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Natural Gas in Asia: History and Prospects

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EXECUTIVE SUMMARY

This paper examines the challenges of increased use of natural gas by Asian nations and what steps may be taken to develop alternatives to coal and oil.

Main Argument

Over the past two decades, use of natural gas in Asia has increased threefold, ensuring that the Asia-Pacific will continue to be a hub of the global gas trade for the foreseeable future. Despite increased growth, however, natural gas is still an underutilized resource and is far outpaced in Asia by the consumption of coal and oil. Increased consumption of natural gas in place of oil and coal would have the dual effect of providing Asian energy security and mitigating climate change. Yet emerging economies are faced with some key challenges. Plentiful and inexpensive domestic reserves in countries such as China and India drive continued coal consumption. Furthermore, political, geographic, and economic constraints have made further investment in gas and development of liquefied natural gas (LNG) pipelines difficult.

Policy Implications

- Despite vastly increased consumption of gas as well as growth in production on the continent, the use of coal and oil far outpace natural gas, leaving room for increased investment in gas as an energy source.
- Overcoming competition from cheap energy sources such as coal and oil requires government policies that encourage investment in natural gas and pipeline construction.
- Increased Asian use of natural gas not only reinforces a decades-long upward trend in consumption, but also has several noticeable benefits, including increased energy security and reduced carbon emissions.
- The development and maturity of the Asian gas market will be incremental and halting while construction of gas pipelines and transportation infrastructure is delayed by lingering geopolitical disputes.

Natural gas use globally has grown steadily over the past two decades reflecting the significant benefits of natural gas in an era increasingly characterized by concerns over energy security and deepening environmental constraints imposed by climate change fears and growing pollution. Use of gas in the Asia-Pacific has grown strongly over the past two decades also, illustrating these dual concerns. Since 1990, global gas consumption rose by 50%, while the Asia-Pacific's gas consumption tripled.¹ Asia also remains the center of global liquefied natural gas (LNG) trade: the region accounts for nearly two-thirds of global LNG demand. Japan and South Korea alone account for one-half of the global LNG market, and growing LNG imports to China and India ensure that the Asia-Pacific will remain the key demand center for LNG. The pipeline gas trade is also growing, and production of domestic gas in the rest of developing Asia is likewise rising rapidly.

That being said, gas remains a relatively underutilized energy resource in Asia. In reality, the region still relies heavily on oil and coal to fuel its economic miracle. For example, Japan, South Korea, Taiwan, and Thailand still rely on oil for about 45% of their energy needs even after two decades of efforts to reduce oil dependence. Oil demand in China is growing at well over 5% a year, and China has rapidly emerged as the second-largest oil consumer and importer in the world after the United States. Natural gas presents an important opportunity to diversify Asia's industrial and power-generation energy use away from oil, while reducing the region's heavy import dependence on Middle Eastern oil and vulnerability to potential oil price shocks. Coal accounts for over 50% of Asia's energy consumption compared to the global average of just 16% (excluding Asia). Hence, rapidly growing oil and coal use in Asia, the two most carbon-intensive fuels, explains why Asia's carbon emissions are rising much faster than the region's overall energy demand. Alternatively, natural gas produces virtually no sulfur emissions, far lower levels of nitrous oxides, 25%–30% less CO₂ than oil, and 40%–45% less CO₂ than coal. Hence, there are potentially huge environmental benefits in expanding the use of natural gas. Gas provides an inexpensive, practical, near-term opportunity for decarbonization and improved pollution outcomes.

¹ All data in the first three paragraphs is from "BP Statistical Review of World Energy 2010," BP plc., June 2010.

Other metrics also suggest the underutilization of gas in the region. The Asia-Pacific accounts for 37% of total global energy demand while only representing 17% of the global gas market. By comparison, the region accounts for 66% of global coal demand, 31% of oil demand, and 25% of global nuclear and hydroelectric consumption. In the region's two largest energy markets, China and India, gas accounts for a paltry 4% and 10% of energy use, respectively. Even after 30 years of LNG development, in the next two largest energy markets, Japan and South Korea, gas represents only 17% and 13% of energy use, respectively.

Thus, even with rapid growth over the past two decades, there remains huge scope for increases in Asia's gas use that would yield major energy security and environmental benefits. From an energy security perspective, the Asia-Pacific is relatively more self-sufficient in gas than in oil, with large gas reserves and production capacity in Southeast Asia, Australia, and growing domestic gas reserves in the large economies of China and India. Moreover, gas and LNG production capacity globally are more diversified and located mainly in non-OPEC countries. In addition, development and transportation of LNG and gas via long-distance pipeline requires strong government-to-government cooperation and locks in long-term market and geopolitical relationships that reduce the potential for political confrontation. Finally, gas is a much more efficient energy source; it has a much higher energy conversion rate than coal, especially in combined-cycle gas turbine power generation technology, which is up to 50% more efficient than conventional coal or oil-fired generation.

Past Constraints and Future Prospects for Gas in Asia

While Asia's gas use is rising and there is growing recognition of its energy security and environmental value, whether gas will become a major fuel in the region's major markets of China, India, Japan, and Korea will depend on overcoming a number of lingering challenges that historically have limited the penetration of gas in the region. Perhaps foremost, gas use in Asia has been constrained by the region's wide geographic and maritime dispersion that make the "tyranny of distance" a key factor in Asian gas use. Natural gas transport infrastructure absorbs a significant share of the raw resource

value compared with oil, and the long distances of Asia magnify this cost constraint. Asian gas resources are mainly in Southeast Asia, whereas the traditional regional markets were developed in Northeast Asia, making maritime distance a critical issue. As a result, the LNG option, which historically has been relatively expensive, has become the main regionally traded gas source, and pipeline gas development has been much more limited in Asia than in the more concentrated continental markets of North America and Europe. Intimately bound up in this was the development of LNG supplies driven largely by energy security anxieties in Japan and Northeast Asia, which produced the oil-indexed pricing system, as reflected in the JCC (Japan crude cocktail) pricing formula that produced relatively high-price LNG. While the wealthy economies of Japan, South Korea, and Taiwan were able and willing to pay premium prices, these high prices have been a strong disincentive for developing Asian countries seeking to expand their gas use to rely on LNG.

However, as several of the papers produced for this summit suggest, the picture of Asian LNG supply, demand, and pricing has been changing dramatically, creating the potential for greater acceptance of LNG among Asia's developing economies. The outlook for LNG supplies is booming with the development of a large number of new projects within and outside the region. Although exports from traditional suppliers Indonesia, Malaysia, and Brunei have stabilized, major new supplies have come from Australia's northwest offshore region as well as from future new coal seam gas LNG projects in the Queensland region. Large, new regional supplies have also emerged from Russia's huge Sakhalin 2 LNG project, and other offshore supplies are coming from new suppliers such as Papua New Guinea (PNG) and East Timor. Moreover, from outside the region, Middle East LNG supplies have been boosted by huge production increases from Qatar and other regional LNG projects. These supplies have helped open up new markets in China and India, which were able to negotiate favorable prices during the oversupplied, weak LNG market conditions earlier in this decade.

The growing perception of ample future supplies of LNG has been fed by the shale gas boom in the United States. Until recently, most forecasts for the global LNG balance expected the United States to become a major importer of LNG as North American gas supplies gradually diminished and LNG increasingly filled the gap. However, the

radically changed outlook for U.S. shale gas production suggests that North America will not need LNG supplies, which has fundamentally changed the view of the global balance. Moreover, the shale gas boom may extend to China and other countries in the Asia-Pacific, such as Australia, which have strong geologic prospects for shale gas production. This could add to rising production of other unconventional gas, such as coal seam gas supplies, in China and Australia.

As other papers for this summit suggest, the robust LNG and unconventional gas supply outlook for the Asia-Pacific is increasingly likely to contribute to the evolution of a more flexible and demand-friendly LNG contract price regime. Long-term contracts that help finance the huge investments required will certainly remain the rule. Nevertheless, contracts have already become more flexible on issues such as oil-price linkages, take-or-pay commitments, and contract tenor. Moreover, the strong gas supply picture seems likely to provide greater confidence among energy policymakers in developing Asia that LNG prices over the long-term will remain reasonably competitive and affordable. These changes suggest that both developing and developed Asia could increasingly see LNG as a base-load choice to fuel economic growth rather than a marginal, high-cost supplemental peaking fuel.

Closely related to the challenges of boosting LNG supplies in the Asia-Pacific are the challenges of developing new pipeline gas supplies to the region that would expand access to and confidence in the stability of imported supplies. In cost and market terms, the “tyranny of distance” has been a significant challenge to expanding pipeline imports, in stark contrast to the situation in North America and Europe, where distances are much shorter. Second, the potentially large continental markets of China and India have only recently begun to focus on expanding gas use. These states have been slow to develop effective domestic demand policies and regulatory arrangements that would give potential exporters confidence to support large pipeline projects dedicated to their markets. The development of new gas pipelines to the Asia-Pacific has also been undermined by the complex geopolitical challenges of multinational gas pipeline projects. Additionally, in Southeast Asia the high cost of undersea pipelines needed to transport gas regionally has been a serious constraint.

Despite these constraints, new regional pipeline developments have begun to take shape as the continental markets of Asia evolve, while other potential projects continue to face challenges. Beijing has sponsored major new regional gas pipelines from Turkmenistan, Kazakhstan, and Myanmar as China constructs a large west-to-east domestic trunk-line gas pipeline infrastructure. This initiative also is being supported by gradual reforms in energy policy and pricing to promote gas use. Beijing sees overland pipeline imports as a way to balance plans for growing imports of LNG along the east coast.

However, the benefits of further expansion of gas pipeline flows in the region will depend on resolving chronic geopolitical constraints. India's considerable efforts to develop regional pipelines to transport the enormous potential supplies available nearby have foundered due to geopolitical and competitive constraints. The potential Iran-Pakistan-India gas pipeline project remains blocked by India's rivalry with Pakistan, U.S. and UN pressure and sanctions on Iran, and Iran's own export pricing demands. The potential for exporting gas from Turkmenistan to India is also blocked by Afghanistan's unstable security situation and Pakistan's transit location. And potential gas exports from Myanmar to India have been diverted by Beijing's project to take that gas north to China. Russia's potential for large gas exports to China and Northeast Asia also will need to await the evolution of Russian policies on exporting gas to Asia. Gazprom and the Kremlin remain uncertain about committing the large investments required to build gas pipeline export infrastructure in East Siberia and about which field supply sources to dedicate to China and Northeast Asia. Gas exports to South Korea are constrained by North Korea's location and the deepening nuclear stand-off between the countries. In Southeast Asia, while the full ASEAN vision of a Southeast Asian gas grid remains a distant prospect, several parts of a potential future grid continue to be put in place where the investment economics make sense. As a result, Myanmar gas has been moving by pipeline to Thailand for many years, and Indonesian gas is exported to Singapore.

A third key for the future of gas as a major fuel in the developing Asia-Pacific is meeting the challenge of competing with coal as a base-load fuel in the region. This is critically important in the major coal-dependent economies of China and India. Coal has reigned in these countries because huge, low-cost domestic reserves have been available,

which have allowed coal to provide the enormous base-load power generation fuel to meet rising electricity demand. By contrast, domestic gas reserves have been fairly modest due to traditionally low administered well-head gas prices, the lack of investment incentives for gas development, and the lack of transportation infrastructure. As a result, each country has a deeply embedded legacy of relatively low, coal-fed power generation fuel costs and low electricity prices that historically has undermined policy efforts to boost gas development and market penetration. In China, for example, coal accounts for 80% of power generation, whereas gas is a paltry 1%. Even relatively low-cost domestic gas is largely unable to compete with coal in power generation and in local and district heating.

Some of these constraints, however, could be easing. The impact of rising coal use in terms of air pollution, health consequences, and carbon emissions is driving both China and India toward gas as part of efforts to de-carbonize domestic energy consumption. While much attention is focused on growth in renewable energy sectors, increasingly gas is seen as a tool to reduce the countries' carbon footprints. Domestic gas production and availability is growing quite strongly as Beijing and New Delhi have begun to offer greater gas development investment incentives both to their national oil companies (NOC) and to foreign investors. Both states also are seeking ways to boost gas use for power generation in selective locations where gas supplies are particularly ample or where coal supplies are relatively expensive due to high transport costs. Owing to more effective policies to boost gas use in residential and commercial markets, gas use has grown recently in these sectors. But the key to making gas a major fuel source economy-wide in China and India will be finding policy solutions that increase the share of gas in power generation. This will require major efforts by policymakers, given that the process would involve fundamental changes in electricity pricing. In addition, the domestic coal industries in each country are critical to employment and social stability. Policymakers in Beijing and New Delhi also will need to become comfortable with the implications of growing gas imports for energy security, since substantial growth in the use of gas for power generation will mainly be met by imported gas supplies (both LNG and pipeline) at the margin.

A fourth set of long-term constraints on the growth of gas use in the region revolves around the challenges of effectively developing a domestic market for gas that depends on domestic gas pricing reform, investment, infrastructure, and regulation. Across developing Asia there has been a tension between the desire to boost gas production, infrastructure investment, and consumption for important environmental and energy security reasons, on the one hand, and the alternative goal of keeping gas prices low to serve domestic economic, industrial, and social objectives, on the other. Each country seeks to manage this tension in a different way but the basic conundrum remains essentially the same. One set of policies is designed to keep gas prices low in order to stimulate gas demand growth, promote gas use in power generation over the use of low-cost coal, and overall to keep energy and electricity prices low for political and social reasons. In many cases, tiered pricing is used to maintain low gas prices for favored industries, such as fertilizer or petrochemicals, and for favored social sectors, such as urban working groups. Higher prices often are charged to industrial and commercial customers, resulting in substantial cross-subsidies.

On average, though, gas prices in developing Asia remain significantly below international or regional gas prices. For example, average Chinese gas prices currently are about one-half regional averages of \$7-\$9 per thousand cubic feet (mcf) and Indonesian gas prices average around \$2-\$3. Three difficulties arise from these arrangements. First, artificially low end-market gas prices create back up into supply-side constraints because the only way to keep prices down is to pay low well-head prices to gas producers, which, in turn, chronically undermines incentives for new gas exploration and development. Second, low average gas prices undermine investment in transportation infrastructure since they leave little margin to support adequate pipeline tariffs. If a government raises well-head prices without raising end-user prices, then transportation companies are further squeezed and require large subsidies. Third, low domestic gas prices make it extremely difficult for higher-priced imported gas, either LNG or pipeline, to compete in markets without heavy government intervention or large subsidies.

In trying to overcome these problems, governments typically use their NOCs and state-owned gas transmission companies as vehicles to subsidize gas by absorbing production and transportation losses. They also frequently compel international oil and

gas companies to meet onerous domestic market obligations at very low prices from gas projects aimed at export markets. This discourages international investment in gas development and, together, tends to contribute to chronic gas supply constraints; poor, inefficient gas transport infrastructure; and reduced investment throughout the gas value chain. This, in turn, undermines efforts to build a large, viable domestic gas market. While these constraints are increasingly recognized across developing Asia, making the necessary changes is politically and socially sensitive because the solutions all tend to lead to higher energy and electricity prices.

Moving Asia's Gas Market Forward

In a broad sense, the future of gas in Asia looks very promising. Governments across the region are increasingly driven by concerns over energy security, the energy-environment nexus, and climate change. Natural gas clearly represents a cheap, practical, near-term opportunity to harvest enormous energy security and environmental gains while technology and industry develop longer-term solutions to these challenges. Reflecting this, Asia's gas consumption is expected to triple again over the next 30 years.²

Nevertheless, energy policymakers and the energy industry will need to overcome a series of significant challenges in order to realize this future. First, the opportunity to take advantage of growing supplies of LNG will depend on developing confidence that the LNG industry and the global LNG market can deliver reasonably priced and secure supplies over the long-term. This requires continued strong partnerships between producing countries and the energy industry to assure LNG importers that supplies will grow and competitive markets will work. Moreover, LNG contracts and pricing structures must evolve toward greater flexibility and market responsiveness to provide confidence to importers in the future of LNG pricing. Second, new gas pipeline projects in Northeast Asia and South Asia must move forward, which will require stronger political will and the development of more robust domestic gas markets in China and India. Russia's gas export policies to the east are particularly critical in this and must

² "International Energy Outlook 2010," U.S. Energy Information Agency, July 2010.

move forward. Third, the use of gas as a power generation fuel that displaces coal must become a priority across the region, especially in China and India. This will require painful but necessary reforms in electricity pricing, markets, and regulatory institutions in China and India. Finally, domestic markets for gas across developing Asia must be made more flexible, competitive, and investment-driven in order to boost supplies, support expensive investment in new gas transportation infrastructure, and allow gas to compete with other fuels across the energy spectrum.