

Natural Gas: The Fuel of the Future in Asia

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I S S U E S

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SUMMARY Asia's economic miracle has largely been fueled by coal and petroleum. Although Asia dominates the world liquefied natural gas market, gas has been underutilized in the region relative to its tremendous potential and gas trade in Asia by pipelines is very limited. As the economic growth continues, natural gas should have a key role in Asia's future. Expanding gas use will reduce troublesome oil dependency, especially high import dependency on the Middle East, because Asia has its own natural gas supplies, and it will alleviate the pollution currently produced by coal burning and carbon dioxide emissions. Furthermore, the long-term political and economic relationships required for maintaining gas trade could help to stabilize the region. The main obstacle to increasing the use of natural gas today is the lack of sufficient terminals, long-distance pipelines, and local network systems for its transport. The development of the transport and distributional infrastructure necessary for dramatic gas expansion will require support from both the private sector and, most importantly, Asian governments.

Natural gas is often referred to as the fuel of the future. In what follows we will explain why the Asia Pacific regionⁱ stands to benefit greatly from expanding the production, trade and utilization of natural gas. We explore what these benefits to the region might be, reasons that natural gas has been underutilized there to date, and how things must change if Asian countries are to fully realize the promise of this clean and efficient source of energy.

Why Gas Should be a Priority: Geopolitical and Environmental Arguments

Asia's rising oil dependency is causing growing governmental concern over the security of energy supply and access

The approach of Asia Pacific countries to natural gas has changed drastically in the past few years. However, historical patterns and the recent economic crisis have not led to the bold initiatives needed to expand natural gas use dramatically. There are many reasons why natural gas should be encouraged and promoted by deliberate government policy, but here we limit ourselves to its potential economic, geopolitical and environmental benefits.

Energy security. Asia's rising oil dependency is causing growing governmental concern over the security of energy supply and access. In 1998, some 57 percent of oil consumed in the Asia Pacific region was imported, with over 90 percent of oil imports coming from the Middle East, and the degree of energy dependency will likely continue to increase. The region's oil reserves are limited, but its potential gas reserves are, in contrast, encouraging. While the region may not become fully self-sufficient in gas supplies, substantially more gas resources can be developed.ⁱⁱ

Gas has another advantage over oil in that it is not concentrated in the politically troubled Persian Gulf. Gas supplies come mainly from non-OPEC countries, and the suppliers of gas are much more varied. Asian countries currently import liquefied natural gas (LNG) from Indonesia, Malaysia, Australia, Brunei, Abu Dhabi, Qatar, and the United States. Singapore imports pipeline gas from Malaysia, Thailand from Myanmar (Burma), and Hong Kong from China (now politically united). Moreover, very large gas reserves exist in the Russian Far East.

Geopolitical factors. Natural gas can also play an important geopolitical role. Gas trade requires and creates long-term bonds between sellers and buyers. Only natural gas has this important characteristic—no other fuel requires the same kind of durable relationship. Whether natural gas is traded via pipeline or as LNG, its buyers and sellers need fifteen to twenty-year agreements that govern sales, prices, and other details. Such long-term agreements are essential to obtaining project financing from banks, and banks are crucial partners in these projects. The projects are so large that development banks can play at most only a minor role—financing must come from private international banks.

Once the buyers and sellers are bound via long-term relationships, with involvement from a consortium of international banks, it is imperative that they avoid dangerous confrontations. Certainly Northeast Asian countries, particularly Japan, believe that large-scale natural gas imports from the Russian Far East can help reduce tensions between the two countries. This view is also shared by Korea and China, both of which have plans to operate long-term, long-distance gas pipelines with Russia. In the distant future, pan-Asia natural gas pipeline networks are a possibility, first linking Northeast Asian nations, and then Southeast Asian, and South Asian countries. These are still a “pipe dream,” but if realized they could well promote international dialogue and ease tensions across countries, not to mention benefiting the region economically. The Russia-Europe pipelines are a model here, having brought enduring stability to Euro-Russian relations.

Economic and environmental gains. Gas is significantly more efficient than other fossil fuels (i.e., gas generates more power and does more work per unit of fuel used). Combined cycle gas technology results in better utilization of gas, with higher electricity output, lower costs, and less pollution. The thermal efficiency of the combined cycle gas turbine power generation process (frequently chosen by users of natural gas) is as much as 50 percent higher than conventional steam technologies using oil or coal, and the gap is growing. Although coal and oil can

Asia dominates the world LNG trade but gas trade by pipelines is very limited

also be gasified for use in combined cycle gas turbine systems, this generally yields lower net thermal efficiencies.

Natural gas is the most environmentally friendly fossil fuel in terms of pollutants and carbon dioxide emissions. Compared to other fossil fuels, natural gas produces essentially no sulfur emissions and significantly lower levels of NO_x and particulate emissions. Gas also produces 25–33 percent less CO₂ than oil, and 40–45 percent less than coal, per unit of energy produced. In 1998, natural gas accounted for about 11 percent of the total fossil energy consumption in Asia, but contributed only 8 percent of the regional CO₂ emissions. In comparison, coal accounted for 42 percent of Asia's total fossil energy consumption and 54 percent of the CO₂ emissions. Because of the higher rate of CO₂ emission, the share of coal in total CO₂ emissions has been consistently higher than its share in total primary fossil energy consumption, while the opposite is true for natural gas. A switch from coal to natural gas, to the extent that is permissible technically and economically, would allow the same amount of energy consumption, but would lower the emission of CO₂ in the Asia Pacific region and throughout the world.

Natural Gas in Asia Today

Gas trade in the Asia Pacific region is predominantly in the form of LNG, and in fact Asia dominates the world LNG market. In contrast, international trade of natural gas via pipelines is quite limited in the Asia Pacific region. There is a short pipeline from Malaysia to Singapore, and another offshore of China's Hainan Island sends gas to Hong Kong. A recently completed pipeline from Myanmar to Thailand is not yet fully operational, in large part because demand plummeted with the Asian economic crisis.

In addition to these existing pipelines, several other international projects are either under construction or ready to begin. These include a pipeline from Indonesia (Natuna West) to Singapore, a line from Papua New Guinea to Queensland, Australia, and Thai-Malay plans for a pipeline from their Joint-Development Area. Asia's individual gas pipeline

projects will result in a slow and small increase in regional pipeline trade and could eventually link up to form a regional pipeline network, at least within much of Southeast Asia. Plans for more extensive gas grids, either in Northeast Asia or throughout the region, will not emerge by design but only as each pipeline project becomes economical. Thus, projects such as pipelines from Turkmenistan to China or Pakistan, or from the Russian Far East to East Asia, continue to be "studied" and may face delays.

Asian importers and suppliers. While the LNG market dominates Asian gas trade, it remains relatively young and limited. Thus, each player and every change in supply and demand has a significant impact on the development of the market and the future of natural gas. For example, only three Asian countries currently import LNG: Taiwan, Korea, and Japan. It is no coincidence that these are the most advanced economies in the region or that all three also lack indigenous fossil fuel resources. The Asian LNG market is the result of explicit government policies, as it has been elsewhere.

In Taiwan and Korea, imports are handled by state-controlled monopolies, although both countries are in the process of privatizing them and deregulating LNG imports. Nevertheless, the state-owned monopoly Kogas in Korea was able to use its powerful position to invest heavily in a national gas transmission system. This is now facilitating expansion of gas consumption in the industrial and residential sectors. In Japan, a number of gas and electric utility companies dominate LNG imports. Historically, these importers were responsive to policies promoted by Japan's Ministry of International Trade and Industry; today, this understanding is disappearing with energy sector deregulation and increasing emphasis on market-oriented business operations. The combined factors of multiple importers, very high land costs, and difficult legal right-of-way issues, have left Japan—the seventh biggest gas consumer in the world—with only a very limited gas transmission system. This means any gas imported via pipeline must go directly to Tokyo or some other large demand center.

LNG imports in Asia increased nearly fivefold between 1978 and 1998

On the supply side, LNG exporters in the Asian region include Indonesia, Malaysia, Australia, and Brunei. Only 10–15 percent of the LNG consumed in Asia is currently imported from Alaska and the Middle East, including Abu Dhabi, Qatar, and soon Oman, but the share of imports arriving from the Middle East is increasing. Indonesia and Malaysia, two of the world's largest suppliers, produce LNG through joint-ventures between state oil and gas companies and one or more of the large multinational energy corporations such as Shell, Exxon Mobil, or TotalFina. The producing countries both capture valuable foreign exchange earnings and benefit from the technical know-how of these multinationals.

Future LNG prospects. Since before the Asian financial crisis, the number of proposed LNG supply projects have been creating the potential for oversupply in the Asia Pacific region. The abundance of proposed LNG projects reflect growing reserves, high demand expectations, oil price behavior, and market strategies. Natural gas reserves in the Middle East have grown threefold since 1976 and account for one-third of proven global reserves. Although proven reserves in the Asia Pacific region amount to only 6 percent of the world total, these have doubled since the late 1970s. The discovery of several large gas fields in and near the Asia Pacific region coincided with rising LNG imports and strong economic growth in the region, and they were therefore targeted for potential LNG projects.

LNG imports in Asia, in fact, increased nearly fivefold between 1978 and 1998 (see Figure 1). The

import growth is still strong at present despite the negative impact of the recent Asian economic crisis, while a number of factors contributed to optimistic demand outlooks. In Korea, for example, official forecasts for LNG demand were revised upwards several times in the mid-1990s and as recently as the spring of 1997. In addition, large oil (increasingly “energy”) companies have shown a growing interest in the power market. This means that planned LNG facilities can constitute complementary or even vertically integrating investments, and potentially increase access to power supply projects. Finally, oil prices (to which LNG prices have been linked) were high in the 1980s and relatively stable in real terms during the 1990s. This, too, contributed to LNG's appeal to potential investors.

LNG in China and India. With plenty of LNG supply available, new buyers will be important to expanding the gas market in Asia. In addition to the pipeline plans mentioned above, two countries, China and India, may soon start importing LNG. China's central government formally approved an LNG-import project in Guangdong province at the start of 2000, with imports likely by 2005. Other possible terminal sites are in Fujian and near Shanghai. International pipeline projects (involving the Russian Far East or Turkmenistan, for example) will proceed more slowly and will not reach into high-growth southeastern coastal regions where there is strong demand for power and a willingness to pay.

India is the third largest consumer of natural gas in the Asian region, relying until now on domestic production; but gas still accounts for less than 10 percent of primary energy consumption there, and the economy is increasingly starved for natural gas and power. For a number of reasons, ranging from environmental concerns to competitiveness in power generation, natural gas remains a sought-after fuel in India. In the thirsty power sector, electricity generation based on imported naphtha and condensates will not be able to compete with natural gas, although increased domestic production could affect demand for gas imports. For now, gas imports via pipeline and increased domestic naphtha production remain

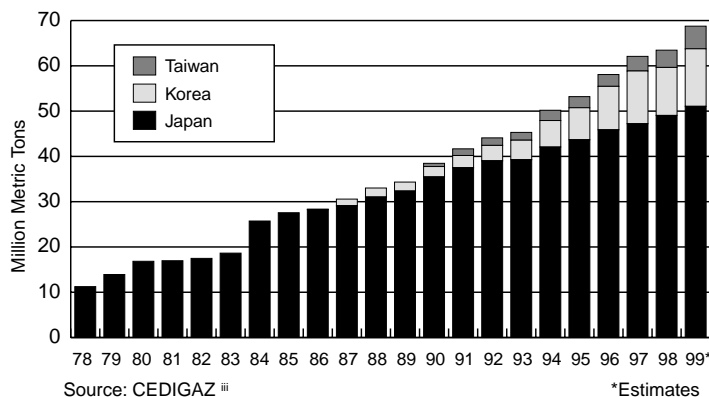


Fig. 1. LNG imports to Asia, 1978–1999

Natural gas accounts for only 10% of the primary energy consumption in Asia, as compared to 24% in the world

more distant possibilities; meanwhile both the government and private industry are pursuing LNG imports.

There are currently announced plans for somewhere between ten and twenty LNG terminals in India. These are at various stages of materializing, and many of these plans are still changing with frequent announcements. Nevertheless, several leading projects are competing to be first in operation (by 2002/2003). Meanwhile, the steady stream of announcements regarding big LNG projects tends to obscure the obstacles that still confront them, as well as the sources of potential delay in meeting targets such as the need to secure final gas consumers, ensure sufficient prices, and resolve shipping issues.

India as an LNG importer will differ significantly from existing Asian buyers in the east (Japan, Korea and Taiwan). India is a larger country with a larger, growing population, and has a much lower per capita income. It produces some domestic oil and gas (although it is under-explored) and has some existing pipeline infrastructure. India's large agricultural sector means that the fertilizer industry (and petrochemicals in general) will facilitate increasing use of natural gas in the domestic economy. While China could conceivably also benefit from a strong fertilizer industry, its pipeline infrastructure is less developed and what does exist may not be as helpful as is India's major pipeline running inland from the coast with several spurs. Still, like much of Asia, neither China nor India has significant gas infrastructures for supplying residential or commercial users, or even a wider variety of industrial users.

Four Reasons Natural Gas Remains Underutilized in Asia

That economic growth requires tremendous inputs of energy is widely accepted. What kind of energy is to be used, its costs, logistics, and its environmental impacts are subject to heated debates. Historically, Asian economic development and growth have been fueled by coal and petroleum. Indeed, the Asian pattern of energy consumption is quite distinctive in the world.

Globally, energy users depend on oil for 40 percent of their total primary commercial energy consumption (see Figure 2). Oil is the most important component of global energy use and coal is a distant second at 26 percent, with natural gas in the third position at 24 percent of the total. Nuclear power and hydroelectricity are relatively minor sources. In Asia, however, coal is the leader, accounting for some 44 percent of total energy used. Oil in percentage terms (39%) is about the same as its global share but natural gas consumption is only 10 percent. Indeed, Asia has the lowest dependency on natural gas of any geographical region in the world. India and China's heavy use of coal overshadows the overall Asia Pacific pattern. But even if they are excluded from our calculations, the share of natural gas in the commercial energy consumption in the region increases to only 16 percent, still less than the global share. If we eliminate India and China, the share of oil also expands to 52 percent (greater than the world share) and coal shrinks to 20 percent (see Figure 3).

The reason for the relatively lower consumption of gas in Asia can be explained by four factors. First,

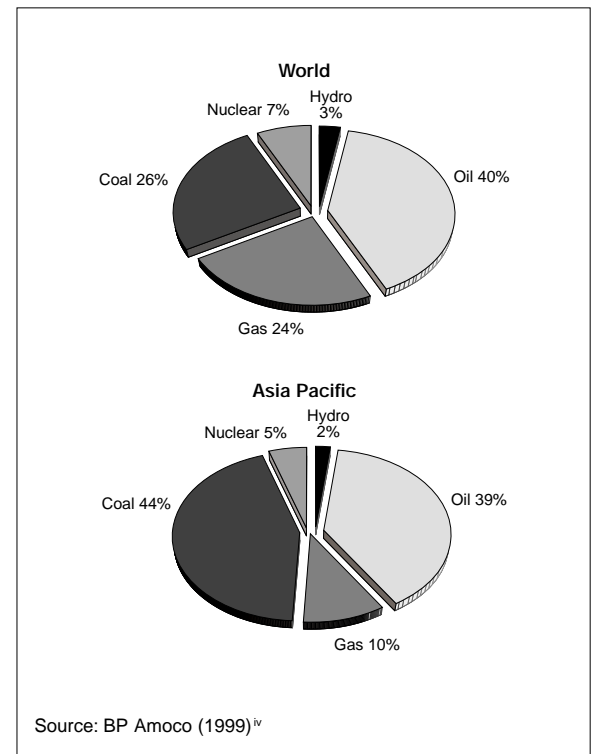


Fig. 2. Primary commercial energy consumption by source, 1998

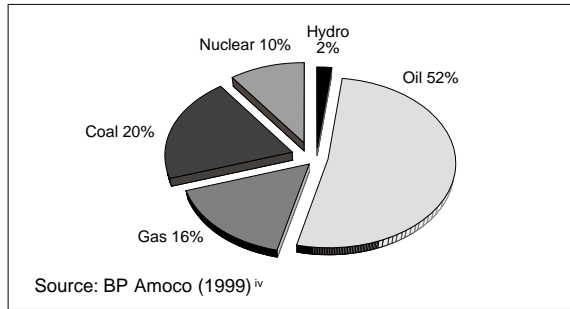


Fig. 3. Primary commercial energy consumption in the Asia Pacific region (excluding China and India), 1998

Asia lacks a preexisting gas-user culture of the kind found in North America and Europe, where an infrastructure for distributing gas was developed long ago to provide light, and later heat. Asia, on the other hand, developed much of its centralized energy infrastructure later, when electricity distribution systems were used to meet most energy needs, so it has lacked a gas-distribution system upon which modern gas use could build.

Second, developing gas use generally requires much larger investments than do oil or coal projects because gas is more difficult to transport. This has deterred lower-income countries seeking rapid economic growth (in Latin America as well as Asia), which have preferred easier, smaller-investment projects using oil. The international corporations exploring for oil and gas in Asia have preferred developing oil there for the same reason—it brings quicker returns on investment and is easier to market. This helps explain why international gas markets are underdeveloped.

Third, Asian gas resources are located far from the biggest, wealthiest centers of demand. This has contributed to the slow development of a regional market. Without large and integrated gas markets and easy means of transportation, consumption is constrained.

The fourth factor behind natural gas being less developed and utilized in Asia is a lack of transparent and competitive gas pricing mechanisms. As mentioned earlier, Asia dominates the growing world LNG trade. However, LNG accounts for only a quarter of international gas trade and it involves

only a few countries in Asia. For most Asian countries, natural gas is locally produced and consumed. Unlike oil, there is no international gas market to which Asian countries can link their domestic natural gas prices. In some countries, local gas prices are loosely linked with the prices of fuel oil. In others, including China and India, natural gas prices are determined and regulated by the governments, often set at low levels to benefit industrial sectors or to subsidize the residential sector in areas adjacent to natural gas fields. Excessive government intervention in natural gas pricing has discouraged exploration, development, and production of natural gas in many Asian countries, leading to less natural gas consumption.

These four factors combined have contributed to a low level of gas consumption in Asia. Promoting gas consumption did not become a priority for national governments until the economic boom of the 1980s generated the skyrocketing energy needs of the 1990s.

Overcoming Infrastructural Obstacles to Natural Gas Utilization

One of the major areas where natural gas competes with other fuels is power generation. While natural gas, especially gas imported via pipelines or as LNG, has higher fuel costs, the capital investment for gas-fired plants is generally lower than for building similar plants using coal or fuel oil. Overall, natural gas can compete with coal and fuel oil if high environmental standards are set that require that clean fuel-oil burning and coal-fired plants be equipped with flue gas desulfurization (FGD) units. Ultimately, which fuels should be used, and at what plant-construction costs, will vary between different locations in different countries, and with the environmental regulations that are adopted.

The most serious impediment to greater use of natural gas in the Asia Pacific region is the lack of infrastructure, and this is the single most important problem facing the natural gas industry in Asia today. The big natural gas users (Japan, Korea, and Taiwan) and the emerging users (India and China)

The most serious impediment to greater use of natural gas is the lack of infrastructure

all face massive infrastructure expenditures which will increase the overall cost of using natural gas. In the meantime, competitive gas-pricing mechanisms should be established to encourage natural gas development, to increase domestic natural gas supplies, and to make those supplies more accessible to potential consumers.

The crucial role of governments. If desirable policies are pursued, infrastructural issues can be addressed partially through private sector investments, especially in commercially viable projects such as LNG terminals and gas distribution networks. However, for bigger projects with longer commitments, such as long-distance pipelines, a precondition for attracting private sector investment will be strong government support.

Since the mid-1990s, a wave of privatization and deregulation has been spreading across Asia. In almost every case, decision-making processes are being delegated to the end-users who, with the help of banks, are increasingly making the key investment choices. Under these circumstances, project financing avoids mega-projects that require long-term commitments predicated on expectations of enduring, robust economic performance. This problem is more complex for pipeline gas than for LNG. Pipeline project costs are enormous, running anywhere from US\$10 to \$30 billion. Moreover, the pipelines are long—2,000–7,000 kilometers (1,200–4,500 miles)—and usually involve broad cross-border issues. No private company can provide enough guarantees to convince international banks to finance such large projects over such long periods of time.

Therefore, governments, although they may wish to rely on private sector investment, have an important role to play in promoting risk management, a competitive investment environment, and access to funds through trade, legal, fiscal, and policy frameworks. At least some recognition of this is increasingly evident in recent projects undertaken within the Asia Pacific community. For example, the Energy Working Group (EWG) of the Asia-Pacific Economic Cooperation (APEC) spawned a Natural Gas Initiative in 1997. Under this initiative, the East-West

Center, in collaboration with the U.S. Department of Energy, prepared reports and recommendations for the APEC Energy Ministers. In 1998, the Energy Ministers were presented with, and approved, a set of recommendations for accelerating investment in natural gas markets in the region. Advances toward implementation of these recommendations were made at a series of meetings held in spring of 1999, which included an Investment Workshop, the inaugural meeting of the EWG Business Network, and an EWG meeting of government representatives. In these and any other efforts business will have to play a key role in motivating and driving the process, and in defining for such groups what it needs in terms of frameworks. This is critical to minimizing obstacles and diversions in what is a highly political and very sensitive process.

Conclusion

So why should governments and industry bother with such efforts, and what about community and citizen end-users? Promoting the necessary frameworks for expansion of gas use in the Asia Pacific community is a win-win (actually win-win-win) undertaking. Individual energy end-users win because gas is more efficient—which can mean it is cheaper—and cleaner. It emits not only less greenhouse gases, but also far fewer pollutants which are carcinogenic or otherwise unhealthy. Business wins because it sees gas as a good investment—both gas exporters and gas importers can benefit from the increased market activity. Finally, governments can also benefit when their citizens and industries benefit. Some governments will win due to increased energy security (rising from reduced reliance on oil and stronger functioning gas markets) and improved geopolitical relationships. To achieve these benefits, business and governments must work together to develop the necessary trade, legal, fiscal, and policy frameworks. End-user citizens should also be engaged in the process; otherwise, they may fail to support the efforts. All of this needs a committed, common effort from the Asia Pacific community. It is a sound investment for the twenty-first century.

***Promoting
expansion of gas
use in the Asia
Pacific community
is a win-win-win
undertaking***

Notes

ⁱ The Asia Pacific region or Asia is defined as East Asia, South-east Asia, South Asia, Australasia, and the Pacific Islands.

ⁱⁱ Fesharaki, Fereidun, "Energy and Asian Security Nexus," *Journal of International Affairs*, Fall 1999, Vol. 53, No. 1, pp. 85–99.

ⁱⁱⁱ CEDIGAZ, *Natural Gas in the World*, 1999 Survey, Paris, October 1999.

^{iv} BP Amoco, *BP Amoco Statistical Review of World Energy*, June 1999.

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