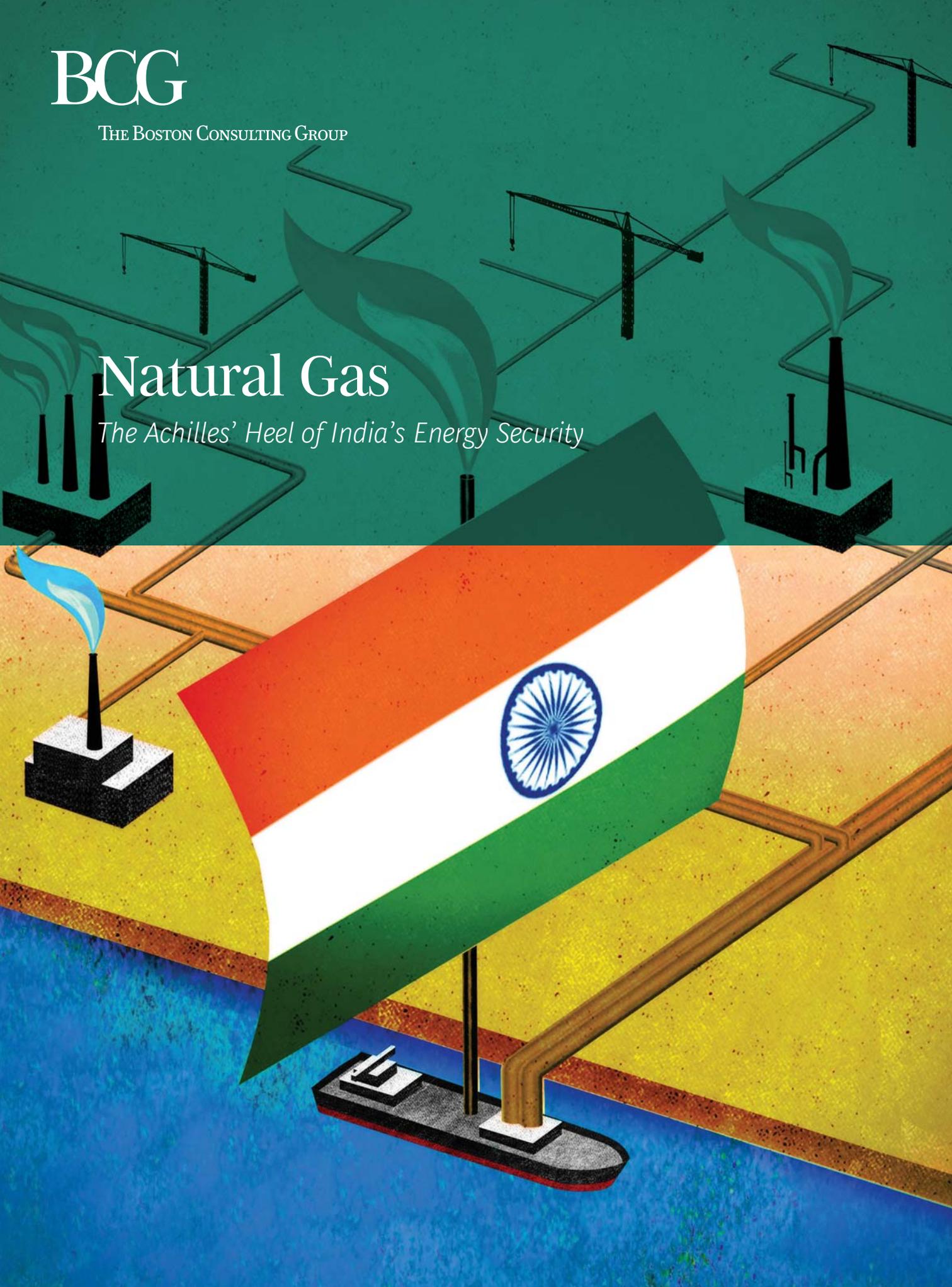


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Natural Gas

The Achilles' Heel of India's Energy Security



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Natural Gas

The Achilles' Heel of India's Energy Security

Kaustav Mukherjee and Rahool Panandiker

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AT A GLANCE

Natural gas can and should play a far greater role in India's quest for energy security. And the time for India to make that happen is now.

INDIA'S NEED FOR NATURAL GAS IS SOARING

The country's appetite for natural gas, led by the power sector and the fertilizer industry, is expanding strongly and will continue to do so.

YET DOMESTIC PRODUCTION REMAINS CONSTRAINED

Domestic production, meanwhile, is already insufficient for the country's needs and is growing far too slowly to meet the expected growth in demand.

INDIA NEEDS AN ACTION PLAN

India's government should expand its current efforts to boost the share of natural gas in the country's energy mix by developing a proactive strategy for sourcing liquefied natural gas (LNG) and, in the immediate term, by acting quickly to capture the opportunities to source LNG that are available in global markets; by encouraging partnerships between Indian companies and upstream players, both domestic and global; and by accelerating the country's development of unconventional sources of natural gas.

THE GAP BETWEEN INDIA'S natural-gas requirements and its domestically produced natural-gas supply is sizable—in fact, almost alarming. A recent study by The Boston Consulting Group concluded that the gap will only widen, at least in the near term, with domestic supply potentially meeting less than half of domestic demand by 2015. This shortfall could intensify the country's already heavy reliance on coal, an increasingly expensive, relatively inefficient fuel source. More significantly, the supply shortfall could act as a brake on the country's longer-term economic-growth prospects.

India's government, aware of the challenge and taking steps to address it, still must do more. Specifically, the government must develop a proactive scheme to source liquefied natural gas (LNG) and move quickly to leverage the sourcing opportunities currently available in global LNG markets. It must encourage partnerships between domestic companies and upstream players, both domestic and global. Finally, it must act to speed the country's development of unconventional sources of natural gas, especially coal bed methane (CBM) and shale gas. And the time for India to launch this three-pronged attack is now.

India's Need for Natural Gas Is Soaring

India needs energy. Energy is a key input to the development of any economy and is particularly vital to a country that aspires to double-digit GDP growth. Yet India faces significant challenges in meeting the energy needs of its masses. Coal is undoubtedly part of the solution. It is India's dominant fuel source and will likely remain so for the foreseeable future, given the country's abundant domestic coal supply. (India has the world's fourth-largest coal reserves.) Yet coal cannot be the entire answer. Other energy sources, both renewable and nonrenewable, need to play a much larger role in feeding India's growing energy consumption. BCG believes that natural gas has an especially critical part to play.

India's use of natural gas has, in fact, risen steadily over time, with the fuel's share of the country's total primary energy demand (TPED) doubling over the past two decades. But in India, natural gas had only a 10 percent share of TPED in 2011, well below the global average of more than 21 percent. Meanwhile, the country's latent demand for natural gas is enormous. As evidence, year-over-year natural-gas consumption leaped 26 percent in 2009, when Reliance Industries' KG-D6 natural-gas fields commenced production. (In comparison, from 2000 through 2008, India's natural-gas consumption grew at a compound annual growth rate [CAGR] of about 6 percent.)

India's latent demand for natural gas is enormous.

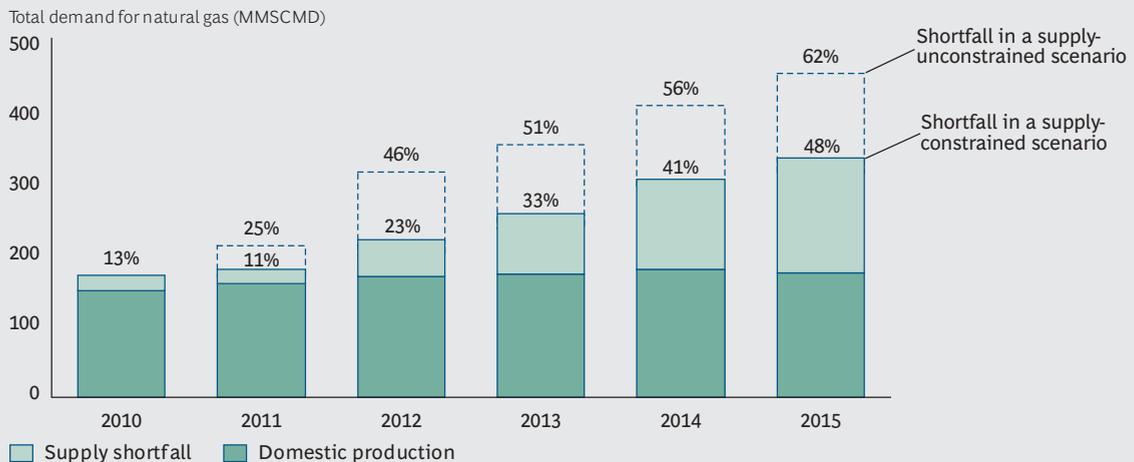
Yet despite the addition of a significant new supply source, India is likely to remain starved of domestic natural gas. Indeed, our analysis indicates that the gap between India's needs and its domestic production will continue to grow, at least in the near term; in a supply-unconstrained scenario, domestically produced supply will satisfy less than half of demand by 2015. (See Exhibit 1.) This scenario reflects, on the supply side, delays in ramping up new domestic natural-gas sources, including the KG basin, and declines in the output of existing sources. On the demand side, it reflects increasingly robust calls for natural gas from many quarters, primarily the power sector and the fertilizer industry.

POWER GENERATION

The major consumer of natural gas in India is the power sector, which accounted for 36 percent of India's total demand in 2010. That percentage could rise materially, however, depending on the fortunes of coal, the power sector's fuel of choice. Coal-based power plants represent 53 percent of India's installed power capacity, and that share is expected to grow at a blistering rate of 16 percent per year through 2015. This growth would further widen the sector's current deficit in the domestic coal supply, thereby increasing the country's reliance on coal imports. (India is already the world's fourth-largest net importer of coal.) Because China, another large coal importer, is also expected to increase its imports, coal prices

EXHIBIT 1 | The Gap Between India's Demand for Natural Gas and Domestic Production Will Continue to Widen

Actual and projected gap between demand and domestic production, 2010–2015



Sources: ProjectsToday; Central Electricity Authority; Fertilizer Association of India; Ministry of Petroleum & Natural Gas; Rystad Energy; Credit Suisse; BCG analysis.

Note: Our projections for the total capacity of gas-based power plants through 2014 are based on industry research and an analysis of project databases; we have assumed an additional 5 gigawatts of new capacity in 2015. We have assumed that the switchover of fuel-oil-based and naphtha-based urea plants to natural gas will not be fully completed until fiscal-year 2013 and that there will be capacity additions of 1.5 MMTPA in both fiscal years 2014 and 2015. In our supply-constrained scenario, we have assumed 7 percent annual growth in the demand for other uses of natural gas; in our supply-unconstrained scenario, our estimate for that demand is based on projections made by the Empowered Group of Ministers in 2010. We estimate that the requirement for gas-based power plants will be 4 MMSCMD/GW based on the allotment for current installations. Our assumption of a 2.315 MMSCMD/MMTPA requirement for urea plants is based on the Ministry of Petroleum & Natural Gas's *Report of the Working Group on Petroleum & Natural Gas Sector for the XI Plan (2007–2012)*. MMSMO = million metric standard cubic meters per day; MMTPA = million metric tons per annum.

could reach \$130 to \$140 per ton within the near to intermediate term (versus approximately \$100 to \$110 per ton currently).

At these prices, gas-based power plants are economically competitive with thermal plants that use imported coal. A typical combined-cycle gas turbine plant utilizing domestic natural gas can produce power at a rate of Rs (rupees) 2.8 per kilowatt hour; for a coal-based power plant using imported coal, the rate is close to Rs 4 per kilowatt-hour. (A plant utilizing domestic coal, meanwhile, produces power at Rs 2.1 to Rs 2.4 per kilowatt-hour.) Gas-fired power plants are also more efficient in their use of energy and pose fewer environmental concerns than coal-based plants. In fact, the World Bank estimates that the environmental “penalty” associated with coal-based generation could be as much as Rs 1.88 per kilowatt-hour.

Gas-fired power plants are more efficient and pose fewer environmental concerns than coal-based plants.

For the time being, despite natural gas’s interesting economics and environmental primacy, natural-gas-based power plants account for only 10 percent of India’s installed capacity of power plants. This low share is largely due to poor plant-utilization rates (natural-gas-plant load factors are in the range of 58 to 66 percent versus 78 percent for thermal-power plants) that ensue from interruptions in supply and slow ramp-up of domestic natural-gas production. The lack of a secure supply of affordable natural gas has been one of the prime concerns of power generation companies.

Nonetheless, our bottom-up analysis indicates that capacity for natural-gas-based power plants in India will grow at a CAGR of roughly 23 percent from 2010 through 2015, with total capacity potentially reaching 45 gigawatts by 2015. Correspondingly, natural-gas demand from the power sector alone could nearly triple by 2015, equaling the country’s total demand for natural gas in 2010. Natural-gas-based power generation has an important role to play in helping India attain its objective of making electricity accessible to all households.

FERTILIZER PRODUCTION

Appetite for natural gas from fertilizer producers, another major demand source, is also poised to increase sharply. Natural gas is the most cost-efficient source of feedstock for manufacturing urea, which accounts for 80 percent of all nitrogenous fertilizers produced in India. Besides being an efficient feedstock, natural gas is comparatively inexpensive, thus allowing for a smaller fertilizer subsidy from the government.

The latent demand for gas in the fertilizer industry is significant. Although urea consumption in India grew by approximately 40 percent overall from 2001 through 2010, no major new production capacity came online during that period or since, largely owing to uncertainty over the availability of efficient and inexpensive feedstock coupled with a less-than-satisfactory investment policy. As a result, imports of urea have grown, representing nearly 20 percent of India’s urea consumption in 2010. Yet imports impose a cost burden. Analysts’ preliminary estimates indicate that India could save up to \$500 million a year in fertilizer subsidies if urea imports were replaced by domestic production.

Taking note of the situation, the government is finalizing its new urea-development policy to attract more investment in domestic production capacity. The government

India's demand for natural gas will show double-digit growth from 2010 through 2015.

also plans to support some existing urea plants to meet growing domestic demand. Additionally, at least six existing plants have announced expansion plans that collectively amount to more than 7 million metric tons per annum (MMTPA) of additional production.

All told, we expect that the capacity of domestic urea plants that utilize natural gas as a feedstock will grow at a CAGR of roughly 11 percent from 2011 through 2015, reaching about 27 million metric tons in 2015. This will drive demand for natural gas from fertilizer makers to approximately 62 million metric standard cubic meters per day (MMSCMD), representing 14 to 19 percent of the total demand for natural gas in 2015.

OTHER KEY INDUSTRIES

Power generation and fertilizer production naturally receive higher priority in the government's allocation of domestic gas than other industries. The resulting shortage of available supply is the main factor responsible for the muted demand for gas from other industries, key among them petrochemicals, refineries, steel, and city gas.

With the natural-gas supply likely to remain constrained through 2015, we expect demand from these sectors to grow at the historical trend of roughly 7 percent per year, reaching 94 MMSCMD in 2015. This would still represent about 28 percent of demand in 2015, versus roughly 40 percent of total demand from these sectors in 2010, illustrating the growing domination of power generation and fertilizer production in natural-gas consumption.

It should be noted, however, that the lower priority accorded these other industries belies their potential demand. The Empowered Group of Ministers, the high-level government entity responsible for defining the key legislative agenda, has indicated that total demand for natural gas from petrochemicals, refineries, steel, and city gas has the potential to grow at a CAGR of approximately 26 percent from 2010 through 2015, with demand reaching 211 MMSCMD in 2015. This would represent fully 47 percent of total 2015 demand in our "supply unconstrained" scenario.

Amid Rising Need, Domestic Production Remains Constrained

While India's demand for natural gas will show double-digit compound annual growth from 2010 through 2015 in both scenarios we considered, we expect domestic production over the same period to grow at a CAGR of only 3 percent. This modest growth is explained by three factors.

First, existing natural-gas fields under public sector control are in a state of decline. Although the oil-recovery programs launched by India's Oil and Natural Gas Corporation, combined with production from its new marginal fields, will partly compensate for this decline, there are no indications that new fields with substantial production capabilities will come online in the near term.

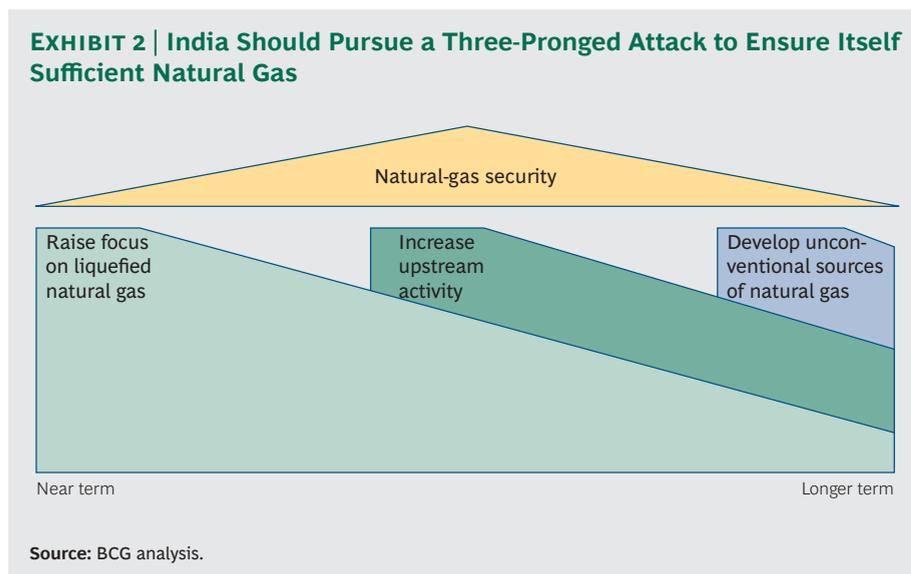
Second, there have been significant delays in the ramp-up of production at KG-D6. The field, which was contributing about 40 percent of India's domestic supply in

early 2010, is currently producing at levels well below that. In fact, the government has recently indicated plans to reallocate KG-D6 gas because the situation is expected to prevail for some time.

Third, India has yet to tap into its vast potential of unconventional gas resources. Encouragingly, a few CBM fields that had been taken offline by owners owing to pricing and regulatory concerns have resumed production, and a policy for shale-gas exploration is currently being formulated. But we expect contributions from unconventional gas to India's domestic supplies to remain marginal through 2015.

India Needs an Action Plan

The fact that India's domestic production of natural gas is insufficient to meet its growing demand is widely acknowledged. The sheer magnitude of the gap, however, calls for serious attention from all stakeholders. The need of the hour is an immediate and decisive action plan. We propose a plan that includes three elements. (See Exhibit 2.)



India should develop a proactive scheme to source LNG and move quickly to leverage the attractive sourcing opportunities currently available in global LNG markets. It should encourage the participation of Indian companies in upstream activities with both domestic and global players. And it should accelerate its development of unconventional sources of natural gas.

INCREASING THE FOCUS ON LNG

Geopolitical considerations have negatively affected plans for natural-gas pipelines to India. Of the three pipelines the country has considered over the past decade, only the Turkmenistan-Afghanistan-Pakistan-India pipeline is close to becoming a reality. Yet with construction expected to take up to five years after ground is broken on the project, imports into India are unlikely to start anytime soon. This

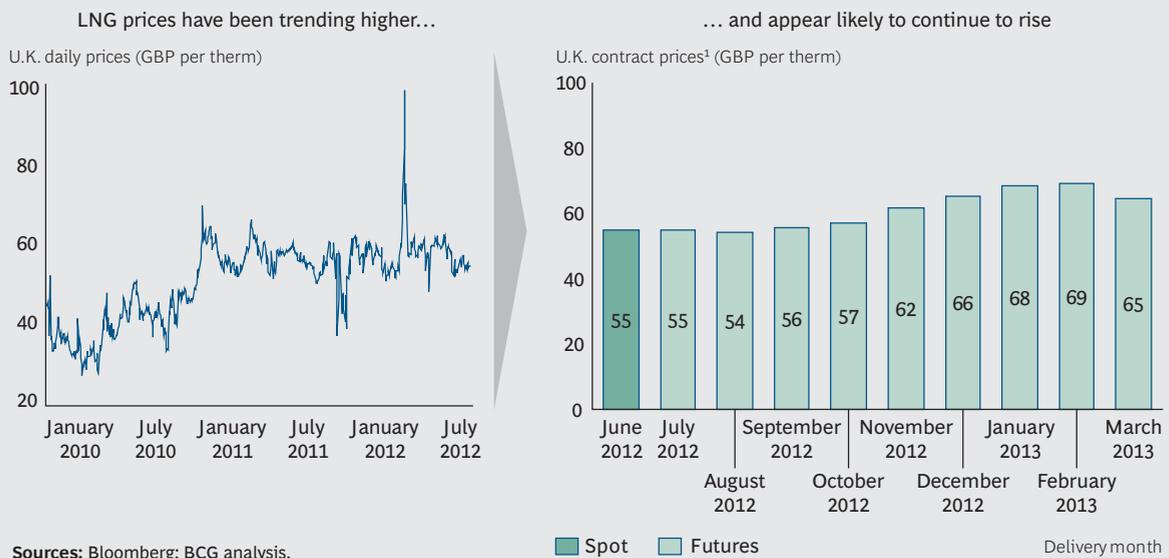
leaves LNG as the default option for India to materially boost its natural-gas supply, at least in the near term.

Global supply-and-demand dynamics—namely, a temporary spike in supply driven largely by the shale-gas boom in the U.S. and that country’s commensurately lower demand for LNG—have created a window of opportunity for India to source LNG through 2015 and beyond on relatively attractive terms. The window is expected to last a brief one to two years and will close as recontracting of LNG supply by major Asian countries gathers speed. (From 25 to 50 percent of import demand from key Asia-Pacific LNG buyers will require fresh contracting in the next five years.) Hence, India must seize the moment and act quickly. LNG prices are already trending higher. (See Exhibit 3.)

Individual Indian companies with relatively small requirements, acting alone, are severely constrained in their ability to find and negotiate attractive prices in global LNG markets. (Note, however, that several larger companies, led by Gail and Petronet LNG, have initiated focused steps to source LNG for India.) Hence, it is imperative that India, as a whole, evaluate the creation of aggregator-type models that can allow it to approach global markets as a single unified entity. An aggregator model would also provide mechanisms for internal hedging and create the conditions for surrogate pooled-pricing mechanism.

A key part of making greater use of LNG, especially over the long term, is ensuring sufficient infrastructure. India currently has approximately 16 MMTPA of LNG regasification capacity, which is almost entirely on the west coast. Another 10 MMTPA of capacity, including Petronet’s Kochi terminal, is in various stages of

EXHIBIT 3 | India Needs to Act Quickly to Secure LNG at the Best Possible Prices



construction, and a further 13 MMTPA of announced capacity additions are likely to be up by 2015. This capacity growth is phenomenal—and necessary. The focus on ensuring regasification and other pipeline infrastructure is critical to sustainable domestic LNG deployment.

RAISING INDIA'S PRESENCE IN UPSTREAM ACTIVITIES

To help secure natural-gas supplies over the long term, Indian firms should explore partnerships with domestic upstream players that are engaged in international projects. They should also more aggressively explore partnerships with global players involved in exploration and production activities and consider equity participation in upstream projects abroad. Tapping into these options could help ensure long-term supply at lower cost.

Australia, which has declared plans for substantial investment in the construction of liquefaction capacity, is the single largest source of increased LNG supply in the world. This could present immediate opportunities for both long-term contracting and equity participation for Indian companies.

ACCELERATING THE DEVELOPMENT OF UNCONVENTIONAL SOURCES OF NATURAL GAS

Tapping into the country's reserves of unconventional gas is also an important element in ensuring long-term supply security. In particular, India may have large reserves of shale gas and CBM, two of the most important unconventional sources in the world today. Preliminary estimates put India's shale-gas reserves in the range of 300 trillion to 2,100 trillion cubic feet and CBM reserves at about 120 trillion cubic feet. The vast potential of these sources is not trivial.

Both shale gas and CBM remain in their early stages of development in India, however. Shale-gas exploration is still in the pilot stage, and the government is finalizing the regulatory framework for its commercial exploration. CBM blocks in India have been awarded through bidding, with four rounds completed in the past decade. However, only a few fields awarded during the first round, in 2002, have commenced production. Gas supply from these blocks is expected to contribute no more than 5 percent of domestic natural-gas production by 2015.

Shale gas and CBM have important roles to play in making India energy independent in the long term. Their development should be accelerated to the greatest extent possible.

ENSURING INDIA'S ENERGY security is vital to the country's economic ambitions. Natural gas can and should play a much greater role in providing that security. But for that to happen, the country needs to act and act quickly, both to seize attractive near-term opportunities and to lay the groundwork for long-term security of supply.

Shale gas and coal bed methane have important roles to play in making India energy independent.

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