Pricing and Demand for LNG in China:

Consistency between LNG and Pipeline Gas in a Fast Growing Market

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PREFACE

The latter part of 2005 has witnessed a significant shift in Chinese LNG import policy, forced upon the country by price and market trends. Having announced plans for building up to 12 LNG terminals on the west coast of the country, Chinese gas companies began to find themselves being outbid by international competitors for LNG to supply those terminals. It was subsequently announced by the government that LNG import plans were being scaled down, at least in the short to medium term.

This paper explains the major reason why these events have happened. High priced LNG cannot compete in Chinese energy – especially power generation – markets, particularly against domestic coal. As long as prices remain around 2005 levels, it will be impossible for Chinese companies to buy substantial quantities of LNG in competition with other Pacific Basin buyers which are better able to pay high LNG import prices. It remains to be seen whether this development will promote the development of Chinese pipeline gas imports which may be cheaper than current LNG prices, and where the competition for large scale supplies is less intense.

We are extremely grateful to Akira Miyamoto and Chikako Ishiguro for writing this paper at a very critical time for Chinese LNG and gas development.

Jonathan Stern January 2006

1. INTRODUCTION

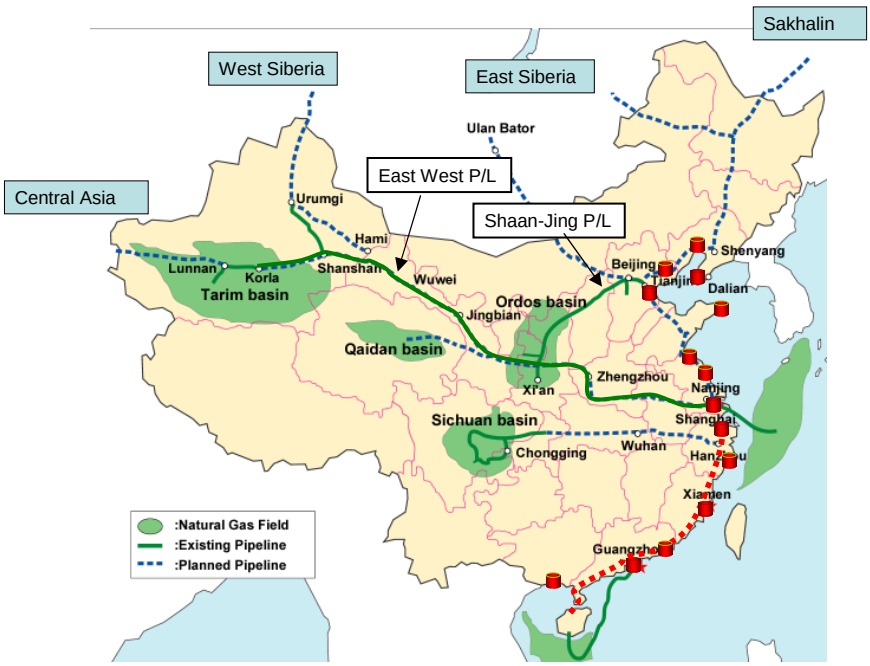
There are numerous LNG terminal projects both planned and proposed in the coastal regions of China where the economy has been rapidly expanding. While the Chinese government has adopted a policy of siting one such project in each coastal province, a simple calculation indicates that, with construction of only about eight LNG-receiving terminals[1], each with a capacity of about 3 million tons per year, this policy would give China a total of around 24 million tons in terminal capacity. Assuming that each of these projects proceeds to the second phase and is consequently expanded to around 6 million tons, the combined import capacity would be close to 50 million tons. Such a dramatic rise in LNG imports by a single country would have substantial impacts on the international LNG market.

In other LNG markets, a similar trend prevails. There are many projects under way for construction of new and expansion of existing receiving terminals in North America and Europe, and LNG demand in the Atlantic Basin is anticipated to increase rapidly over the coming ten years. In the Asia-Pacific market, too, LNG demand should steadily expand along with the rise in huge emerging markets such as China and India as well as continuing growth in established markets such as Taiwan, South Korea and Japan. In this situation, world LNG trade could more than double around 2015. In this climate of fast-paced growth, market power is shifting from the buyers, who have dominated it thus far, to the sellers.

Under these circumstances, the trends in China, which has the world's largest population and continues to achieve a high rate of economic growth, are behind the bullish attitude of sellers; but how certain is China's LNG demand? Focusing on prices for indigenous gas supplied by pipeline and LNG in the foreseeable future, this report first looks at China's LNG projects and then examines its LNG demand.

[1] Terminals currently under construction or where a full feasibility study is under way.

Figure.1 Natural gas supply in China



Source: Prepared by the authors.

2. STATUS OF LNG-RECEIVING TERMINAL PROJECTS

2.1. LNG as a Factor in Long-Term Energy Supply and Demand

As there are many factors of uncertainty in the long-term outlook for energy demand in China where the economy is rapidly expanding, it makes little sense to engage in a detailed quantitative analysis. This section, therefore, presents a brief profile of the role of natural gas in China's energy market, considering long-term energy policy and supply and demand outlooks[2] prepared by the government and research institutes in China, as well as the corresponding outlooks prepared by international energy organisations[3].

- Over the years leading up to 2020, the Chinese economy is forecast to continue growing at high rates averaging between 5 per cent and 7 per cent annually, and energy demand is expected to increase by half of the rates even if the GDP elasticity is assumed to be as low as 0.5.
- Although its share of the total will shrink, coal will continue to account for the major part of China's energy supply.
- Natural gas consumption will accelerate, increasing faster than the total primary

[2] For example, the government's 'Mid and long-term energy development program (2004 –2020)', 30 June, 2004, and the Long-Term Energy Supply and Demand Outlook prepared by China's Energy Research Institute.
[3] For example, 'World Energy Outlook 2004' by the IEA, and 'International Energy Outlook, 2005' by the US DOE/EIA.

energy supply. In the context of the government's energy policy, natural gas will be positioned alongside nuclear energy and renewable sources as a means of diversifying energy supply.

- In many outlooks, the share of natural gas in the primary energy supply is predicted to rise no higher than 10 per cent by 2020, even in the most optimistic scenario in which natural gas use is significantly promoted.
- However, some observers have suggested that natural gas consumption in 2020 could exceed 200 bcm/year, just over 7 per cent primary energy supply.[4]

LNG supply to China in the context of the total natural gas supply may be summarised as follows:

- In the government's policy on natural gas supply, top priority is given to development of domestic gas reserves. As is clearly shown by the West-East Pipeline, development of indigenous reserves is being driven by the political requirement to narrow the economic disparity between inland and coastal regions. Also, offshore gas fields in Bohai Bay, the East China Sea and South China Sea are also being developed to make effective use of domestic resources, but have only a low production potential.
- In long-term outlooks from Chinese sources, a steep increase in domestic natural gas production is predicted, but not enough to cover total demand. Consequently, China will require imports of pipeline gas from Russian and Central Asian countries, and LNG for the coastal regions.
- LNG projects are already under way in the provinces of Guangdong and Fujian, which are difficult to supply with indigenous gas in large quantities. In contrast, for Zhejiang and the coastal provinces further north, LNG would be in competition with domestic (and imported) pipeline gas.
- In summary, China's natural gas supply options comprise four different sources: domestic onshore gas, domestic offshore gas, imported LNG, and imported pipeline gas. Rational policy-making is necessary in order to introduce these four types of gas supply to the energy market. Substantial supplies of pipeline gas have commenced with the opening of the West-East and Shaan-Jing pipelines. The pricing schemes for this new pipeline gas deserve attention in relation to the outlook for future natural gas demand.

[4] The study, ' Energy Development, Policy and Strategy in China', presented in the JAPAC seminar by the Energy Research Institute under the National Development and Reform Commission (NDRC) on 15 March 2005, assumes a high growth scenario for natural gas consumption to increase to 250 bcm/year in 2020, representing a 9 per cent share in total primary energy.

2.2. Status of LNG Projects

Process of LNG project

China began to investigate LNG imports in 1995. At the time, the China National Offshore Oil Corporation (CNOOC) started to survey the possibility of constructing LNG-receiving terminals at several locations in the coastal regions under the instruction of the State Development and Planning Commission (SDPC). As a result of this study, the Zhujiang Delta, Fujian Province and Changjiang Delta were selected as candidate locations. Eventually, the Guangdong Project in the Zhujiang Delta was initiated as the first venture.

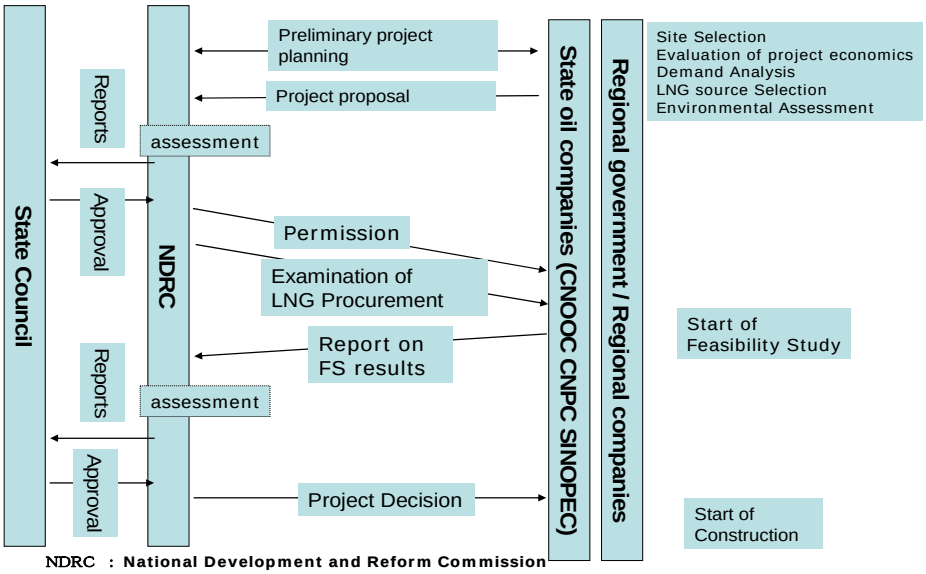
Thereafter, numerous plans were drafted for construction of LNG-receiving terminals in coastal regions. Figure.2 shows the basic process generally followed before the establishment of LNG projects in China. Individual project plans evolve through the complex interaction of motives on various fronts, including macroeconomic projections of long-term energy and natural gas supply by central government, requests from local governments and enterprises,[5] and the business strategy of the three major state oil companies. At the initial stage, activities are centred on the three state oil companies, and a preliminary feasibility study is undertaken with the participation of concerned parties such as local governments and enterprises on items such as candidate sites for terminal construction, demand estimates, sales projections, project economics, LNG procurement and assessment of environmental impacts. Upon the conclusion of the preliminary study, a basic draft of the project is submitted to the National Development and Reform Commission (NDRC), which examines it and, if the plan is deemed suitable, grants permission for the start of a full feasibility study. When foreign firms are involved in the project, the central government conducts a more cautious study. Generally speaking, many projects for terminal construction reported in the press have not yet reached the stage of receiving permission to begin a full feasibility study (see Table 1).

Only when central government's permission has been granted for a full feasibility study is a project officially recognised. As shown in Figure.3, the feasibility study for the Shenzhen Project in Guangdong took about two years. At this stage, the parties are also negotiating contracts with LNG suppliers. Basically, however, as acquisition of equity in upstream projects (including LNG liquefaction terminals in some cases) is tied to projects for terminal construction as a matter of official policy, these negotiations are thought to begin at the preliminary feasibility study stage.

[5] For example, companies in the power sector, gas distribution sector and financial sector.

Once the official feasibility study is completed and the project obtains NDRC permission and authorisation from the State Council, it proceeds to construction. In the Shenzhen Project, the passage of time from the start of the official feasibility study to the start of gas supply (assuming the project remains on schedule) will be about five years.

Figure 2. Outline of the LNG project formation flow



Source: Prepared by authors based on interviews in Beijing.

Figure 3. Schedule for the Shenzhen (LNG) Project in Guangdong Province

	2001	2002	2003	2004	2005	2006
Sign JV Principal Agreement						
Feasibility Study						
Approval of the FSR						
LNG Source selection/ negotiation						
LNG SPA Draft Agreement						
Gas Sales Contract						
Project Finance Commitment Letter						
EPC Bidding Process						
Terminal Construction						
Trunkline Design Bidding						
Trunkline Construction						
First Gas						

Source: CNOOC Gas and Power, 'CNOOC View on Natural Gas Market', Natural Gas China Conference, 13–14 May 2004, Beijing.

Progress of specific projects

As shown in Figure 1 and Table 1, plans for 14-16 projects in coastal regions have been reported in the press. The projects that have already entered the stage of actual construction are those in Guangdong and Fujian provinces. As noted above, the Guangdong Project is now at the stage of construction and is scheduled to commence operations in mid-2006. In the Fujian Project, land reclamation has been completed, and the terminal construction is expected to be finished by the end of 2008. It has been decided to procure LNG from the NWS Project in Australia for the former and the Tangguh Project in Indonesia for the latter.

Table 1. Plans for LNG-receiving terminals (as of Nov. 2005)

Provine /City	Location	Operation	Capacity Mt/year	Main Company	Status
Liaoning	Dalian	After 2010	4	CNPC	Full Feasibility Study Bidding for FEED
	Yingkou		3	CNOOC	Not in progress
Hebei	Tangshan	After 2010	3	CNPC	Full Feasibility Study
	Qinhuangdao		?	CNOOC	Not in progress
Tianjin	Tianjin port		?	Sinopec	Pre-feasibility Study
Shangdong	Qingdao	After 2010	3.3	Sinopec	Full Feasibility Study
Jiangsu	Rudong	After 2010	3.5	CNPC	Full Feasibility Study Bidding for FEED
	Binhai		3	CNOOC	Not in progress
	Lianyungang			Sinopec	Not in progress
Shanghai	Yangshan	Around 2011	3	CNOOC	Full Feasibility Study
Fujian	Putian	2009	2.6	CNOOC	Under construction
Zhejiang	Ningbo	Around 2010	3	CNOOC	Full Feasibility Study
Guangdong	Shenzhen	2006	3.7	CNOOC,, BP	Under construction
	Shantou		2.5	CNOOC	Not in progress
Hainan	Hainan		?	CNOOC	Not in progress
Guangxci	Not decided		?	CNPC	Not in progress

Note: Operation judged by authors based on status.

Capacity for only one phase.

Source: Various sources.

In Zhejiang Province and the city of Shanghai, projects are being promoted by CNOOC. Both of these are at the stage of finalizing the site. In Shanghai, a terminal is to be constructed in the Yangshan Deep Water Port development area taking shape offshore, and the construction consequently depends on the progress of the port project. As of November 2005, LNG procurement (source selection) was still being negotiated for both projects.

In Jiangsu Province, a project is being promoted by China National Petroleum Corporation (CNPC), and Rudong has been selected as the site. The NDRC granted permission for initiation of the feasibility study in May 2005 and the project will reportedly commence operations around 2010. In Shangdong Province, China Petroleum & Chemical Corporation (SINOPEC) is promoting a project. The site is reportedly Huangdao, but this has still not been finalised. The Sakhalin Project is one of the possible sources for LNG procurement, but this is still being negotiated. Operations are scheduled to commence in 2008, but there is a good chance that the start will be delayed considering the lead time required for construction.

In the city of Tianjin and in Tangshan (in Hebei Province), SINOPEC and the CNPC, respectively, are going ahead with plans for the construction of terminals that target natural gas demand in Tianjin and Beijing. In each, the plans envision of the start of operations in 2008, but are not making concrete progress. Because the targeted demand of these projects overlaps, it is likely that only one terminal will be constructed in this region, at least by 2020.[6]

In Liaoning Province, the CNPC is leading a project with Dalian as the prospective site. The start of operations is reported as 2008, but it is likely to be delayed.

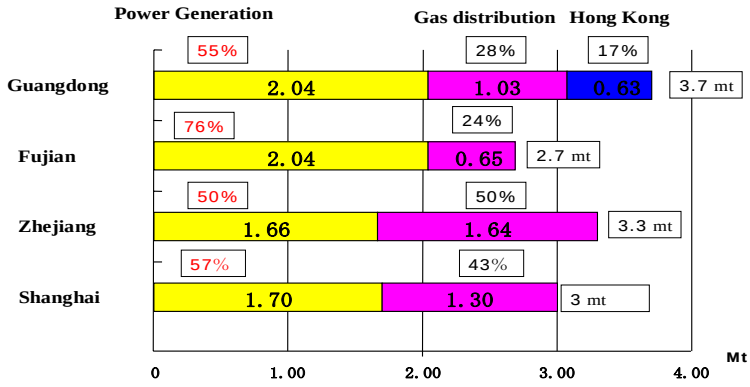
2.3. Demand for LNG

This section considers the components of demand which will hold the key to the success of these projects. As can be seen from Figure 4, the core demand is for power generation, with its share of the total ranging from 50 per cent in the Zhejiang Project to 76 per cent in the Fujian Project. In addition, almost all of the power plants supplied with LNG are to be newly built; very few of the existing coal-fired and other thermal power plants are likely to be converted to gas. The load factor of the new gas-fired plants is projected to be about 40 per cent (about 3,500 hours per year). In many cases, the plants will be operated between mid-merit and peak load.[7]

[6] The core demand for the two projects is likely to be provided mainly by the power and the gas distribution sectors of Beijing and Tianjin.
[7] According to the findings of an interview with the Shanghai office of British Petroleum in January 2005.

Most of the remaining supply will be distributed to: residential customers, district heating utilities and large industrial customers. In some projects, gas will also be used for transportation as compressed natural gas (CNG). City gas companies convert coal-based gas or liquefied petroleum gas (LPG) to natural gas; district heating utilities convert mainly from coal to gas. These markets are already established. There are also plans for additional gas utilisation technology such as cogeneration systems in the commercial and industrial sectors of major cities such as Beijing and Shanghai (although installation is still in the early stages). This suggests a steady increase in future city gas demand. However, the majority of this demand at present derives from residential customers. New large-scale demand in the commercial and industrial sectors is likely to require more time to establish itself because of the need to build transportation and distribution infrastructure and install appliances. As such, it cannot be counted on to support the launch of LNG projects in the short to medium term.

Figure 4. Regional demand for gas from LNG projects



Source: Prepared by authors based on interviews in China.

3. FACTORS DETERMINING LNG IMPORT PRICES

3.1. Pipeline gas Sales and Prices

Marketing and pricing of gas from LNG is significantly different for the two main groups of end-users: power generators and city gas distributors. This is also the case for pipeline gas supplies by the West-East and Shaan-Jing pipelines, which have already started operations.

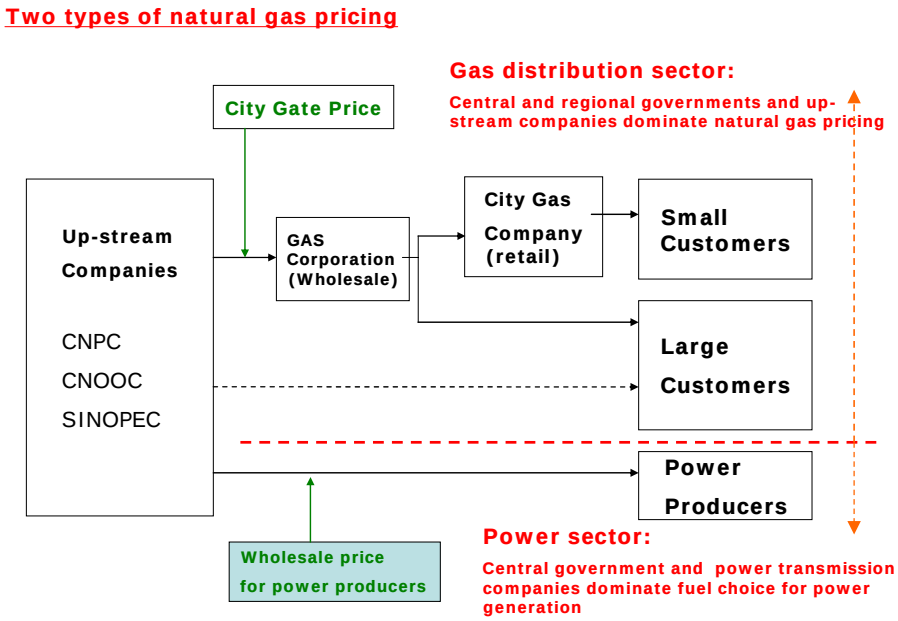
The pipeline gas supply chaim is shown in Figure.5. The organisation of city gas sales and prices can be summarised as follows.

- The supply to gas distribution companies is aggregated by the (wholesale) gas corporation newly established in each province (e.g. the Zhejiang Gas Corporation). These corporations purchase gas from upstream companies such as CNPC, and distribute it to gas distribution companies. In special administrative regions such as the cities of Beijing and Shanghai, there is only one gas distribution company which controls the whole gas chain.
- The volume of supply by the upstream company to the gas corporation is a subject of advance negotiation involving central and local governments, upstream enterprises and gas corporations, but is ultimately determined by the NDRC.
- The term ‘city gate’ price refers to the price paid to upstream companies by the “city gate keepers”, that is the wholesale gas corporation in each province. These prices are also determined by central government (the NDRC).
- City gas retail prices vary with the sector (residential, industrial, etc.). They are controlled by the provincial commodity price bureaux. Similarly, the city gas companies do not have the right to determine their purchase volumes which are allocated by the gas corporation.

Organisation and pricing of natural gas supply to power producers (generation companies) has the following features:

- Power producers make purchases directly from upstream companies.
- Sales prices to power producers are the subject of advance negotiation between upstream companies on one side and the regional power grid company and power producers on the other, but the final determination is made by the NDRC.
- As in the city gas sector, the amount of pipeline gas supplied to power producers is ultimately determined by the NDRC. In the case of the West-East Pipeline, for example, current supplies are not sufficient, and power producers receive allocations required for power plant operation for about 3,500 hours per year (equivalent to a load factor of about 40 per cent).

Figure 5. The natural gas supply chain (except Beijing, Tianjin, Shanghai)



Source: prepared by authors based on interviews in Beijing and other cities.

3.2. Pricing in the Power Sector

The following is an outline of transactions in the power sector, as of January 2005, which make up the core demand for LNG projects at each stage from fuel procurement to power sales (see Figure 6).

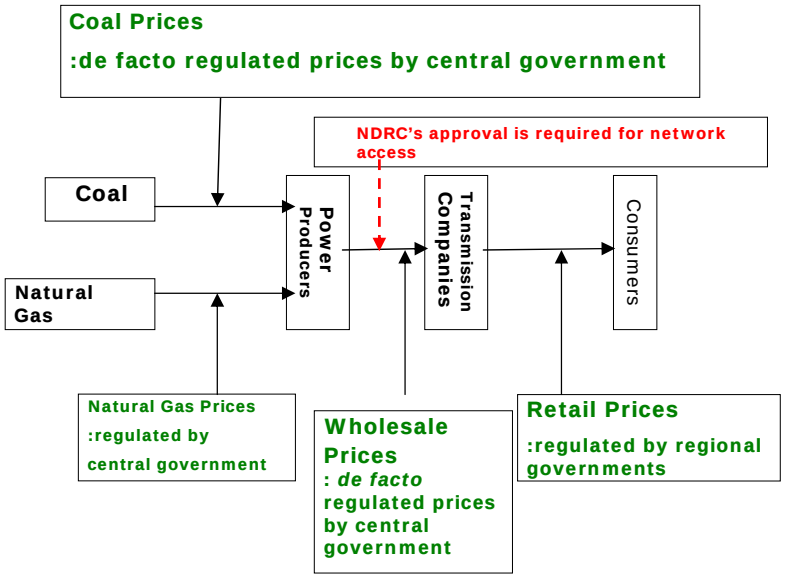
- Electricity supply from power plants to the regional transmission companies requires authorization by central government.[8] Without authorisation, power producers cannot access transmission networks.
- Procurement, prices for power generation fuels (coal and natural gas) are controlled, and supplies are allocated under a quota system. In terms of both volume and price, only a limited part of the fuel procurement process is freely determined by power producers (operating rates have been set for each power plant, and thus fuel consumption is fixed).
- As viewed from the standpoint of power sales, power supply during a given period of the day is under the control of the grid company in the region. In addition, around 80

[8] Power plant construction does not require authorisation by central government.

per cent of wholesale supply to the grid by the generators is sold at the price set by the central government for each generation unit. The remaining 20 per cent is sold under a so-called 'liberalised pricing' system but, since the central government price for this remaining 20per cent is a ceiling price, it can hardly be considered liberalised.[9]

Although the power sector is moving towards liberalisation, in terms of fuel procurement and electricity sales, both prices and quantities are under the control of the government or the transmission companies. As such, the market mechanism does not have a direct impact on enterprise operation.[10] In other words, wholesale power prices are set for each generation unit, and the operating rate is also adjusted by the transmission company. The reality is that power producers would not buy natural gas unless the transmission companies coordinating supply and demand judged that the price was sufficiently attractive.

Figure 6. Power sector : *de facto* price control by the central government



Source: Prepared by authors based on interviews in Zhejiang Province.

[9] In general, the accounts balances of power producers have reportedly worsened due to soaring coal prices, but interviews with power producers found that they expected to be secured by revisions of wholesale (electricity) prices by the central government.

[10] Power grid companies take the initiative in power supply and demand adjustment, and issue instructions to power generators on an hourly basis. A wholesale price corresponding to cost is determined separately for each generation unit. Natural gas supply, which is not sufficient at present, is allocated to each plant, and consequently acts as a constraint on the load factor. Even assuming no quantitative constraints on fuel procurement, operating rates of gas-fired plants must take account of the balance with coal-fired, hydropower and nuclear power plants and it is the transmission company that makes the necessary regional market adjustment.

3.3. Pricing in the Gas Distribution Sector

In the city gas sector, natural gas is in competition with coal and oil products including LPG. However, a look at China's city gas business reveals that volumes and purchase prices of feedstock and gas sales prices are entirely under official control. Conversion to natural gas would be decided by the policies of the central and local governments rather than the business strategy and/or management of the companies in question. Needless to say, studies determining these policies are not limited to issues of competition with other fuels; they undoubtedly take account of various other factors, including consumer purchasing power (impact on society), macro and micro energy supply and distribution policy, environmental requirements, and technical and physical feasibilities. City gate prices are heavily affected by gas production costs and the economics of trunk pipeline projects, and there is no connection between the latter and the economics of the downstream power sector.

4. LNG PRICES FROM THE PERSPECTIVE OF THE CURRENT NATURAL GAS MARKET

4.1. LNG Price Levels

This section considers the competitive level of natural gas prices in the power sector and the implications for the pricing of LNG, with reference to actual transaction prices. We assume that LNG pricing should be consistent with pricing for indigenous pipeline gas. We start with actual pipeline gas prices,[11] which may be summarised as follows:

- City gate prices along the West-East Pipeline route average 1.29 RMB/m^3 as compared to 1.35 RMB/m^3 in Shanghai. In Jiangsu Province, the price for supply from the West-East Pipeline to an industrial (large-volume) customer is 1.4 RMB/m^3.
- In contrast, a price to a power producer in Jiangsu Province is lower at around 1.1 RMB/m^3. Furthermore, although the matter is still under negotiation, a price for a gas-fired plant in Shanghai will reportedly be 0.88 RMB/m^3[12]. For this reason, pipeline gas prices supplied to power producers are thought to be significantly lower than prices for city gas companies. This low price for the power sector naturally reflects competition with coal-fired plants.
- This observation may be corroborated by, for example, the price of 1.0 RMB/m^3 reportedly targeted by power producers in negotiations with CNPC during construction of the West-East Pipeline.[13] In addition, in the overall project plan for this pipeline, power producers are said to have offered incentives for purchase of natural gas in order to ensure demand. Furthermore, prices targeted by power producers are

[11] Figures are as of late 2004.
[12] Materials provided by Beijing eMarkets Energy Technology Co.,Ltd., as of February 2005.
[13] World Gas Intelligence.

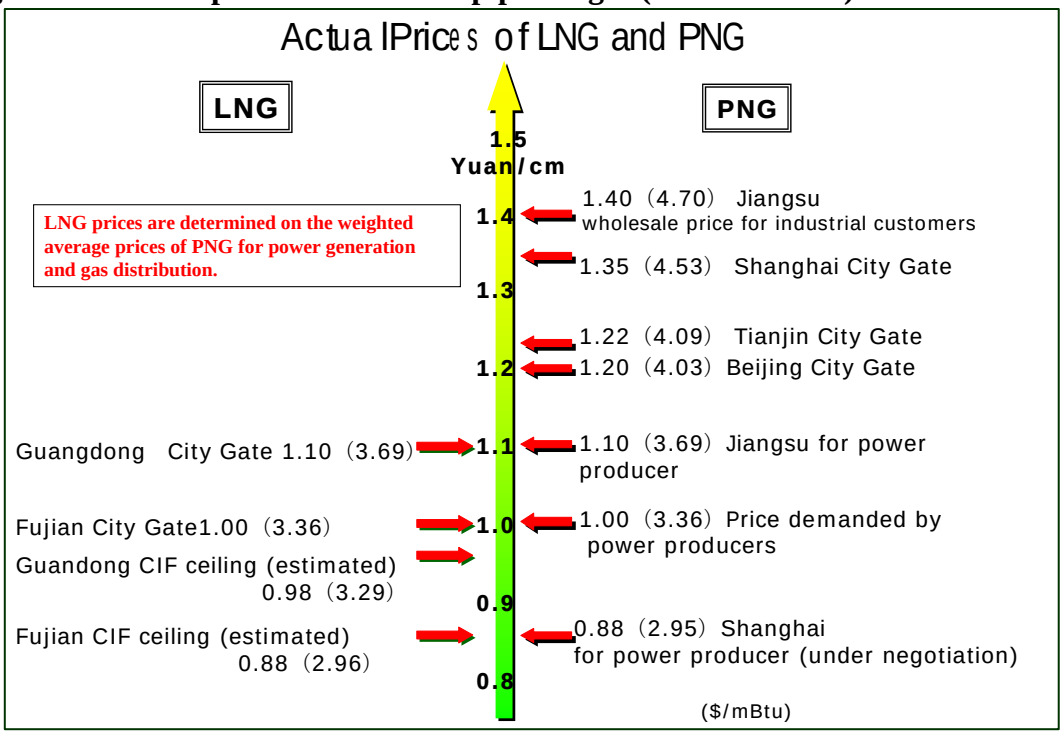
therefore likely to be lowered further as described in the example of Shanghai (0.88 RMB/m^3). The inability to create demand in the power sector unless natural gas prices are set at these low levels, jeopardsing the anticipated return on investment, might lie behind the withdrawal of international major oil companies from the East-West Pipeline Project.

Meanwhile, the situation surrounding LNG prices in contracts already concluded in the Guangdong and Fujian Projects may be summarised as follows:

- LNG purchase price in the Guangdong Project is based on a free-on-board (FOB) contract, with a ceiling set at $2.89/mBtu. The corresponding ceiling in the Fujian Project is $2.66/mBtu. Converting to CIF basis by adding the transportation cost (estimated at $0.40/mBtu in the Guangdong Project and $0.30/mBtu in the Fujian Project)[14] yields ceiling prices of $3.29 and $2.96/mBtu respectively.
- In RMB per cubic metre (assuming a calorific value of 9,000 kcal/m^3 and an exchange rate of 8.276 RMB/$), these ceiling prices would come to 0.98 and 0.88 RMB/m^3 respectively. With the addition of $0.4/mBtu as the terminal cost (and other transportation costs),[15] the LNG prices at the city gate price basis would be $3.69/mBtu in the Guangdong Project and $3.36/mBtu in the Fujian Project, or 1.1 and 1.0 RMB/m^3 respectively.
- As compared to pipeline gas prices to power producers described above, even the low price in the Fujian Project would be higher than that of 0.88 RMB/m^3 (= $2.95/mBtu) for using LNG at current prices and would not be competitive with coal-fired plants.

[14] These figures are rough estimates by the authors.
[15] Ibid.

Figure 7. Actual prices of LNG and pipeline gas (as of late 2004)



Source: Based on interviews in China.

The following rough calculation can be made using the hypothesis that the LNG price will be a weighted average of the power city gas prices.

LNG price (ceiling price):	Lp
Price to power producers:	Pp
Price to city gas companies (city gate price):	Cp
Power producer's demand share in an LNG project:	α
City gas companie's demand share in an LNG project:	β

$$Lp = \alpha \cdot Pp + \beta \cdot Cp$$

In actual LNG projects, the power sector's share is estimated at 55 per cent in the Guangdong Project and 75 per cent in the Fujian Project. Use of the aforementioned CIF-based ceiling prices in the simultaneous equation produces the following results:

$$Pp\ (CIF) = \$2.55/mBtu$$
$$Cp\ (CIF) = \$4.19/mBtu$$

$$Lp\ (CIF) = -1.64\ \alpha + 4.19$$

The following is a comparison of the prices resulting from our calculations with actual pipeline gas prices.

Actual

Price to a power producer in Shanghai (SPp) = 0.88 RMB/m^3 = $2.95/mBtu

City gate price to Shanghai (SCp) = 1.35 RMB/m^3 = $4.53/mBtu

Calculated

Pp (city gate) = $2.95/mBtu (adding the terminal cost, etc., to the CIF-based price)

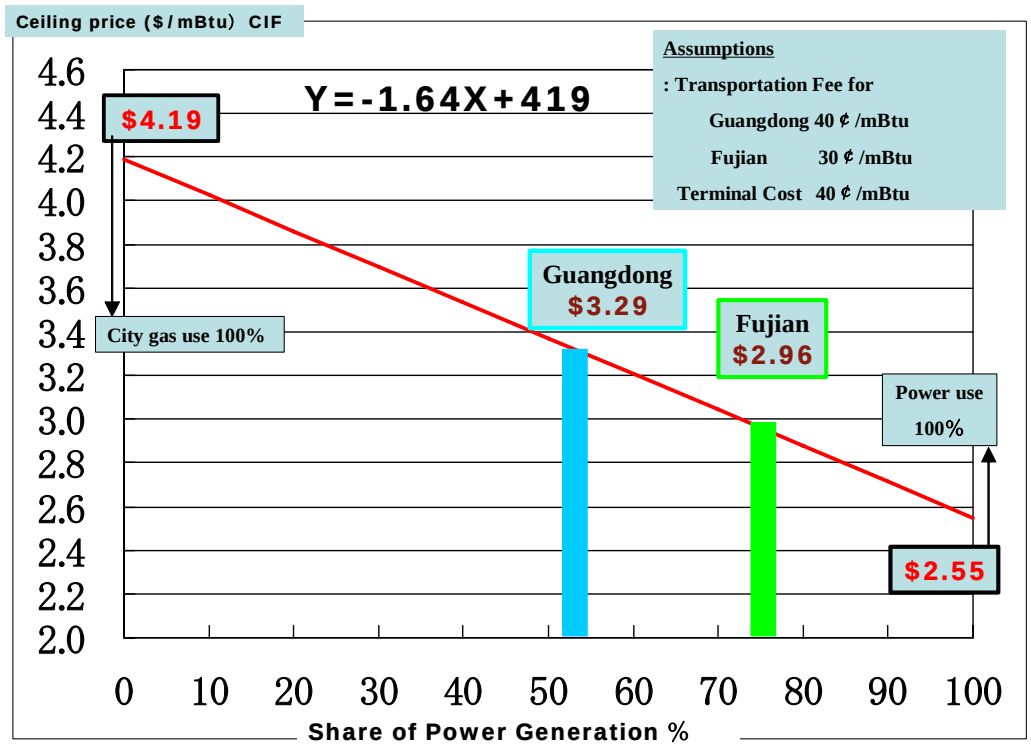
Cp (city gate) = $4.59/mBtu (adding the terminal cost, etc., to the CIF-based price)

It is clear that our calculations are almost the same as the actual prices applied in pipeline gas transactions. In other words, these results could also be interpreted as indicating that the prices for LNG purchased in the Guangdong and Fujian Projects are premised on fairly low prices in the power sector. It should be noted that the pipeline gas price to a power producer quoted here (0.88 RMB m^3) is no more than a figure still under negotiation and may not be accepted by the gas suppliers.[16] Nevertheless, it is also true that the interviews for this study found a consensus to the effect that gas-fired plants would clearly be less competitive than coal-fired plants at the price under negotiation along the West-East Pipeline route (1.1 RMB m^3). Although this is only a hypothesis, LNG prices in China could be viewed as a weighted average of prices for power and city gas use.

Given that competition between coal and natural gas changes with the variation of regional coal prices, the competitive LNG price level will also differ by region. If the price to power producers and the city gate price for a region can be determined, it should be possible to deduce the LNG ceiling price from the shares of power demand served by the LNG project. For example, Guangdong and Fujian Provinces are far from coal-producing areas and pay relatively high prices for coal. As a result, the LNG price required in the power sector could be even higher than in the Changjiang Delta. In contrast, in Shandong, Tianjin and Liaoning Provinces, coal prices are lower, and the LNG prices would have to be commensurately decreased.

[16] Some sources suggest that the city gate price in Shanghai is the sum of the wellhead price of the West-East Pipeline (0.45 RMB /m^3) and the transportation cost to Shanghai (around 0.9 RMB /m^3).

Figure 8. Estimating target LNG prices for Chinese buyers based on existing projects



Source: Prepared by the authors.

Table 2. Natural gas transaction prices in China (as of the end of 2004)

Region		Price definition	RMB/m^3	$/mBtu
Average along the West-East PL route		City gate	1.29	4.33
Shanghai	West-East PL	City gate	1.35	4.53
	East China Sea	City gate	1.40	4.70
	East China Sea	Retail price in the residential sector	2.10	7.05
	East China Sea	Retail price in the industrial sector	0.88	2.95
	East China Sea	Power sector	0.88	2.95
	East China Sea	Retail price in the transportation sector	0.88	2.95
Jiangsu P	West-East PL	City gate	1.31	4.40
	West-East PL	Power sector	1.10	3.69
	West-East PL	Wholesale price in the industrial sector	1.40	4.70
	West-East PL	Retail price in the industrial sector	2.15	7.22
	West-East PL	Retail price in the residential sector	2.21	7.42
Zhejiang P	West-East PL	City gate	1.37	4.60
Beijing	Shaan-Jing PL	City gate	1.20	4.03
Tianjin	Shaan-Jing PL	City gate	1.22	4.09
	Dagang gas field	City gate	1.00	3.36
	Bohai Bay	City gate	1.20	4.03
	Pingyuan gas field	City gate	1.11	3.73

Note: At a natural gas calorific value of 9,000 kcal/m^3 (8,500–9,500 kcal/m^3 in the official transaction standard) and exchange rate of 8.276 RMB/dollar.

Source: Prepared with reference to data from interviews with major city gas companies.

4.2 Ceiling Prices for LNG Imports

Based on the above analysis, we move to a more concrete examination of the maximum price which would allow LNG to compete in the Chinese gas market.

Ceiling price in the Changjiang Delta area

To estimate the ceiling price in the Changjiang Delta, the calculation shown in Table 2 quoted the Zhejiang city gate price of 1.37 RMB/m^3 ($4.60/mBtu) for the price to city gas companies,

and the figure of 1.1 RMB/m^3 ($3.69/mBtu) which is actually applied to power sector sales along the West-East Pipeline. Assuming shares for the power sector in an LNG project of 25 per cent[17] and 50 per cent, the respective city gate prices would amount to $4.37 and $4.15/mBtu; on a CIF basis, this would translate into corresponding figures of $3.97 and $3.75/mBtu. In summary, under the current pricing scheme applied in the Changjiang Delta area, the ceiling LNG price demanded by the Chinese side would probably be within the approximate range of $3.75–$4.0/mBtu on a CIF basis.

Ceiling price in the Bohai Bay coast area

Table 2 quoted the Shaan-Jing Pipeline city gate price of 1.22 RMB/m^3 ($4.09/mBtu) in Tianjin as the price for city gas companies. For the price to the power sector, we used a figure of 1.1 RMB/m^3 ($3.69/mBtu), the same as in the Changjiang Delta region, due to lack of information on pipeline gas prices to power producers in the area.[18] Given power shares of 25 per cent and 50 per cent, the respective LNG city gate prices would be around $3.6 and $3.5/mBtu CIF.

Table 3. Estimate for LNG prices

Region		**Yangtse Delta**		**Bohai Bay**	
Assumptions	Pipeline Price for Power Generation	1.10 Yuan/m^3 $3.69/mBtu		1.10 Yuan/m^3 $3.69/mBtu	
	Pipeline Price for Gas Distribution	1.37 Yuan/m^3 $4.60/mBtu		1.22 Yuan/m^3 $4.09/mBtu	
	Share of Power Generation Use	25%	50%	25%	50%
LNG Ceiling Price (CIF) ($/mBtu)		4.0	3.75	3.6	3.5

Exchange Rate: 8.276 Yuan/$, Heat contents for pipeline gas : 9000 kcal/m^3

Source: Authors' estimates.

[17] This case assumes that a power plant with a capacity of 1,200 MW in a project handles about 3 million tons of LNG per year.

[18] Although there are plans for construction of ga- fired power plants in the area, few actual gas-fired plants have been placed in operation yet. Because the region is even closer to coal fields than the Changjiang Delta area, gas prices to the power sector will probably be lower. Use of a figure of 1.1 RMB /m^3 would result in a price level that is on the high side, and this would be reflected in the LNG ceiling price as well.

5. ISSUES IN CHINESE LNG PROJECTS AS VIEWED FROM THE INTERNATIONAL MARKET

Over the next ten years, global LNG demand is projected to increase very rapidly from 131 million tons in 2004 to more than 300 million tons in 2015.[19] Prices for oil, a competitor for LNG, have soared in 2005 with West Texas Intermediate (WTI) temporarily topping the remarkable level of 70 dollars per barrel. There is a good possibility that oil prices will remain as high as $40/bbl in 2010 and $50/bbl in 2020 in nominal terms.[20] In these circumstances, LNG is likely to become a sellers' market, and this could make it extremely difficult for buyers to obtain long-term LNG contracts at prices as low as those in the Guangdong and Fujian projects. Meanwhile, as noted above, in China, a 'desirable' LNG purchase price is one which equates to prices for indigenous pipeline gas. As a result, the Chinese side could face –and arguably are already facing - the following issues.

First, future LNG contracts are likely to apply price formulae that are linked to prices for crude oil such as Japan Crude Cocktail (JCC). It must be questionable whether buyers will be able to negotiate price formulae with ceiling prices as was achieved in the Guangdong and Fujian Projects. For China, purchase of LNG under this type of price formula would assure the competitiveness of LNG relative to domestically produced coal and natural gas even if oil prices rise. The Chinese government has domestic energy prices under effective control, holding them down even if international prices rise. This suggests that the existence of a ceiling price would be a very important factor for LNG imports under the current energy policy and pricing systems in China. As long as oil prices are forecast to remain high, sellers will almost certainly not agree to ceiling prices.

A second issue is the price level sought by the Chinese side. Even with its strong bargaining power, it is uncertain whether China could obtain prices below $4.00/mBtu in the Changjiang Delta, and below $3.6/mBtu in the Bohai Bay area. Thirdly, the Chinese government requires the acquisition of upstream equity in LNG projects as a condition of LNG imports. CNPC and the two other major Chinese oil companies have been aggressively pursuing upstream oil interests outside China, and a similar policy is strongly in evidence for LNG projects. With soaring crude oil prices, acquisition of upstream equity is becoming increasingly difficult. In this climate, the Chinese side will find it increasingly difficult to maintain its practice of low LNG purchase prices and a link to acquisition of upstream equity.

[19] Aauthors' estimate.
[20] For example, see 'World Energy Outlook, 2005', International Energy Agency.

Judging from the situation in the international LNG market, a major question is the extent to which the Chinese side will need to make concessions to LNG sellers. As described above, however, LNG supply has yet to be given a high priority in the context of China's official energy policy. Price concessions will increase the problem of the competitiveness of gas in relation to domestic energy prices. Otherwise, structural revisions in coal and power sector prices, and even for the indigenous gas supply, would have to be made. There is thought to be little possibility of such a policy shift by the central government, at least at present.

6. CONCLUSION

Central government is heavily involved in all aspects of Chinese LNG projects, from approval of plans to decisions on matters such as purchase prices and sources of gas. In addition, LNG imports need to be compatible with the energy policy framework in the coal and power sectors.

As far as policy on natural gas supply is concerned, the highest priority is given to indigenous gas supplies, which are taking precedence. Therefore, LNG prices need to be in line with those of indigenous gas.

In the power sector, which constitutes the core of the demand for LNG projects, gas-fired stations will have to be competitive with coal-fired plants, which account for by far the largest share of the installed generation capacity. Unless LNG maintains a certain level of economic advantage for the power sector, power producers could decide against use of natural gas. Therefore, sales to city gas companies, which command relatively higher prices, hold more promise than those to the power sector. As a whole, however, city gas companies are all at an early stage of development,[21] and demand is neither firm enough nor large enough to support the launch of LNG projects in some regions.

Meanwhile in the international market for LNG, demand is rapidly growing around the world despite high oil prices. In this commercial context, LNG conditions will probably become tougher for buyers and as a result it may be difficult for Chinese buyers to purchase LNG at prices compatible with the prices of domestically produced fuels, that is, a ceiling price of $4.00/mBtu CIF.

[21] The scale of existing demand for city gas in the residential sector is considerable in major cities such as Beijing and Shanghai, but even in these cities the number of large commercial and industrial customers is limited. Outside these cities, moreover, the infrastructure for transportation and distribution has yet to be established. Assurance of natural gas sales volume for city gas production requires improvement of the supply infrastructure and promotion of gas appliances. These tasks will take considerable time and investment.

For these reasons, LNG projects may fall behind schedule owing to factors such as an inability to reach price agreements with sellers, problems related to the acquisition of upstream equity and demand-side issues. If satisfactory agreements cannot be reached with sellers on LNG prices, the Chinese side could very well deliberately defer projects. At least, by late 2005, although Chinese companies have been negotiating with LNG sellers for new LNG projects, none has reached successful agreement as sellers' interests have been shifting towards more attractive markets such as the USA, and the existing Asian importing countries. Under such circumstances, it is likely that the number of terminals actively going ahead will be further reduced.[22]

Table 4 shows our projections of Chinese LNG demand over the next decade by project, taking into consideration the current situation and likely future progress. In our view, it would be reasonable to expect total LNG demand to reach about 6 million tons per year in 2010 and 12–18 million tons per year by 2015. This is a significant rate of progress but less impressive than the 30–50 million tons per year which is indicated by the number of terminals at various stages of planning.

Table 4. Outlook for LNG imports

<table>
<tr><th rowspan="2">Project</th><th colspan="2">2010</th><th colspan="2">2015</th></tr>
<tr><th>mt</th><th>note</th><th>mt</th><th>note</th></tr>
<tr><td>Guangdong</td><td>3.3</td><td>Full operation</td><td>3.3～6.0</td><td>6.0 in Phase 2</td></tr>
<tr><td>Fujian</td><td>2.0</td><td></td><td>2.6</td><td>Full operation in 2012</td></tr>
<tr><td>Zhejiang</td><td rowspan="2">0.6</td><td rowspan="2">One project starts in 2010</td><td rowspan="2">3.0</td><td rowspan="2">One project will start full operation</td></tr>
<tr><td>Shanghai</td></tr>
<tr><td>Jiangsu</td><td>0</td><td rowspan="3">Those projects are unlikely to start operation before 2010</td><td rowspan="3">0～6.0</td><td rowspan="3">Two out of four will start full operation</td></tr>
<tr><td>Shandong</td><td>0</td></tr>
<tr><td>Tianjin / Hebei</td><td>0</td></tr>
<tr><td>Others</td><td>0</td><td></td><td>0</td><td></td></tr>
<tr><td>Total</td><td>6.0</td><td></td><td>12～18</td><td></td></tr>
</table>

Source: Authors' estimates.

[22] Xinhua Financial Network News reported that as few as three terminals are likely to be built in addition to Guangdong and Fujian. 24 November 2005.