

ASIA/GAS POWER

CAN NATURAL GAS BRIDGE ASIA'S POWER GAP?

The developing countries in the Asia Pacific region (encompassing China, Indonesia, Malaysia, Papua New Guinea, Philippines, Thailand and Vietnam) are energy hungry. Their formidable economic growth, fuelled by booming industries, is creating momentous demand for investment in new infrastructure, in particular in the electricity sector. Demand for power is increased further by continued population growth and rising living standards in the region. The International Energy Agency (IEA) forecasts an annual growth rate for power consumption of 5% a year in China and approximately 4% for the rest of the region. In terms of power generation capacity, this translates into an additional 1,089 GW for China alone before 2030, representing an approximate investment of \$3trn. *By Sophie Guiny, associate and Diane Rudo, senior energy adviser, Taylor de Jongh.*

INCREASING POWER GENERATION capacity presents two key issues: the choice of the fuel for new power plants, and the environmental impact of increased energy use. Emerging Asian economies have traditionally relied on coal as their dominant fuel for power generation, with a small share of the electricity generated by natural gas and hydropower. Coal is abundant, but

generates more polluting emissions than natural gas or hydropower. Most developing Asian economies have some level of natural gas reserves; however, these are not always fully exploited. Natural gas could therefore play a critical role in fueling Asia's industrialisation, provided natural gas power plants are economically viable and financially feasible.

When taking into account environmental criteria, natural gas appears to be a promising fuel for Asian power plants. Natural gas produces only a fraction of the NOx and CO2 emissions that coal produces, with almost no particulate matter or sulphur dioxide emissions. Combined cycle and gasification technology (CCGT) is being used in generation facilities in developing Asia. Photograph by Carolina K. Smith, supplied by Dreamstime.com, January 2007.

Fuel Comparisons

For most developing Asian economies, coal has been and will continue to be a dominant fuel used in electricity generation due to its abundance, but this situation presents environmental issues. In China, coal-fired power makes up a prodigious 83% of the country's total generation capacity, in contrast to only 2.1% for natural gas. The exception in the region is Thailand, where natural gas makes up 70% of the country's power generation capacity. Coal is particularly attractive because it is abundant, has lower infrastructure requirements and costs less to transport than other fossil fuels. It also does not require complex storage facilities. At the same time, coal-fired power plants have higher construction costs than other types of power plants, and, for technological reasons, their generation capacity is less flexible at meeting demand variations. Coal is therefore fundamentally utilised in Asia as a base load fuel. Yet, with traditional pulverised coal (PC) technologies, the emissions of sulphur dioxide (SO₂), nitrogen oxide (NO_x), carbon dioxide (CO₂) and particulate matter, are substantially contributing to degraded air quality throughout Asia.

Recent breakthroughs, such as integrated gasification-combined-cycle (IGCC), manage to reduce SO₂, NO_x and particulate matter emissions by 90%. But existing and planned units are currently limited to the US and

European markets, mostly because this new technology comes at a greater cost – 15-20% more than conventional PC units. However, IGCC is unable to eliminate CO₂ emissions, a problem that current carbon capture and storage (CCS) research aims to address. The technology, sometimes touted as “clean coal”, is not likely to reach developing Asia for a few more years, too late for immediate power needs.

When taking into account environmental criteria, natural gas appears to be a promising fuel for Asian power plants. Natural gas produces only a fraction of the NO_x and CO₂ emissions that coal produces, with almost no particulate matter or sulphur dioxide emissions. Combined cycle and gasification technology (CCGT) is being used in generation facilities in developing Asia. Because construction costs and time requirements are lower relative to other plant types, CCGT has often been used to provide peak load power. CCGT plants are also more flexible than coal-fired plants in being able to be adjusted to demand. Regarding efficiency, measured in terms of delivered energy and heating value of the fuel, current generation CCGT plants average 50%, compared to only 36% for PC plants. Although construction costs for CCGT plants are lower than for coal-fired power plants, natural gas as a fuel is generally more expensive than coal. A recent global increase in demand has led to a peak in coal prices, but coal prices are still expected to remain below natural gas and oil prices in the future.

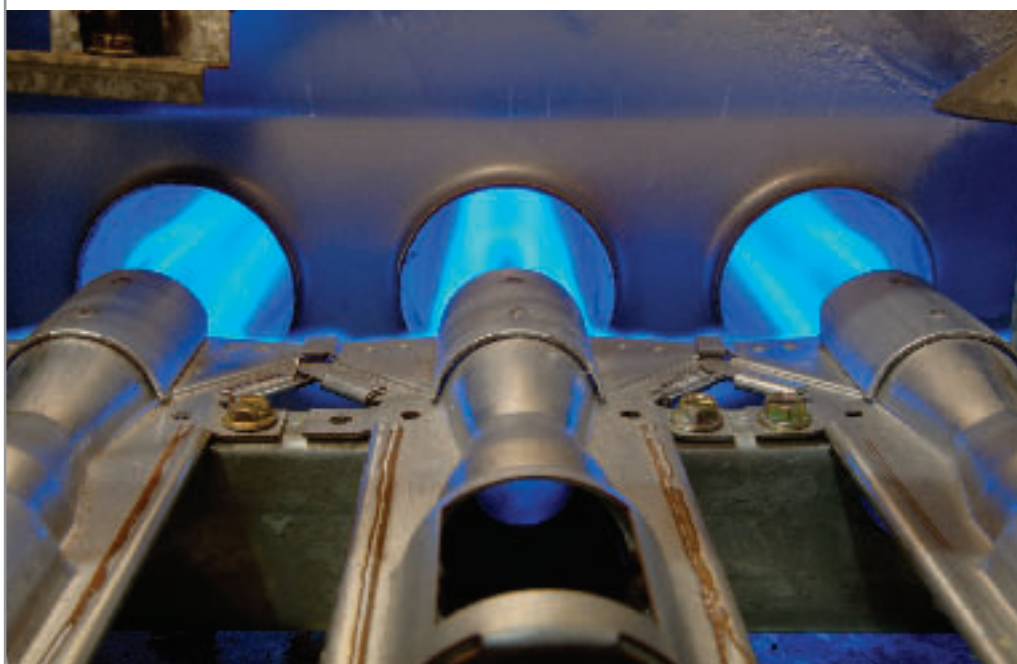
Coal and natural gas face limited competition from other fuels in the Asia Pacific region, with the exception of hydroelectricity. Hydropower is gaining importance in

China and Vietnam, but it will eventually run into resource limits. Moreover, hydropower is affected by seasonal variations. China and Vietnam are the only two emerging economies in the region currently planning new nuclear facilities. New renewable sources of energy, such as biomass, wind and solar, will also grow, but are expected to stay well below 5% of total generation capacity.

Determining factors of natural gas usage

Given these basic trends, the factors that will determine the development of natural gas facilities include its price – especially relative to coal – its availability, the development of environmental regulations and national energy strategies. Natural gas prices have risen sharply over the past few years, driven by increased demand and tight supply. Countries that are net importers of gas are more likely to be affected by increasing prices, as that will negatively affect the competitiveness of natural gas compared with coal. Most developing Asian economies, however, have sufficient domestic natural gas reserves to enable the development of gas-fired power generation at a reasonable cost. Such is the case for Indonesia, Malaysia, the Philippines, Thailand and Vietnam. The Philippines has successfully used gas from its Malampaya field to fuel three power plants and Vietnam is implementing a similar strategy for the Nam Con Son basin.

China, on the other hand, does not have sufficient natural gas reserves to support a projected annual GDP growth averaging 6.5% over the next 15 years, for which capacity additions of 44,000 MW per year are needed. This translates into one world-scale power plant, per



Cross-border policies, such as the Clean Development Mechanism (CDM), whereby certain developed countries may receive financial credits for building clean energy projects in developing countries, may also play a role. China currently accounts for approximately 60% of carbon credits trading under the Kyoto CDM system, with notable projects including the world's largest coal-bed methane power project under way in the Shanxi province. Photograph of a natural gas fired power plant, photographed by Mosista Pambudi, supplied by Dreamstime.com, January 2007.

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week, needed to be build for the next 15 years! The government hopes to reduce pollution and to diversify its sources of energy by bringing the share of coal down from 83% to 60% of the total generation capacity by 2020. China is therefore increasingly looking at LNG, as well as pipelines from Russia, as potential sources of natural gas supply. One LNG development strategy is to plan associated gas-fired power facilities; this model is being implemented for the Guangdong Terminal, China's first LNG terminal under construction.

As is the case in China, the development of the natural gas sector throughout Asia will depend on factors beyond market forces. Governments play a decisive role in shaping energy strategy and determining the fuel choices for new power plants, as well as the development of related natural gas infrastructure (pipelines, LNG terminals, storage). Governments are also responsible for determining the priority of uses for domestic natural gas reserves. Export strategies, such as the ones practised by Indonesia, can come in conflict with the use of natural gas for domestic power projects. While Indonesia is one of the largest exporters of LNG in the world, the country's significant gas potential has been slow to come online. Unfavourable revenue sharing arrangements and subsidies for domestic industries have depressed investor returns. Furthermore, oil product subsidies have dampened incentives for the further development of a domestic gas market. As a consequence, state-owned electricity firm PT PLN plans to increase capacity by 35% by building an additional 10,000 MW of coal-fired generation capacity.

Governments may not always consider power to be the "best" use for natural gas, particularly because it does not bring foreign exchange into the country. Exporting gas in the form of LNG or using it to fuel the petrochemical sector can be perceived as having a higher value added for a developing economy than power generation, especially if decision makers think that the power needs can be satisfied by coal. Malaysia has followed a strategy where new power plants will be coal-fired in order to free the gas for export.

For most developing Asian economies, however, environmental issues are becoming more pressing and could be a motivating factor in favor of natural gas. Environmental policies such as emissions controls and the development of emissions trading markets are beginning to be put in place in developing Asia. For instance, China recently announced plans for a domestic SO₂ emissions trading market. Cross-border policies, such as the Clean Development Mechanism (CDM), whereby certain developed countries may receive financial credits for

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A case for public/private partnership

For most emerging Asian economies, the development of the natural gas sector cannot be done purely by the public sector. Developing a country's natural gas sector is a complex and challenging process. While national energy companies are crucial in determining strategies and proposing projects, private companies can bring in know-how and much needed equity capital to the projects. Building multiple gas-fired power plants is an extremely capital intensive endeavor, which requires an appropriate framework and the commitment of a wide variety of public and private sector players.

A successful example of this strategy is the series of gas-fired power plants built in Vietnam. Phu My 2-2, which came online in 2005, was the first Build Own Transfer (BOT) scheme and largest project finance deal to date in Vietnam at its closing. Loans were partially guaranteed by multilateral banks such as the Asian Development Bank, which also created an arrangement with a private risk insurer that was the first of its kind. Key to success were the sound prospects for continued electricity demand growth, the strong long-term power purchase and supply contracts, reputable private project sponsors, and the commitment of the government and the World Bank.

Despite a few difficulties, Vietnam has since used the same framework for other projects at Phu My and for the planned O-Mon project. Vietnam is not the only country to favour private sector initiatives for the development of its power infrastructure. The power sector has finally seen a rebound since the Asian financial crisis, and new gas-fired Independent Power Projects (IPP) are planned in Thailand as well.

Gas-fired IPPs are poised to play an important part in bridging developing Asia's power gap. Environmental benefits can make natural gas more attractive than coal despite its cost, and the private sector can bring in the much needed capital to develop new power plants. Important conditions for success are clear energy policies encouraging the development of natural gas and stable favorable investment frameworks. The current industrial boom in Asia and renewed attention surrounding environmental issues make the development of natural-gas fired generation a timely opportunity for the region.