



**Asian LNG Trade and Gas Market Reform:
Implications for Gas and Power Consumers**

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Oxford Institute for Energy Studies

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CONTENTS

	Page
ABSTRACT	1
1. Northeast Asian Imports and Southeast Asian Exports	2
2. Gas and Power Markets in Southeast Asian Exporting Economies	4
3. Potential for Energy Market Reform in Southeast Asia	7
4. Gas and Power in Northeast Asian Importing Economies	11
5. Potential of Reform to Reduce Gas Transportation Costs	13
SUMMARY OF CONCLUSIONS	18
REFERENCES	19

FIGURES

Page

Figure 1.	LNG Imports into Northeast Asia in 2003 by Exporting Economy	3
Figure 2.	LNG Imports into Northeast Asia in 2003 by Exporting Market Type	3
Figure 3.	Some APEC Economies with Large Natural Gas Reserves	9
Figure 4.	Indicative LNG Terminal Charges in APEC Economies and Europe, 1999	14
Figure 5.	Sectoral End-Use Gas Prices and Crude Oil Prices in Japan, 1985-2000	15
Figure 6.	Industrial Gas Prices in Japan, Korea, Chinese Taipei and Thailand	16
Figure 7.	Household Less Industrial Gas Prices in Selected APEC Economies	17

ABSTRACT

Asia's three largest gas consuming economies – Japan, Korea and Chinese Taipei – are heavily reliant for their gas supplies on Asia's three largest gas producing economies – Brunei, Malaysia and Indonesia – as well as on Middle Eastern economies of OPEC. As a result, the potential benefits of reform in gas-importing economies are limited by the pace of reform in gas-exporting economies. And since a large share of electricity is produced from gas, this constraint will affect not only gas prices but also power prices. But some gas-exporting economies are starting to reform their gas markets to position themselves more competitively vis-à-vis other gas exporting economies. And importing economies should continue to reform their gas markets, despite their limited ability to affect gas commodity costs, since competition might greatly reduce gas transport costs.

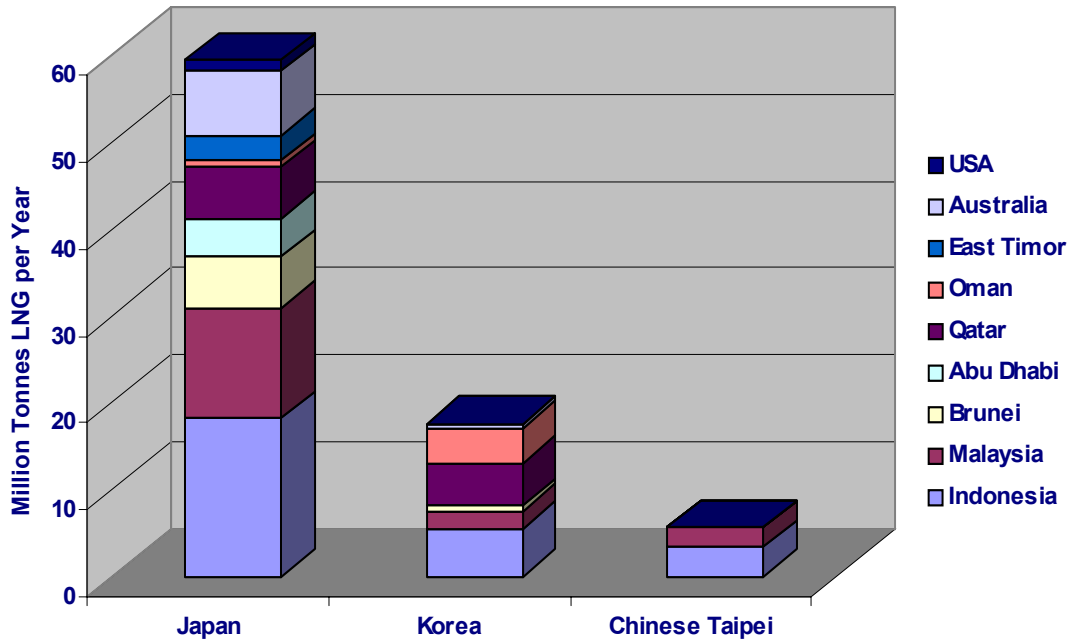
1. NORTHEAST ASIAN IMPORTS AND SOUTHEAST ASIAN EXPORTS

In principle, Japan, Korea and Chinese Taipei have a significant degree of wholesale competition in their gas markets. In Korea and Chinese Taipei, a single gas supplier purchases gas from competing producers for customers of all types. In Japan, the electric utility in each of several electric service areas buys gas from various gas producers for itself, while the gas utility in each of several gas service areas buys gas from different producers for industrial and residential customers.

But all three gas-importing economies are highly reliant on LNG supplies from Southeast Asian gas exporters, namely Brunei Darussalam, Indonesia and Malaysia. LNG imports account for nearly all gas used in Japan and Korea and 95 percent of gas supplied in Chinese Taipei. But each of the LNG-exporting economies has had a vertically integrated gas market with a single gas producer and exporter. Moreover, the bulk of exporters' gas resources have been controlled by the state. Hence, gas prices in Northeast Asian importing economies depend not only on the design of their domestic gas markets, but also on gas market design in Southeast Asian exporting economies.

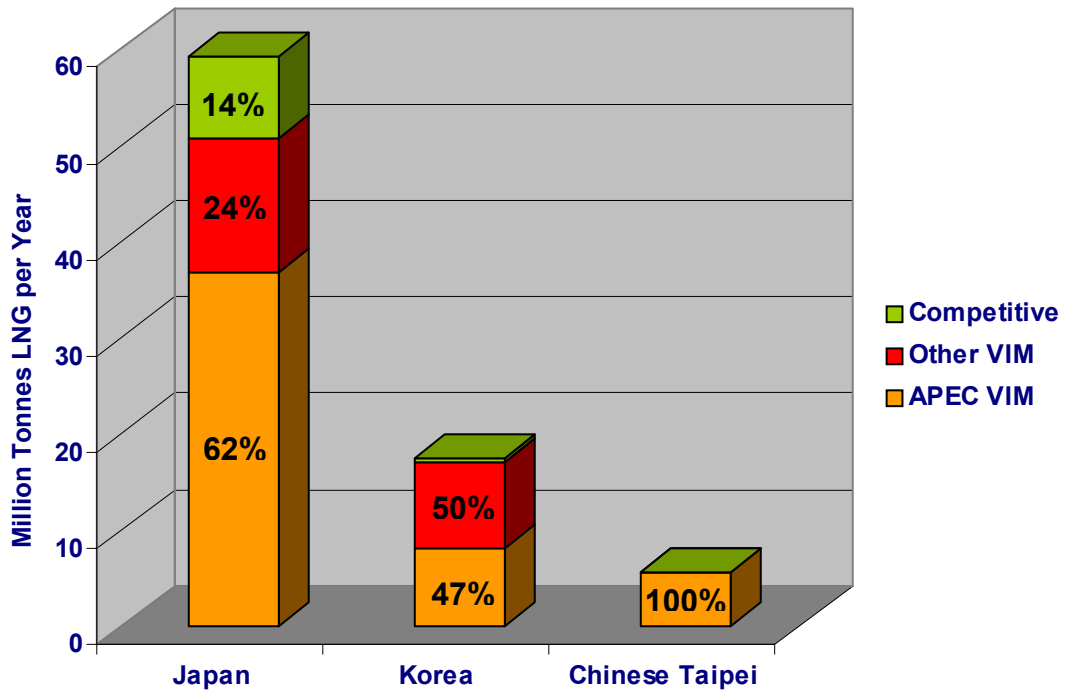
Economies from which Northeast Asia imports LNG under long-term and medium-term contracts are shown in figures 1 and 2. The largest share of the imports comes from the aforementioned Southeast Asian economies with vertically integrated gas monopolies. Together, these account for 62 percent of contract volumes in Japan, 47 percent in Korea and 100 percent in Chinese Taipei. Another large portion of the imports comes from other economies with vertically integrated gas monopolies, including Abu Dhabi, Qatar, Oman and East Timor; all but the last of these are members of the Organisation of Petroleum Exporting Countries (OPEC) located in the Middle East. These account for another 24 percent of the LNG imports in Japan and 50 percent in Korea. Only 14 percent of the LNG in Japan and 3 percent in Korea (and none at all in Chinese Taipei) comes from APEC economies with competitive gas markets, namely Australia (with several competing producers) and the United States (with hundreds of producers).

Figure 1 LNG Imports into Northeast Asia in 2003 by Exporting Economy



Source: IEEJ (2002), IEA (2002c), Cedigaz (1999).

Figure 2 LNG Imports into Northeast Asia in 2003 by Exporting Market Type



Asian gas producers have significant market advantages over more distant competitors in selling gas to Asian gas consumers. Not only do the Asian producers have lower transport costs stemming from their greater proximity to importing markets, but they also may well have lower production costs than competing exporters with relatively depleted gas fields. With lower production and shipping costs, it should be possible for Asian gas producers to sell to Asian gas consumers at a “competitive” price even if their integrated monopolies result in production that is less efficient and more costly than it would be if several gas producers in each exporting economy were competing. This may mean that importing economies, even if they develop highly competitive gas markets internally, may not be able to obtain fully competitive bids for their purchases of gas from abroad.

Within the Asia Pacific Economic Cooperation (APEC), which consists of 21 economies on both sides of the Pacific, this analysis indicates at least two ways in which Northeast Asian APEC economies might benefit from gas market reforms in other APEC economies. One way would be to import a greater share of gas from the economies that already have competitive gas markets, such as Australia, Canada and the United States. But given the current shortage of gas in North America, as reflected in sharp price increases, the overall potential for this option appears limited. The other option would be for the exporting economies with vertically integrated gas markets to make their gas markets more competitive. In view of the greater abundance and proximity of undeveloped gas reserves in Southeast Asia, the latter route may have more potential if exporters are willing to follow it. Northeast Asian economies can also help to limit the cost of gas to their consumers by fostering greater competition and efficiency in their gas transportation networks.

2. GAS AND POWER MARKETS IN SOUTHEAST ASIAN EXPORTING ECONOMIES

Brunei Darussalam, Indonesia and Malaysia are mature gas exporters with vertically integrated monopolies in their internal gas markets. Brunei has been exporting gas since 1972, Indonesia since 1977, and Malaysia since 1983. The internal gas market in each of these economies is dominated by a single state-controlled firm that produces gas and

transports it to local users. The dominant firm produces all the gas in Indonesia and Malaysia and 90 percent of the gas in Brunei Darussalam. All gas transmission over high-pressure pipelines is controlled by the dominant firm in Brunei and Malaysia, while the function is shared with another government-controlled firm in Indonesia.

Each of these economies also has a high degree of vertical integration between its gas and power markets. A large share of power is generated from gas, and electricity generators can only purchase gas from the state-owned gas supplier. Gas fuels very nearly all electricity production in Brunei, around 80 percent in Malaysia, and over 30 percent in Indonesia. Thus, inefficiencies in gas production or transportation could be readily passed on to power producers, who have no alternative supplier of gas and little flexibility to shift to other fuels in response to higher prices. It is difficult to gauge the extent of such inefficiencies, or the extent to which they are passed on, since information on production costs is closely held and the optimal mode of production is specific to each gas field. But with a dominant supplier in each case, such inefficiencies are likely.

Since all power producers in these economies must obtain gas from the single buyer, their fuel costs will not differ much and the effective scope for competition among them will be limited to capital costs and non-fuel operating costs. Since Malaysia and Indonesia have in fact liberalised their wholesale power sectors, with 43 percent of electricity in the former and 9 percent in the latter generated by independent power producers, this is of more than theoretical significance. Further gas market reform, with retail competition and all power producers allowed to shop directly for the lowest-cost gas or import their own, would greatly enhance the impacts of power market reform in these economies.

Regardless of their relation to costs, gas prices to power producers in these economies are held substantially below gas export prices. In Brunei, where all power is produced and transported by a government agency, it is not clear whether all the savings are passed on to electricity consumers. In Indonesia and Malaysia, too, despite wholesale competition from IPPs, the continued presence of a single buyer for power means that

there is still no guarantee that fuel price cost savings will be passed on to power consumers.¹

The electricity sector's share of gas demand exceeds 50 percent in Malaysia, 30 percent in Brunei and 20 percent in Indonesia.² Thus, the impact of reforms in the gas market would be significantly enhanced if there were parallel reforms in the electric power market. Indonesia and Malaysia, despite the important role of independent power producers, retains a single buyer-retailer in its power market. That single buyer may not pass on to consumers all cost reductions from a more competitive gas market just as it may not fully pass on savings from low gas prices offered by the gas monopoly today.

The potential for inefficiencies in production of gas is limited, in major gas-exporting economies, through the mechanism of production sharing contracts (PSCs). International oil and gas companies have competed for roles in existing PSCs, and several different companies are operating in each of these economies. However, since each PSC provides a defined share of production revenues at a given gas field over a long period of time, in return for production activity over that period of time, there is limited assurance that cooperating companies will not develop inefficiencies in the course of their contracts.

Beyond this, Indonesia has recently taken some remarkable steps toward opening up its gas market to wholesale competition. Pursuant to the Law Concerning Oil and Natural Gas of 2001, the state-owned integrated monopoly, Pertamina, no longer has to be included in production sharing contracts as of late 2003. With respect to new gas field developments and expiring contracts at existing developments, the various gas companies operating in Indonesia will be free to operate as independent producers or consortia.³ Insofar as the share of competitive gas production in Indonesia grows, so will competition in the economy's gas market.

¹ Asia Pacific Energy Research Centre (2003), page 15.

² Asia Pacific Energy Research Centre (2002).

³ Republic of Indonesia, People's Legislative Assembly (2001a) and (2001b).

3. POTENTIAL FOR ENERGY MARKET REFORM IN SOUTHEAST ASIA

A recent study on *Deregulating Energy Markets in APEC* has estimated that major benefits would flow from comprehensive liberalisation of energy markets in APEC economies. These would include higher productivity, lower energy prices, and greater output. The economic boost would be greatest for economies with large energy sectors since a relatively large share of their output would be directly affected by the reform.⁴

APEC-wide energy market reform would substantially increase demand for gas by making it more competitive with other fuels for power generation, the study finds. Natural gas consumption in 2010 would increase by nearly 5 percent in APEC as a whole, but more in those economies that are furthest from competitive energy markets and in which gas use is already important. LNG imports in 2010 would be 8 percent higher in Japan and 10 percent higher in Korea than in reference case projections.

Reform of energy markets in the APEC region would have an even greater impact on production of gas supply. More efficient production and reticulation of gas would make APEC economies more competitive, increasing gas exports outside the region. This impact would be greatest in those economies that have the least competitive gas markets and largest indigenous gas reserves. The study projects that gas production in Indonesia, Malaysia and Mexico would increase by 14 to 20 percent. Their exports would grow because they have large gas reserves and because they would become more competitive with other major gas-exporting economies like Canada. However, growth in exports could be lower than projected in the study if domestic gas use were to grow more rapidly than anticipated.

If the gas sector were liberalised but other energy sectors were not, the benefits would be substantially reduced. Gas represents only a small share of energy production and use in APEC, and roughly four-fifths of APEC gas production occurs in Australia, Canada and the United States, which “already have relatively open and competitive gas markets.” But economies with sizeable gas reserves, like Malaysia and Indonesia, would

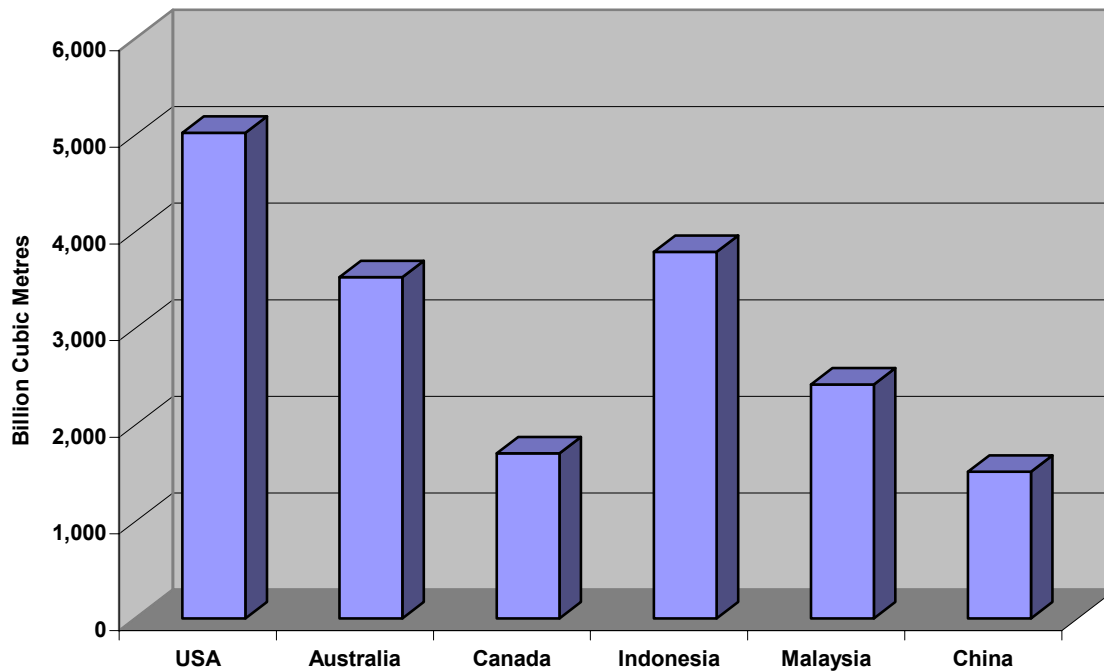
⁴ APEC Energy Working Group and Abareconomics (2002).

still benefit substantially from gas market reform because they would become much more competitive with other gas producing economies. For Indonesia, the study finds reform of gas markets alone would boost gas exports in 2010 by 20 percent, almost as much as with reform of both gas and power markets.

The potential for real competition in Indonesia's gas market, and in Malaysia's should reforms be implemented, would seem to be substantial, as indicated by the reserve numbers in figure 3. The United States, with about 5,000 Bcm of gas reserves, and Canada, with around 1,700 Bcm of reserves, has hundreds of competing gas producers each. Indonesia has some 3,800 Bcm of gas reserves while Malaysia has about 2,400 Bcm. Since their gas reserves are much larger than Canada's, it would seem that they could have quite a number of competing producers on an economical scale.

Since Indonesia and Malaysia have major share of their gas resources offshore, it might be argued that the economies of scale are substantially different than in North America, where most resources have traditionally been on land, making it easier and cheaper for small producers to spring up. But this is more an argument about the degree of competition that might be feasible than about whether competition is feasible at all. If hundreds of producers can compete economically onshore in North America, perhaps only tens of producers could compete economically offshore in Southeast Asia, but that would still be sufficient to foster a competitive marketplace. Indonesia, which has several offshore fields and several different international oil companies involved in their operation, seems to have recognised this in deciding to implement competitive reforms.

Figure 3 Some APEC Economies with Large Natural Gas Reserves



Source: Cedigaz, as cited in International Energy Agency (2002b)

Brunei has much smaller gas reserves, but they are comparable to those of Thailand and roughly double those of the Philippines, both of which have embarked upon a path of gas market reform. The Philippines are an emerging gas market with just a single source of domestic gas supply. Yet they are already considering detailed plans for moving toward deregulated production and open access to transportation facilities. According to official proposals circulated in 2002, all suppliers would have access to spare capacity on the existing pipeline, as well as capacity at any new LNG terminals and pipeline facilities, on a non-discriminatory basis.⁵ Thailand has increasingly vigorous wholesale competition in its gas market, with several different suppliers. Competing gas producers obtain negotiated access to pipelines of the publicly-owned Petroleum Authority of Thailand and are to be guaranteed open and non-discriminatory access to transmission facilities from 2006.⁶ In both economies, virtually all gas production is destined for domestic use, so gas market competition is seen by the government as having clear benefits for the public.

⁵ Department of Energy (Republic of the Philippines) (2002).

⁶ Energy Policy and Planning Office (Thailand) (2002).

Even without full-blown market reform, Brunei and Malaysia might take significant steps to enhance competition in their gas markets. Within the existing system of production sharing contract system, a more competitive bidding process for new contracts might be instituted. This could help ensure that the most efficient and innovative firms are signed on to assist the state monopoly in exploiting gas resources. Alternatively, or in addition, targets might be set for raising efficiency within production sharing agreements that are ongoing. For example, targets might be set for million cubic metres of production per employee per year. Such targets might vary according to the maturity and output trends of different fields. More generally, a target could be set to improve the efficiency of all fields by a certain percentage per year for a certain number of years.

A more aggressive approach to gas market reform in these exporting economies might be to increase the number of individual entities that are allowed to compete in gas production. One way to increase the number of competing producers could be to split the state-owned monopoly firm into competing divisions, perhaps corresponding to different gas production fields. A further step to promote competition could be to divest the assets of the monopoly firm into competing firms. Yet another step might be to let private firms produce gas on their own, as recently decided in Indonesia. In any of these cases, for competition in the gas market to be effective, transportation services would have to be provided to all competing producers on a non-discriminatory basis.⁷

GAS MARKET MODELS IN APEC ECONOMIES

Mature Exporters with Vertically Integrated Monopolies

Brunei Darussalam, Indonesia, Malaysia

Recent Developers with Vertically Integrated Monopolies

Papua New Guinea, Peru, Philippines, Viet Nam

Dominant Supplier with Competition at the Edges

Hong Kong, Mexico, New Zealand, Russia

Dominant Supplier with Disincentives for Domestic Gas Transport

China, Russia

Importers with Wholesale Competition and Single Buyers

Japan, Korea, Singapore, Chinese Taipei, Thailand

Evolving Retail Competition and Customer Choice

Australia, Canada, Chile, United States

4. GAS AND POWER MARKETS IN NORTHEAST ASIAN IMPORTING ECONOMIES

Gas and electricity markets in Northeast Asian economies are closely linked. Sales to electricity generators account for a large and growing share of gas demand – roughly 40 percent in Korea, 50 percent in Chinese Taipei and 60 percent in Japan.⁸ So gas market reforms that make gas supply more competitive will have a greater impact if competitive power markets oblige electricity generators to vie for the lowest-cost gas.

Conversely, gas accounts for a large and growing share of electricity generation. The gas share of generating capacity was 26 percent in Korea, 22 percent in Japan and 14 percent in Chinese Taipei in 1999. In Korea and Chinese Taipei, the gas share of generating capacity will soon be approaching 30 percent.⁹ So reforms aimed at encouraging greater competition in power markets will have a greater impact if there are also gas market reforms that make it possible to buy gas from the cheapest supplier.

Gas and power markets in Northeast Asia are vertically integrated not only because a large share of power is generated from gas but because all gas-fired power plants must obtain fuel through a single gas buyer. There is growing competition from independent power producers (IPPs), which accounted for 14 percent of generating capacity in Korea in 2000 and 15 percent in Chinese Taipei in 2002. But all power producers must buy gas from the same supplier. So the scope for competition among gas-fired plants, which account for a very large share of new generating capacity, is limited to capital and non-fuel operating costs. Moreover, with the large share of capacity that is gas-fired, power producers have limited flexibility to shift to other fuels in response to higher prices. Thus, the single gas supplier has significant market power to pass on inefficiencies in gas procurement, shipping and processing, as well as in the construction and operation of LNG facilities and pipelines, in higher gas prices to power producers.

⁸ Asia Pacific Energy Research Centre (2002).

⁹ APEC Energy Working Group (2002).

The Japanese case is somewhat particular in that there is a dual buyer for gas in most regions rather than a single buyer. Electric utilities import their own gas through their own LNG terminals, while gas utilities import gas for industrial, commercial and residential consumers through separate LNG terminals. Moreover, there is little competition in wholesale power markets, where IPPs account for less than 1 percent of generation and generating capacity. [In the retail power market, only large industrial firms, representing about a quarter of electricity demand, have a choice of suppliers.] So with respect to the power sector, the electric utility in each region is in effect the single gas supplier to itself. It can often pass on inefficiencies in procurement, shipping and processing, as well as in the construction and operation of LNG facilities, in higher prices to electricity consumers, most of whom who have few alternative power sources.¹⁰

Northeast Asian economies have embarked upon reform efforts which should eventually open up their gas markets to retail competition and thereby help to make their power markets more competitive as well. In Korea, a proposal was made in 1999 for KOGAS to provide open access to all LNG, pipeline and storage facilities as of 2003. To ensure that competing suppliers are treated in a non-discriminatory fashion, the proposal would divest KOGAS of most functions that do not relate to gas transportation. At a later stage, open access would be extended to gas distribution, with regional distribution monopolies unbundled into separate distribution and retail supply firms. Competing suppliers would then be able to use the distribution grid on non-discriminatory terms to bring gas to small residential and commercial customers. This would be a significant step since small consumers constitute two-fifths of Korea's gas market. However, it is not clear at what point or to what extent the reform proposal will be implemented.¹¹

In Japan, the Gas Utility Industry Law was amended in June 2003 to require that the owners of LNG facilities make public the amount of capacity at such facilities that is not being utilised, negotiate for use of such capacity by third parties, and explain why access to spare capacity is denied, if that is the case. The amended law will gradually extend access to natural gas pipelines to all customers, rather than just large industrial

¹⁰ Asia Pacific Energy Research Centre (2003), pages 17-18.

¹¹ International Energy Agency (2002d).

and utility customers, and to provide access to all pipelines, rather than just those owned by gas companies. As the amendments are implemented, Japan will have negotiated third-party access for LNG facilities and regulated third-party access for gas pipelines, expanding opportunities for competing gas retailers and power producers to enter the marketplace. Moreover, parallel amendments to the Electric Utility Industry Law will expand retail choice in the power market to customers accounting for over 60 percent of demand, so enhanced competition in gas will be carried over to a significant extent into power.¹²

5. POTENTIAL OF REFORM TO REDUCE GAS TRANSPORTATION COSTS

Northeast Asian economies are entirely dependent upon LNG imports for their natural gas supply. In these economies, the delivered price of gas depends not only on the landed cost of LNG fuel, but also on the charges for use of the LNG terminals and pipelines through which fuel is processed and transported to users.

In point of fact, LNG terminal charges vary enormously from one economy to another, as shown in figure 4. While they are usually around \$1 per million Btu in Europe and \$2 per million Btu in Korea, they typically range from \$3 to \$4 in Chinese Taipei and from \$5 to \$6 in Japan. Otherwise stated, LNG charges are double European levels in Korea, more than triple in Chinese Taipei, and up to six times higher in Japan.¹³

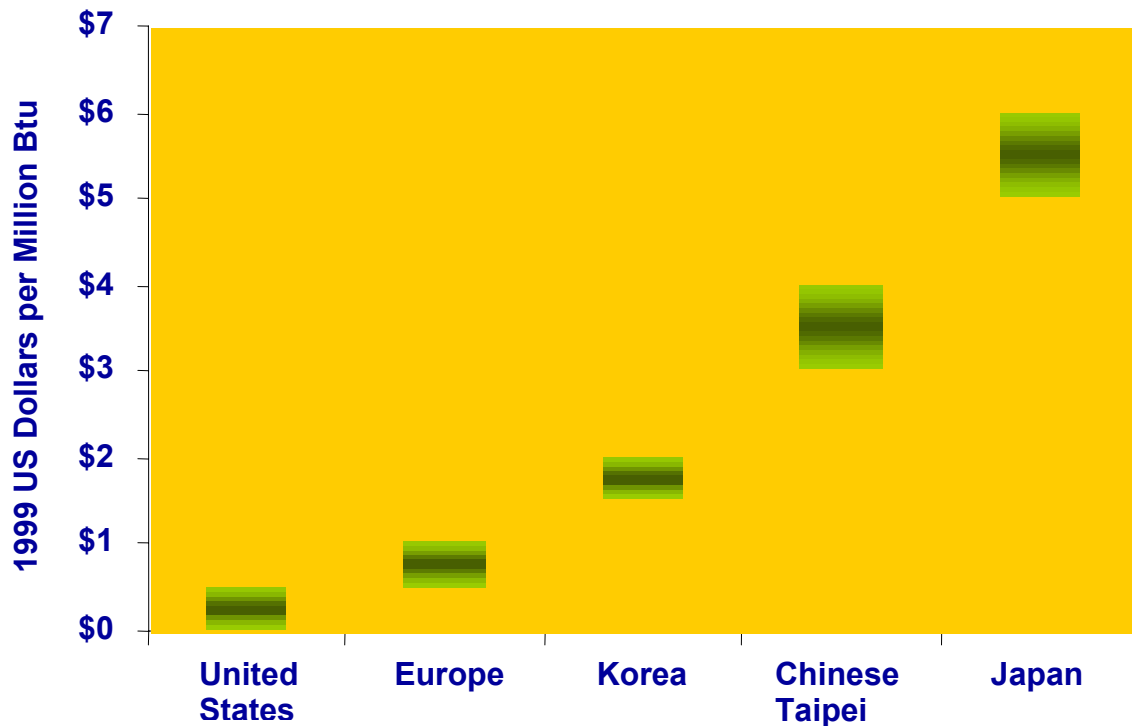
These three major gas-importing economies are located in the same region, with similar costs for the materials and equipment that would be involved in LNG terminal construction. While unit labour costs are substantially higher in Japan than in Korea or Chinese Taipei, labour costs should constitute a relatively small share of total costs in capital-intensive projects like LNG facilities. Moreover, unit labour costs in Japan should be comparable to those in Europe. Hence, the fact that LNG terminal charges vary by a factor of three within Asia and a factor of six among industrialised economies in Asia and Europe is difficult to explain other than in terms of the relative efficiency

¹² Government of Japan (2003). Ministry of Economy, Trade and Industry (Japan), 2003.

¹³ Williams (2003).

with which terminals are built and operated, or in terms of the share of terminal costs which gas importers (gas and electricity companies in the case of Japan) charge to customers. Thus, increased competition in natural gas supply might substantially reduce delivered LNG costs in Northeast Asian economies.

Figure 4 Indicative LNG Terminal Charges in APEC Economies and Europe, 1999



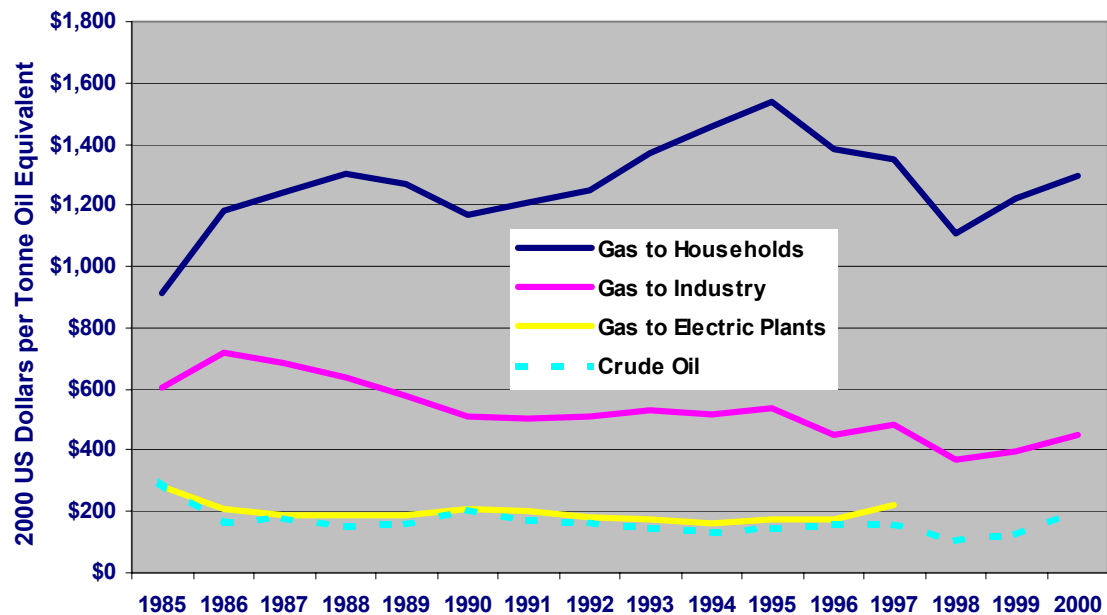
Source: Williams (2003)

An important component of delivered natural gas prices in Northeast Asia, on top of LNG commodity charges and terminal charges, is the cost of gas transmission and distribution by pipeline. Typically, costs to large industrial gas users will include a substantial charge for high- pressure pipelines, to which such users can often connect directly. Costs to residential and commercial customers, who cannot connect directly to the high-pressure grid, will also include a substantial charge for the low-pressure pipelines that distribute gas to individual buildings.

The role of pipeline transportation charges is well illustrated by the case of Japan, shown in figure 5. Electric utilities, which import their LNG directly into their own terminals, pay LNG prices that are linked by contract to crude oil prices. Industrial firms,

whose costs typically include a substantial charge for transmission over high-pressure pipelines, on average pay about twice as much for their gas as power companies. Households, whose costs include charges not only for transmission but also for local distribution, typically pay five or six times as much for their gas as power companies do.

Figure 5 Sectoral End-Use Gas Prices and Crude Oil Prices in Japan, 1985-2000



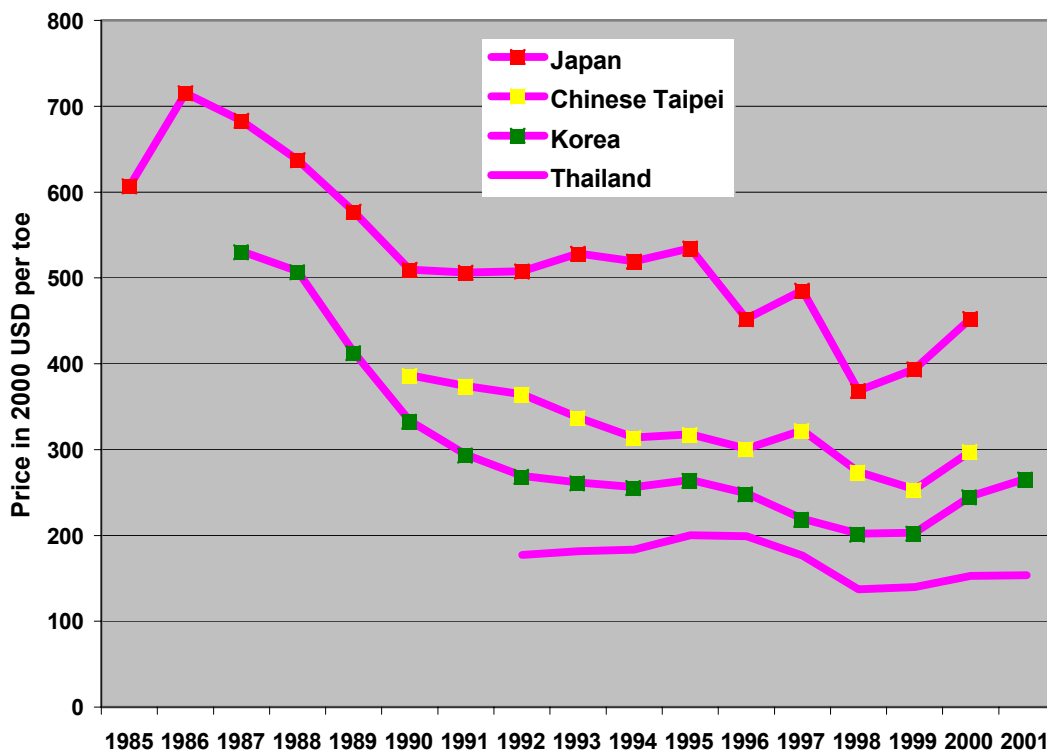
Source: International Energy Agency (1993), (1997) (2002a), (2002b). U.S. Department of Commerce price deflators

The burden of LNG terminal charges and high-pressure pipeline transmission charges to industry differs substantially among APEC economies in Southeast Asia. Delivered gas prices to industry are substantially higher in Japan than in Chinese Taipei or Korea, as indicated in figure 6. Delivered gas prices to industry in Thailand, where most gas is produced indigenously and transportation costs are therefore much lower, are shown as well for reference.

The potential for greater competition to reduce gas pipeline distribution charges would seem to be substantial, as shown in figure 7. The difference between industrial and residential gas rates in Japan since 1990 has ranged from US\$659 to \$1,003 per tonne oil equivalent. By comparison, the difference between industrial and residential gas rates

has ranged from \$112 to \$173 per toe in the United States, from \$101 to \$134 per toe in Canada, and from \$123 to \$191 per toe in Korea. Assuming that the difference between industrial and residential rates approximates distribution charges (which generally apply to residential customers but not industrial customers), distribution charges for natural gas in Japan each year have been about 4.3 to 6.6 times as high as those in the United States, 5.2 to 10.0 times as high as those in Canada, and 3.5 to 5.7 times as high as those in Korea. These numbers appear to imply some room for improving the efficiency of natural gas distribution by fostering competition among retail suppliers for residential customers' business.

Figure 6 Industrial Gas Prices in Japan, Korea, Chinese Taipei and Thailand

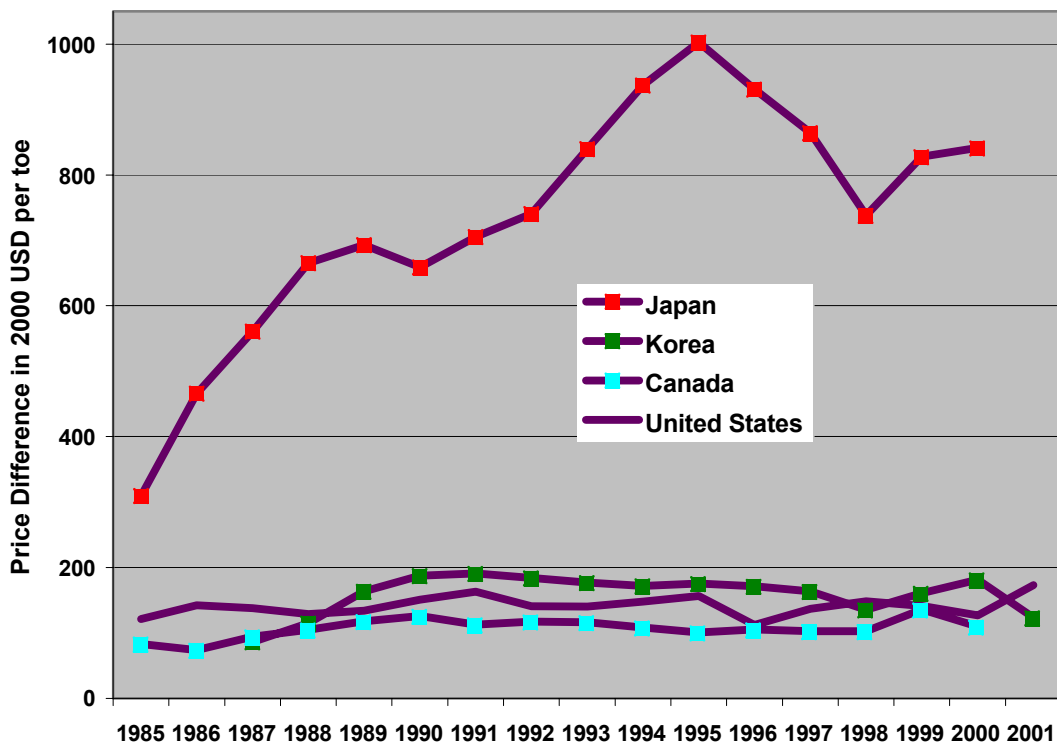


Sources: International Energy Agency, Korea Energy Economics Institute, Thailand Energy Policy and Planning Office

But figures on comparative distribution costs must be interpreted with caution, since a large portion of the price differential across economies is probably due to differences in the typical volume of household gas consumption. For example, while

average yearly household gas consumption is just 17.4 megajoules in Japan, it is about 61.7 megajoules in Korea, or about 3.6 times as great. Since the costs of extending distribution pipelines to households do not vary much with volume, this would imply that the distribution cost per household might well be 3.6 times as high in Japan as in Korea even if distribution systems were built and operated with equal efficiency. Yet there still appears to be room for efficiency improvement since the gap between industrial and household prices, a reasonable proxy for distribution costs, has been up to 5.7 times as high in Japan as in Korea during the 1990s, sometimes exceeding the 3.6 volume differential factor by half.¹⁴

Figure 7 Household Less Industrial Gas Prices in Selected APEC Economies



Sources: International Energy Agency, Korea Energy Economics Institute, US Department of Commerce

¹⁴ Figures for city gas utilities in Japan from IEEJ. Figures for city gas utilities from Korea City Gas Association (2002). The Korean figures include some distribution to commercial and industrial customers, whose average consumption is greater than that of household customers. Thus, average household gas consumption in Korea may be somewhat lower than 61.7 MJ and less than 3.6 times as great as in Japan, implying still greater room for efficiency improvement.

SUMMARY OF CONCLUSIONS

Several key points emerge from the preceding discussion:

- The success of gas market reform in Asian gas-importing economies depends in large part on the success of gas market reform in Asian gas-exporting economies, since greater competition holds the potential to limit gas production costs and prices.
- But Asian gas importers can benefit from gas market reform on their own, since greater competition can help to limit gas transmission and distribution costs.
- Gas and power markets in Asia are closely linked. Competitive reform of power markets cannot succeed without competitive reform of gas markets, and vice versa.

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