Thermal Coal Derivatives Discussion

Studying CME and ZCE Thermal Coal Futures
CME has a full suite of Thermal Coal futures

CME Group (CME) is the exchange of choice for trading thermal coal futures and options. NYMEX, now a part of CME, began offering North American coal in 2001 with the launch of the Appalachian Coal futures. CME has since then taken coal risk management global, offering a comprehensive product slate of both thermal and coking coal covering the US, Europe, South Africa, Australia, Indonesia and China.

CME’s US domestic contracts include the Central Appalachian, the Western Railway Delivery (Power River Basin), and the Eastern Railway Delivery (CSX Platts OTC Index) coal futures. Outside of the US, the coal suite includes the API 2, API 4, Indonesian sub-bituminous, API 5 and API 8 contracts.

How big is the thermal coal derivatives market

Coal currently provides over 40% of the world’s electricity and can be categorized into 3 groups; Steam (Thermal), Coking (Metallurgical) and Lignite (Brown) coal.

The annual world trade of thermal coal has been increasing at 10% year on year with 3 billion Metric Tons (MT) of coal traded in 2013, 90% of this being derivatives. For Atlantic coal (which is a more mature market) there is currently a ratio of 9:1 on the derivatives market versus the physical. The corresponding ratio in Asia is much lower.

CME has 70% share of non-US coal market

China is the world’s largest coal producer and a major importer. Over 400 million MT a year is imported by China and India. The proportion of coal being traded in Pacific versus Atlantic is increasing every year.

A successful 2013; 2014 off to good start

CME had a very successful year in coal. A total of 1,298,386,000 MT traded across all non-US Coal products in 2013. 98% of this volume was in the Atlantic Coal Markets (API2 and API4); however we envisage this percentage to change with the maturing of the Asia markets.

2014 had an excellent start also. Volume and Open interest across the non-US contracts stood at 172,797,000 MT and 123,335,000 MT respectively, as of end-February 2014.
**International markets use 6,000 kcal indices**

Argus and IHS McCloskey publish a series of API indexes, which are used for 90% of the world’s internationally traded coal derivatives. All the API indexes are calculated by averaging the relevant Argus and IHS McCloskey assessments.

The established non-US market is dominated by high quality coal (6,000 kilocalories net and received or kcal NAR). This is the grade which Australia and South Africa supplies, and which Europe imports.

Europe is a major trading hub for thermal coal. CME is a recognized provider of an established over-the-counter futures market for the 6,000 kcal markets servicing Europe and South Africa. The bulk of non-US coal derivatives market is settled against either the API 2 (delivery Amsterdam, Rotterdam and Antwerp) or the API 4 (export price from Richards Bay South Africa).

**Asia is a sub-6,000 kcal market**

However, Asia (with the exception of Japan) is not a 6,000 kcal market. It is a multi-grade, multi-origin market. The more relevant coal trades traded in Asia are the 5,500 kcal and 4,900 kcal grades of coal. With the increasing importance of Chinese demand, the non-US thermal coal market has shifted its attention to the lower calorific materials.

Australia and Indonesia are the world’s largest exporters of thermal coal; China is the world’s largest consumer. As the Asian markets grew, more localized hedging tools were called for, and the Indonesian sub-bituminous and South China swaps markets emerged.

In Asia, the 5,500 kcal NAR market quickly became the more closely watched coal metric, after China became a net importer of coal in 2009. Australia has been exporting 5,500 kcal coal to China, but this was previously considered to be an “off spec” market. But as development of the API 8 index progressed, it became clear that this “off spec” market was an important and active spot market in its own right.

**CME has 3 coal futures covering Asia market**

The API 5 (5,500 kcal FOB Newcastle) and API 8 (5,500 kcal CFR South China) indices were launched by Argus & IHS McCloskey in 2012. These two benchmarks are considered to be true reflections of the 5,500 kcal market, reflecting Australian supply and Chinese spot demand. Derivatives contracts that settle against the API 5 and API 8 indexes are now frequently brokered together.

CME launched the API 8 futures in September 2012 and the API 5 futures in June 2013.

Meanwhile, not forgetting the older and more established of the Asian indices, this is the IHS McCloskey Indonesian Sub-Bituminous marker. It provides transparency to the important FOB Indonesia seaborne coal trade route, for the Asian markets.

CME had launched the Indonesian Sub-Bituminous (Sub-Bit) Coal since January 2011.

Futures based on all three Asian indices are listed for central clearing on CME ClearPort. API 8 continues to draw interest from new market players. It traded an average of 1,272,000 MT per month from December to February, and has overtaken the Sub-Bit coal, which traded an average of 1,028,000 MT over the same period. The API 5, our newest contract launched in June last year, continues to grow, with 175,000 MTs traded in February.
Current situation on Thermal Coal globally

From 2008 to 2011, the coal market was booming. Thermal coal prices reached a high of $200 per metric ton. Many coal companies across the world had expanded.

However, prices have since then slumped, and are trading at about $75 per ton currently. The market now appears to be in an over-supplied situation. To make matters worse for coal miners, shale gas is gaining traction as a cheaper energy alternative. Newer technology is enabling shale to be produced more efficiently, and more cost competitively.

Production margins have reportedly turned negative on most grades of coal in 2013, but miners, particularly US miners, seemed unwilling to cut production and have continued to export. This is possibly due to the high coal inventories accumulated in the US in 2012 and 2013.

During the first two months of 2014, the US thermal coal situation appeared to have improved slightly. The US economy was gradually strengthening, and the very cold winter has helped increase domestic coal consumption. But import of coal by China has also slowed down. Domestic coal production from inland China is gradually being unlocked as railroad capacity increases. This might exacerbate the current global oversupply situation on coal as the year progresses.

In 2013, Asia accounted for 75% of South African thermal coal shipments. Demand for South African 6,000 kcal coal from both the Atlantic and Asian markets has also been slow. China and India seemed to prefer the cheaper sub-6000 kcal material from Indonesia and Australia.

Delivered prices of thermal coal delivered into Northwest Europe (API 2) had averaged US$84/MT in the fourth quarter of 2013. Average prices for FOB Richards Bay, South Africa (API 4) fell 14% to US$80/MT, from 2012 to 2013. Both are currently trading at around US$75/MT.

Asia Pacific is at the center of the Coal Exports

Over 75% of the world’s seaborne thermal coal exports originate from just four countries. As the chart shows, 58% of the coal exports are from Australia and Indonesia alone.

![Coal Exports ('000 short tons)](source)

Source of data: EIA

Asia Pacific is at the center of Coal Imports

Two thirds of all coal imports are also into Asia, with China, Japan and South Korea accounting for almost half of the global imports. In the 1990s, China was among the top 6 global exporters of thermal coal, but with its rapid infrastructural build-up, China has now become the world’s largest importer of coal, accounting for 23% of all seaborne coal imports.

Global coal demand grew by 170 million MT in 2012, according to IEA. Almost the entire growth came from China.

![Coal Imports ('000 short tons)](source)

Source of data: EIA
The role of thermal coal in China

Like the US, the most important use of thermal coal in China is in power generation. Coal is regulated in China. The National Development and Reform Commission (NDRC) tightly controls the retail electricity prices charged to consumers, and the electricity tariffs given to coal-fired power plants.

On the other hand, government control of coal prices is more benign, and coal prices are given more leeway to move with the market rate. This mismatch distorts domestic power plant’s revenue and costs, since electricity rates are fixed, while coal prices are a bit more variable. If coal prices rise, the power plants are not able to pass along the costs to customers by raising electricity tariffs.

For example, in 2011, electricity demand grew 12% in China. Yet the increase in coal prices caused many power generators to post losses. In 2012, electricity demand growth fell to 5%. But coal prices also fell, and major power plant owners posted excellent profits, despite the slower electricity demand growth.

Not only do the power plants have little control over their cost and revenue structure, many of the coal mines are outdated, which makes it very costly to improve or make them more efficient. China has 10,000 small local mines, and the government is opening its coal sector to foreign investments, in an effort to consolidate and modernize its outdated mines.

China domestic production vs imports

Prior to 2009, China’s domestic coal production met all of its consumption requirements. In recent years, China had to ramp up its imports because of domestic demand growth. China has become a net importer since 2009.

Although China is currently the largest importer of coal in the world, it is worth noting that imported coal accounts for only 7% of China’s consumption. The bulk of coal consumed by China is produced domestically.

Production of thermal coal is concentrated in the North and North West of China, while consumption is highest is the East and South of China. Due to this geographical layout between coal production and consumption, China turned to imports to meet its rising coal demand. It is currently both easier and cheaper to import sea-borne coal to coastal China, than to transport coal by rail from inland China.

China is now importing roughly as much seaborne coal as the rest of the world combined, and also consuming as much coal as the rest of the world combined.

Not surprisingly, the pricing of thermal coal, the most common coal produced in China, has drawn attention from regulators. Thermal coal prices in China have been volatile historically, and thermal coal companies in China are keen to have hedging tools to reduce their price risks.
**NDRC wanted to stabilize coal prices**

Until recently, the NDRC had mediated annual contracts between coal producers and power plants. In 2012, NDRC removed this coal price negotiation system. At the same time, coal prices have been declining steadily since the end of last year. The government wants to see coal prices remaining relatively stable.

The Chinese government decided that a domestic thermal coal futures contract should be developed. The futures would serve as an important hedging tool for miners and end-users. It hopes that the contract will improve the thermal coal pricing mechanism, and enhance China's influence on the international coal market.

**ZCE launched Thermal Coal in August 2013**

Zhengzhou Commodity Exchange (ZCE) was the first experimental futures market approved by the State Council of China and was established in 1990. In August 2013, the China Securities Regulatory Commission (CSRC) approved a steam coal futures contract to be listed on the ZCE.

In total, 10 steam coal futures contracts, with base prices starting at 520 RMB and delivery times ranging from December 2013 to September 2014, made their debut on the ZCE. Since its debut, monthly volumes have grown to 0.9 million contracts in February 2014, from 0.5 million contracts in September 2013.

### ZCE Steam Coal Specifications

<table>
<thead>
<tr>
<th>Product Code on ZCE</th>
<th>TC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contract Unit</td>
<td>200 metric tons</td>
</tr>
<tr>
<td>Minimum Fluctuation</td>
<td>0.2 RMB per metric ton</td>
</tr>
<tr>
<td>Settlement Type</td>
<td>Physical</td>
</tr>
<tr>
<td>Benchmark Quality</td>
<td>5500 kcal/kg NAR</td>
</tr>
<tr>
<td>Maximum sulfur content</td>
<td>1% dry basis</td>
</tr>
<tr>
<td>Designated ports</td>
<td>Qinhuangdao, Caofedian, Jingtang, Tianjin, Fuzhou, Guangzhou, Fangcheng</td>
</tr>
</tbody>
</table>

Source of data: ZCE

### Comparing CME and ZCE coal prices

The table below shows the historical traded prices of ZCE thermal coal (TC), and CME's suite of Asia thermal coal futures. The 4,900 kcal Sub-Bit coal is of lower calorific value and therefore trades at a lower value than the 5,500 kcal coal.

The TC, API 5 and API 8 are all based on the same underlying 5,500 kcal grade of coal. The broad price differences between them can be explained by freight cost and tax reasons.

API 5 is FOB Australia and API 8 is CFR South China. So the price of API 8 can be estimated to be around the price of API 5 plus the freight cost for the Australia-to-South China route.

And the price of TC coal (plus domestic cost of transporting it from North to South China) would be around the price of API 8 plus the value-added tax imposed on the import of coal into China (currently at 17%).

\[
\text{API8} \approx \text{API5} + \text{Australia to China Freight} \\
\text{TC} \approx \text{API8} + 17\% \text{ tax} – \text{North-to-South China freight}
\]

As the chart shows, the prices of all four coal contracts have behaved reasonably consistently with one another. There is a general downtrend in thermal coal prices since the end of last year. This is due partly due to the decline in heating demand as winter came to an end.

### Prices of ZCE & CME Asian Thermal Coal

Source of data: CME/Bloomberg
CME’s Asia coal are closely correlated

Coal prices in Asia are largely correlated when trading the sub-6000 kcal grades – API 5, API 8 and Sub-Bit. This is consistent with the fact that all three are affected by the wider Asian buying activities, and that most of the Sub-Bit and Australian coal produced end up within the Asian markets.

### Price Correlation amongst CME Asia Coal

<table>
<thead>
<tr>
<th></th>
<th>API 5</th>
<th>API 8</th>
<th>Sub-Bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>API 5</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>API 8</td>
<td>0.83</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Sub-Bit</td>
<td>0.93</td>
<td>0.84</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Comparing ZCE and CME Asia Coal prices

Analyzing the correlation between the price of ZCE coal and the prices of CME’s suite of Asian Coal prices is trickier, due to two reasons.

The first reason is due to differences in the pricing mechanisms underlying these contracts. The floating prices of CME’s coal futures are based on Argus and/or McCloskey indices. These indexes are published on each Friday. This means that there is only one spot price point for each product per week, which can be used to compare with ZCE’s prices.

The second reason is the relatively short trading history of ZCE’s coal futures and CME’s API 5 coal futures. ZCE coal was launched in August 2013, and CME’s API 5 was launched in June 2013. As such, there is not enough trading history to draw firm conclusions about the correlation.

### Price Correlation between ZCE & CME Asia Coal

<table>
<thead>
<tr>
<th></th>
<th>API 5</th>
<th>API 8</th>
<th>Sub-Bit</th>
</tr>
</thead>
<tbody>
<tr>
<td>TC vs API 5</td>
<td>0.40</td>
<td>0.74</td>
<td>0.38</td>
</tr>
</tbody>
</table>

ZCE Coal also correlated to CME Asia Coal

Comparing ZCE coal with CME’s Asia coal suite, the correlation is somewhat lower, based on the short history of data points. It does appear that API 8 has a better correlation with ZCE coal. Since API 8 is an assessment for CFR South China, differentiated from ZCE’s TC only by the value-added tax, this does make sense from a physical trading point of view.

### What to monitor when trading thermal coal

We had explained the broad price differentials between API 5, API 8 and TC coal in terms of freight cost and taxes. Even after adjusting for them, the price differentials do diverge and fluctuate, as a result of other significant but localized industry and political factors.

When seeking an exposure to Asian thermal coal prices, an investor needs to be aware of the various macro-economic and geopolitical factors which affect coal prices. Some obvious ones are listed below.

- Although China uses predominantly thermal coal for power generation, it does use substitute products when prices are relatively low. Price movements of natural gas, crude oil, and refined products such as naphtha can have an impact on the price of coal.
- Coal demand is significantly affected by power consumption in the industrial and consumer sectors, and by refinery output. Economic indicators such as the China PMI, GDP forecast, and currency exchange rate must be factored into investment decisions.
- Weather conditions, such as heavy rain and flooding, impact mining conditions and the transport of coal via rail and roads. One has to keep an eye on the local weather conditions, not only in China, but also in export countries such as Australia, the US, Indonesia and South Africa.

Source of data: CME/Bloomberg
Conclusion

The API 5 and API 8 indices reflect the 5,500 kcal NAR prices of Australian supply and Chinese spot demand of thermal coal. The Indonesian Sub-Bituminous index reflects another important seaborne route for the sub-6000 kcal grade coal exported from Indonesia. Futures trades based on all three indices can be cleared on CME ClearPort.

China has launched a thermal coal futures which reflects the domestic import of coal through four major transfer ports in North China, and three southern ports in South China. The ZCE futures contract is intended to improve the thermal coal pricing mechanism, and enhance China’s influence on the international coal market.

Investors wishing to gain an exposure to the growing thermal coal market in Asia have a range of actively traded futures to choose from.

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Contracts at a Glance

<table>
<thead>
<tr>
<th>Coal (API 5) fob Newcastle (Argus/McCloskey)</th>
</tr>
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<tbody>
<tr>
<td>Contract Code</td>
</tr>
<tr>
<td>Contract Unit</td>
</tr>
<tr>
<td>Minimum Fluctuation</td>
</tr>
<tr>
<td>Settlement Type</td>
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<tr>
<td>Source of Index</td>
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<table>
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<tr>
<th>Coal (API 8) cfr South China (Argus/McCloskey)</th>
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<tbody>
<tr>
<td>Contract Code</td>
</tr>
<tr>
<td>Contract Unit</td>
</tr>
<tr>
<td>Minimum Fluctuation</td>
</tr>
<tr>
<td>Settlement Type</td>
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<tr>
<td>Available Option Types</td>
</tr>
</tbody>
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<table>
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<tr>
<th>Indonesian Coal (McCloskey Sub-Bituminous)</th>
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<tbody>
<tr>
<td>Contract Code</td>
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<tr>
<td>Contract Unit</td>
</tr>
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