DOMESTIC LNG PRICING IN CHINA

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The quantity of LNG delivered within China by trailer reached ~24 million tonnes in 2018. This substantial LNG market is, however, perhaps one of the least studied. Some ~14 mt was loaded from coastal LNG import terminals, comprising about a quarter of the total LNG imported into China. The remaining ~10 mt came from nearly 200 onshore mini-LNG plants, processing pipeline gas or located at fields not connected by pipeline. This market is highly dynamic, with de-regulated pricing and many small operators.

In the winter of 2017/18, gas shortage led to very rapid price increases in this market, with prices peaking at more than double the usual level, far exceeding Asian spot LNG prices. The disconnect between China domestic and global LNG prices, as illustrated by this event, reflects the complex drivers of domestic LNG supply and pricing. Imported LNG is linked to international LNG prices, while local LNG production depends either on domestic pipeline gas availability and prices, or forms part of small-scale primary production systems. This paper examines how these different drivers combine and interact to influence China domestic LNG availability and pricing. Key factors considered include infrastructure access, geographic factors and information asymmetry in a market where an effective price discovery mechanism is still lacking.
1. INTRODUCTION

In 2017 China overtook South Korea to become the world’s second largest LNG importer. The momentum continued in 2018, with LNG imports to China rising by ~40% to reach nearly 54 million tonnes. The impact of China’s demand on the global LNG market is extensively discussed, including widely at this conference. Less widely analysed is China’s domestic LNG (DLNG) market, which amounted to 20.2 mt in 2017, and grew ~18% to reach 23.9 mt in 2018, corresponding to more than a million 20-tonne trailer deliveries each year. This is much the largest DLNG market globally.

My colleague Yuan Yuan elsewhere describes the uptake of DLNG as a heavy-duty transport fuel in China, and the importance of the DLNG-diesel price differential for this sector. While this is an important sector of DLNG demand, nearly half of DLNG in China is consumed by Industrial customers (typically in facilities which lack a connection to the pipeline gas network), while another 20% is purchased by Local Gas Distribution Companies to replenish their emergency back-up facilities and is thus ultimately regasified and delivered to consumers by pipeline (see Figure 1).

Figure 1: China Downstream LNG consumption by sector in 2017 and 2018.
   Source: Sublime China Information (SCI)

About 10 mtpa (~40% in 2018) of China’s DLNG supply was produced domestically, in so-called mini-LNG plants (each producing 0.1 to 0.3 mtpa), supplied with pipeline gas or connected to remote gas fields. The remainder (~14 mt in 2018) is sent out by road trailer from coastal LNG import terminals, where it has over the last two years represented ~25% of total throughput (the remaining LNG imports being regasified and sent out by pipeline).

Figure 2: China Downstream LNG supply and growth rate. Source: Sublime China Information (SCI)
In this paper, we examine the drivers for DLNG pricing in China. A key point to note is that, unlike the pipeline gas market, the DLNG market is de-regulated both in terms of participation and pricing. Furthermore, DLNG prices in China are remarkably transparent, with multiple sources (terminals and mini-LNG plants) publishing “list” prices on a daily basis. Accordingly, it is possible to follow DLNG price movements both geographically and over time.

2. DYNAMICS OF DLNG PRICING IN COASTAL AREAS

The cost of DLNG ex-terminal in coastal areas should, in principle, be simple to calculate, by adding a typical terminal handling charge of ~450 RMB/tonne (equivalent to ~US$1.33/MMBtu at representative 50.5 MMBtu/tonne and 6.7 RMB/US$ exchange rate) and applicable import taxes (currently 10% VAT) to the ex-ship LNG price. However, pricing is rarely as simple as this.

First, it is unclear which ex-ship LNG price is or should be the foundation for DLNG pricing. Figure 3 compares the listed ex-terminal LNG prices for terminals in Guangdong (in the south) and Tianjin (in the north) with the reported weighted average China imported ex-ship LNG price (“CLC”) and with the prevailing Asian LNG spot market price (Platts JKM), in both cases with the addition of typical terminal charge and VAT.

Figure 3: LNG ex-terminal price (in US$/MMBtu) in Guangdong and Tianjin versus CLC and JKM (both adjusted to ex-terminal) for January 2016 to March 2018. Sources: IHS, China Customs, SCI
It is obvious that there has not been a simple relationship over the past two years. The picture is further complicated by the fact that each LNG importer has its own unique portfolio of LNG import contracts and associated prices, which may differ from the national average. Nevertheless, it is possible to see some broad patterns, and to identify the specific events that brought about deviations from the norm.

The largest LNG importers (the three National Oil Companies (NOCs)) have the primary responsibility to maintain security of supply to their pipeline gas customers, including the major citygas distributors. This security of supply obligation has, if anything, strengthened in recent years, as the Government’s major coal-to-gas conversion programme has switched millions of households in northern China to dependency on natural gas supplies for winter heating in homes, schools and hospitals. It is thus not surprising if the NOCs use DLNG sales to help balance their supply & demand through the year, by offering increased (and more competitively priced) DLNG availability during summer months (when pipeline gas demand is lowest) and restricting DLNG supplies during the winter (when they need to maximize pipeline send-out). An example of this philosophy at work was when CNOOC in early 2018 packaged an auction of winter DLNG supply with an obligation to take corresponding volumes of summer DLNG.

Following this logic, ex-terminal DLNG should be priced at a roughly constant differential to the average LNG import price in the summer, and against the higher marginal (i.e. spot) LNG import price in the winter. In the second half of 2017 this pattern was observed in southern China (see Figure 4), with the ex-terminal price closer to the average China LNG import price (and materially above the spot LNG import price) from July to September, and then following the rising spot LNG price from October 2017 to January 2018.

Figure 4: LNG ex-terminal price (in US$/MMBtu) in southern China (Guangdong) versus CLC and JKM (both adjusted to ex-terminal) for 2017/18. Sources: IHS, China Customs, SCI
However, we’ve also observed deviations from the cost-plus pricing approach, indicating that ex-terminal prices to quite some extent may be driven by seasonal market demand/supply balances. When there is market slackness (normally in the shoulder season), ex-terminal prices can be even lower than average import cost (adjusted for regasification fee and tax), while at times of market tightness, ex-terminal prices can go much higher than the marginal cost of supply, which is spot. For example, in the autumn and winter of 2017/18, LNG importers in China found themselves critically short of supply, with their efforts to procure additional supplies leading to a spike in international LNG spot prices. In northern China the situation was even more critical, with LNG supplies limited by terminal capacity. LNG importers initially tried to limit DLNG send-out by allowing the price to rise. This can be seen in Figure 5, with the ex-terminal price closer to the average China LNG import price from March to September (as in southern China), but then rising significantly more sharply than even the spot LNG price from October 2017 to January 2018 and maintaining that premium to the end of the winter.

Figure 5: LNG ex-terminal price (in US$/MMBtu) in northern China (Tianjin) versus CLC and JKM (both adjusted to ex-terminal) for 2017/18. Sources: IHS, China Customs, SCI
However, due to rather inelastic demand (i.e. difficulty of many DLNG users to switch to alternative fuels at short notice), along with the curtailment of pipeline supplies to mini-LNG plants described in the next section, this led to a sharp increase in DLNG prices, by a factor of as much as three, from ~3,000 RMB/tonne to ~9,000 RMB/tonne (~US$9/MMBtu to ~US$27/MMBtu). This increase was much steeper than the increase in international spot LNG prices over the same period. In face of accusations of “profiteering” major LNG importers undertook to cap their ex-terminal DLNG pricing, and in effect imposed a rationing system on lifters. While this stabilized ex-terminal DLNG prices, it to some extent resulted in the super-profits achievable in the still tight DLNG market being transferred from the LNG importers to those DLNG distributors able to secure supply.

By contrast, in the winter of 2018/19, LNG importers have generally been fully (and sometimes even over-) supplied, so have been keen to maximize DLNG send-out to help accommodate their LNG import commitments. As a result, there has been no such notable winter DLNG price spike this winter, and the price has remained around ~4,500 RMB/tonne (~US$13.30/MMBtu), which is not far from the average China LNG import price, adjusted to ex-terminal. Ironically this has itself caused some challenges for DLNG traders and distributors, who had hoped to make greater margins in the winter to offset very thin margins through the summer.

For the future, it seems likely that major LNG importers continue to improve their ability to forecast seasonal demand and manage their LNG procurement accordingly, reducing the fluctuations in under- and over-supply. Furthermore, the development of increased LNG storage capacity at terminals will increase the ability of LNG importers to manage temporary supply/demand imbalances, without resorting to curtailment of DLNG. In that case they may increasingly see DLNG as a market in its own right, with its own requirement for supply security and price predictability. The emergence of liquid-out only LNG import terminals may further insulate the DLNG market from the effects of swings in pipeline gas demand, as these terminals cannot be tempted to divert supplies to the
pipeline market. Although it may be expected that these terminals will ultimately also seek pipeline connections to increase throughput.

3. **DYNAMICS OF DLNG PRICING IN INLAND REGIONS**

DLNG generally has an economic distribution radius of less than 500 km. Therefore, DLNG consumption in inland regions of China relies largely on domestic production, from local mini-LNG plants. These fall into two main categories: (i) plants liquefying purchased pipeline gas; and (ii) plants liquefying local gas production (often not connected to the pipeline system).

In the first category, the ex-plant cost of DLNG can clearly be determined by the pipeline gas input price plus the cost of liquefaction (including fuel). Hence, the relativity of DLNG to pipeline gas prices, if based on the cost-plus approach, should be essentially constant. This broadly holds true during periods of pipeline gas availability. The total nameplate capacity of China’s mini-LNG plants is some 20 mtpa, so the average utilization is only around 50%, with production determined by the level of demand, and hence pricing is kept competitive. However, when there is a general gas shortage, pipeline suppliers prioritize other gas users (as happened in the winter of 2017/18), curtailing supplies to “non-essential” customers, such as heavy industry and mini-LNG plants. The mini-LNG plants must then shut in, with the resulting shortage of DLNG leading to sharp price spikes (as seen in Figure 6).

Figure 6: Inland LNG price vs Shanghai Citygate price for 2016 to 2018. Sources: China customs, IHS, CEIC

The second category of mini-LNG plants is generally associated with gas production that has no alternative outlet, so maintain continuous LNG production almost regardless of price. In normal times, these producers price their LNG output to remain competitive with other regional DLNG suppliers (i.e. they operate as price takers). However, when those competitors are forced to shut down by gas supply curtailment, these remaining producers gain substantial (albeit temporary) pricing power. In essence, DLNG prices are then limited only by the willingness of end users to pay (or of authorities to tolerate). DLNG end-users, unless they have alternative fuel options, are faced with the stark choice of ceasing operations or paying whatever it costs for supply. In the winter of 2017/18 LNG-fuelled trucks were especially severely affected, as LNG retail sites generally have on-site storage for only 1-2
days of throughput, and so quickly stock out. This experience undoubtedly contributed to the slow-down in LNG truck adoption in 2018.

4. THE LINKAGE BETWEEN ONSHORE AND OFFSHORE LNG PRICES

We have now described separately the key drivers for DLNG pricing in coastal and inland regions of China. However, there is no sharp dividing line between the two. The seasonality of ex-terminal and inland DLNG prices, especially in northern and eastern China, is quite similar, and likely to increase in the future with increased connectivity between southern terminals (located where seasonal swing is insignificant) with the supply system in northern China. Meanwhile, any price difference could be arbitraged away. With the cost of transporting DLNG typically less than 1 RMB/tonne/km, a sufficient price differential between regions can make it economically viable to transport DLNG by road over much longer distances. Most famously, large convoys of DLNG trailers were organized in the winter of 2017/18 to transport LNG from the (relatively well-supplied) south to the (shortage affected) north. The use of ISO containers has also been piloted. With sufficient DLNG trailer availability, it should be possible to reduce inter-regional DLNG price differences to the cost of transportation. However, it has been observed at times that there emerges a significant gap between DLNG price ex-terminal and DLNG price inland, which was the case for the 2017/18 winter (see Figure 7).

![Figure 7: Onshore DLNG and ex-terminal DLNG prices for 2016 to 2018. Sources: China customs, IHS, CEIC](image)

There are at least two reasons for that. First, the ability to move LNG between regions is restricted by the size of the available LNG trailer fleet, as well as ex-terminal DLNG suppliers limiting the ability of purchasers to re-direct volumes to destinations other than those specified at the time of purchase. During the winter peak season, the market may anyway see limitations on trailer capacity, thus constraining the market’s capacity for coastal-to-inland or south-to-north DLNG arbitrage. Secondly, terminals and mini-LNG plants are subject to different levels of regulatory scrutiny or government intervention. As in other sectors, if the “market” is seen to be leading to extreme outcomes, especially where this causes unsupportable pressure on energy users, authorities have typically intervened (informally or formally) to limit those extremes. Terminals, largely operated by NOCs, will be more
influenced by such intervention, as was the case in 2017-18 winter when CNOOC was reportedly directed to cap its ex-terminal price to help stabilize DLNG prices.

6. OTHER FACTORS
The DLNG price curve has also been shaped by procurement strategies intended to lower buying cost, such as the shift of procurement from peak to shoulder season. The experience of winter 2017/18 was severe for many DLNG users. In the transport sector, LNG-fuelled trucks were idled, while industrial users were forced to curtail their operations. For winter 2018/19, some industrial users took steps to pre-purchase DLNG supplies, including examples of using ISO tanks for additional on-site storage. While this insulated these users from possible winter price spikes, the consequent shifting of their purchasing may have contributed to the relatively higher DLNG prices during the autumn of 2018 and the relatively lower DLNG prices during the following winter.

7. CONCLUSIONS
The DLNG market in China comprises multiple players (domestic producers, importers, traders, distributors, hauliers, retailers and customers) and formally deregulated pricing. As such it has operated as a kind of safety valve for the much larger, and more regulated, pipeline gas market. A consequence is that supply/demand imbalances in the China gas market as a whole have tended to be magnified in the DLNG market (due to curtailment of supply to mini-LNG plants and prioritization of gas send-out from LNG import terminals). The knock-on effect has been that DLNG price volatility is also magnified. Volatilities could be reduced in LNG import terminals devoted solely to DLNG send-out (i.e. which would not prioritize gas send-out).

We’ve also looked at the linkages between the price formation mechanisms for the two sub-segments of DLNG — LNG ex-terminal and from mini-LNG plants. These prices normally move in the same directions, but the onshore LNG price has tended to be more volatile than ex-terminal LNG prices. There is also some linkage between ex-terminal LNG prices and international LNG prices, but it seems not to be a simple cost pass-through. Pricing strategy is driven to quite some extent by the domestic market balance, including seasonal balances, which in turn change as a result of shifts in seasonal demand.

The DLNG price environment is set to continue to evolve. One key development to be watched is the impact of expanded terminal access by traders. Another is the Government’s stated intention to introduce a greater role for the market in setting prices in the wider gas market. This would have the most significant positive impact, by removing distortions in the current dual pricing regime (DLNG liberalized while gas market largely regulated) and thus enabling the DLNG and pipeline gas markets to establish a more balanced pricing relationship.

REFERENCE
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