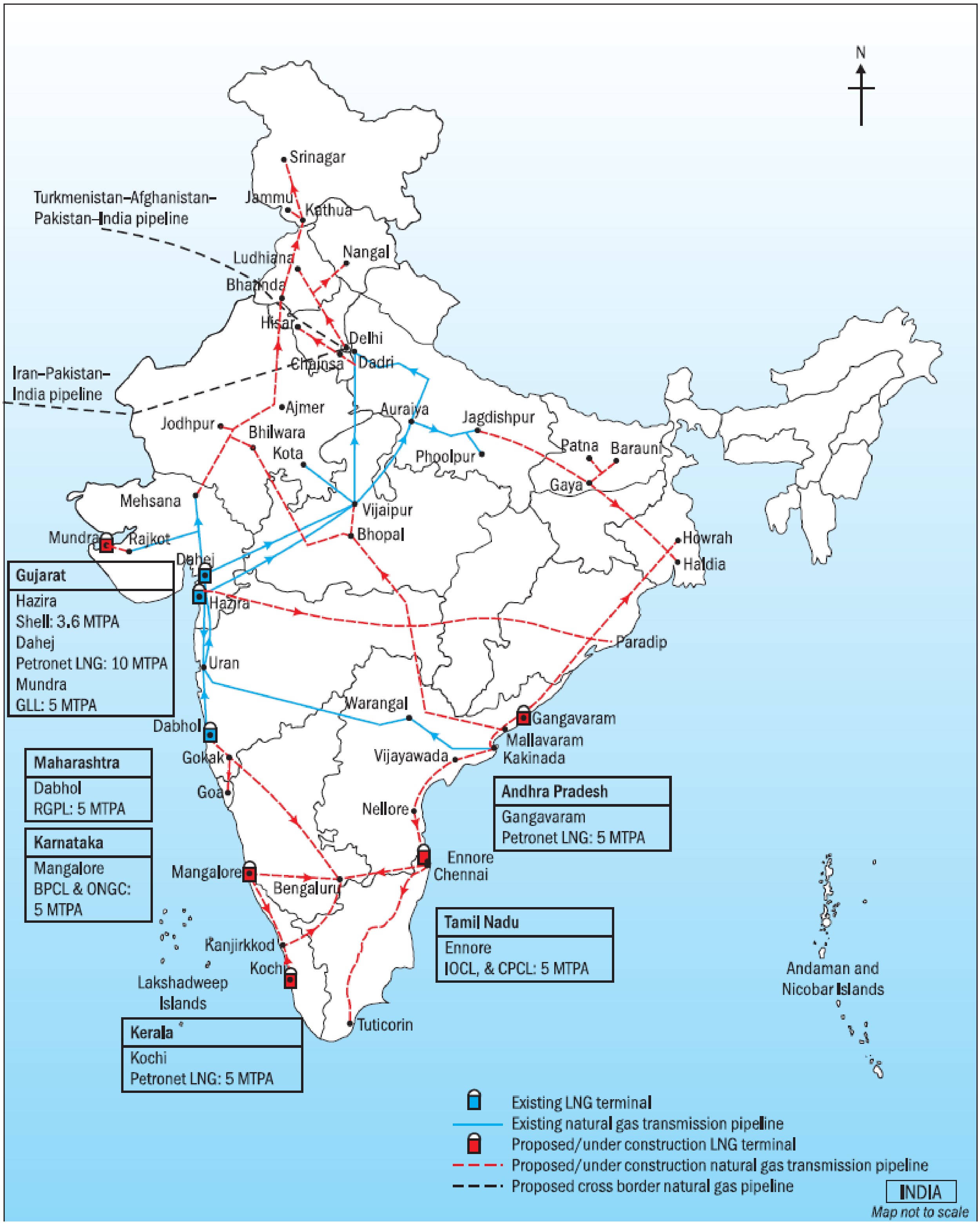

Figure 15: Map of existing and proposed natural gas infrastructure in India
Source: (TERI, 2013)

Diversifying LNG import sources

As mentioned before, the global LNG market has changed significantly since the shale gas revolution and India could look not only at the United States, but also at Australia, Mozambique Tanzania as well as Canada for future LNG supplies. The advantage of securing long term import contracts with suppliers is the insulation such contracts provide against short term price volatility, which affects spot LNG markets.

As part of the efforts to secure new long term LNG imports from different countries, India's major LNG importer, Petronet LNG Limited (PLL), had signed a contract with Exxon Mobil Corporation in 2009 for importing 1.5 MTPA of LNG from the Gorgon project in Australia. Supplies under this contract are supposed to go on for 20 years, beginning in the year 2014 (Economic Times, 2009). More recently, in December 2011, GAIL has signed a long term contract with US-based Cheniere Energy for importing 3.5 MTPA of LNG from the Sabine Pass terminal over a 20-year period. Although there were concerns regarding the viability of this contract since India did not have a Free Trade Agreement with the USA, these concerns have been somewhat allayed after the US allowed LNG exports from Sabine Pass to non-FTA countries. Since then, the United States Department of Energy (DoE) has issued another order allowing LNG exports to non-FTA countries from the Freeport LNG terminal as well (US Department of Energy, 2013).

Apart from these contracts, India should also explore potential LNG contracts from East African nations, expand LNG imports from Australia and seek to collaborate with other Asian importers on bringing down LNG import costs in Asia. Moreover, investments along the value chain of LNG (such as ONGC Videsh Limited's ongoing investments in the upstream sector in Mozambique) could also help secure further gas supplies.

Reviewing pricing of domestic natural gas

Apart from the issues mentioned before, the differential between domestic natural gas prices and imported LNG prices, coupled with the government's Gas Utilisation Policy continues to be an issue for gas consuming sectors in India. As per the Gas Utilisation Policy, domestic natural gas (which is priced at around one-third the price of imported LNG) is allocated on a priority basis to the power and fertilizer sectors. Since these sectors are heavily regulated (with large subsidies on electricity and fertilisers), the gas consumers from these sectors oppose any increase in natural gas prices which increases their production costs.

More recently, however, the government seems to be ready to bite the bullet since the Cabinet Committee on Economic Affairs (CCEA) has approved an increase in the price of natural gas to USD 8.4 per mBtu from USD 4.2 – 5.7 per mBtu. This increase will take effect from April 1, 2014. The mechanism of gas pricing is also going to change from the Administered Pricing Mechanism (APM) to a weighted average of international gas prices (as suggested by the recent Rangarajan Committee). The new price of natural gas is supposed to be uniform for production from all fields, therefore mitigating the concerns regarding multiple pricing regimes for domestic gas. The new pricing formula is expected to be in effect till March 31, 2019 (PIB, 2013).

The logic behind linking gas prices to a weighted average of international hub prices and netback price of India's LNG imports (term contracts only) to arrive at a more competitive price is questionable since these calculations are not linked to production costs of gas in India and expose the gas markets to international price volatility. A more typical arms' length transaction between buyers and sellers, where each gas purchase contract is signed between two parties without intervention from the government would be the most efficient solution. However, with the existing regulations on power and fertilizer industries, such a free price determination mechanism would be wholeheartedly opposed by these two sectors, which currently account for the lion's share of gas demand in India.

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