Global Commodities

Coal: Is seaborne trade in terminal decline?

Equities

Global
Mining & Metals

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Is seaborne coal trade in terminal decline?

Seaborne thermal and met coal trade has retreated from peak rates in early 2014 for a mix of cyclical but worryingly structural reasons too. Substantial new supply appears not to be needed medium term. These drivers will weigh on demand for some time; cost compression offers the best hope to maintain margins. We downgrade long term thermal and met coal prices as a consequence.

Thermal coal: Prices to remain cool…

China continues to retreat from the trade, as authorities lean on demand growth and support domestic supply. India's imports are subject to rising uncertainty as policies there encourage domestic supply and other energy to fill the power shortfall. Globally, momentum continues against relatively carbon intensive coal fired power. Seaborne trade is down from peak levels and we aren't sure it will recover on at least a 5 year view, given above developments. New mines will be needed to replace depletion by which time capex and opex intensity will likely have eased from China boom peaks. We cut our long term thermal coal price from US$82/t to US$55/t real.

Metallurgical coal: China steel decline makes it hard for met…

UBS forecasts structural decline of China's steel output to commence from next year, implying a weak demand outlook for seaborne met coal. The early phase of this retreat last year has resulted in China flooding world markets with crude steel. All the while China has supported domestic met coal output. This combination has displaced China's met coal imports, but also met coal demand where Chinese steel imports have displaced local steel output. We see seaborne trade flat to 2020 and again don't see significant new mines needed beyond replacing depletion. We downgrade long term real HCC prices to US$105/t, from US$132/t.

Equities that matter

We prefer prudent operators with long life low cost assets ideally exposed to met coal. BHP Billiton stands out here. At the smaller end, Whitehaven continues to execute well. Consol Energy is preferred for exposure to US gas demand.

Figure 1: UBS new vs old thermal coal price forecasts

	old	new	new vs old	Vs Consensus	
JFY	US$/t	US$/t	%	US$/t	%
2015E	68	68	0%	67	2%
2016E	63	61	-3%	64	-4%
2017E	65	60	-8%	65	-7%
2018E	72	61	-15%	67	-9%
2019E	85	62	-27%	71	-12%
LT price (nom. 2020)	92	62	-32%	71	-12%
LT price (real 2015)	82	55	-33%	n/a	n/a

Source: UBS Research.

Figure 2: UBS new vs old met coal (HCC) price forecasts

	old	new	new vs old	Vs Consensus	
	US$/t	US$/t	%	US$/t	%
2015E	102	102	0%	102	15%
2016E	91	85	-6%	92	-7%
2017E	104	89	-15%	101	-12%
2018E	126	95	-24%	112	-15%
2019E	142	105	-26%	122	-14%
LT price (nom. 2020)	149	118	-20%	127	-7%
LT price (real 2015)	132	105	-20%	n/a	n/a

Source: UBS Research.

UBS Research THESIS MAP

	MOST FAVORED	LEAST FAVORED
	High quality metallurgical coal	**Low quality thermal coal**

PIVOTAL QUESTIONS

Q: Do coal markets need new mine capacity?
Not beyond replacing depletion. Both met and thermal coal are expected to remain in surplus to 2020 at least. Supply needs to continue to exit to rebalance but exit is often costly & hard. With no large new growth capacity needed into the medium/long term, prices don't need to reward investment in new projects. We cut LT prices closer to our estimate of marginal cost.

Q: How much more cost compression can come from the coal industry?
The coal industry has been under intense cost/margin pressure for some years. Much has been achieved. But costs are still well above pre-China levels. Our new met & thermal coal price profiles are consistent with margins normalising as modest further cost compression is achieved from here.

Q: How long can uneconomic supply remain?
Myriad factors including closure costs, pension liabilities, bankruptcy restructuring, factor take or pay contracts and cost compression keep supply operating for longer than many anticipate. Our prices are set to maintain pressure on marginal suppliers in anticipation of gradual rebalancing.

WHAT'S PRICED IN?

Near term (cyclical) weakness: Coal equities are pricing in a more aggressive structural decline in the coal sector, on top of cyclical weakness. Consensus continues to see a meaningful recovery in coal prices into the medium/longer term. Given the structural headwinds facing coal markets, we no longer agree that coal (esp thermal) prices should recover strongly and sustainably in the medium/long term.

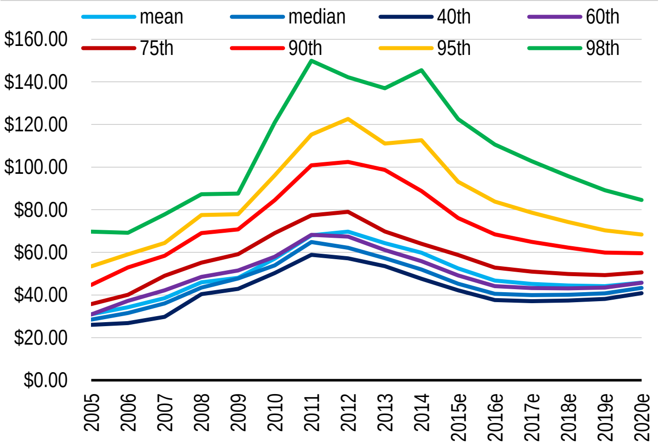
UBS VIEW

Coal trade has peaked near/medium term, no new scale capacity needed, LT prices to reflect MC: Thermal coal will remain a major part of global energy requirements, but anti-carbon momentum pressures marginal demand (and prices) lower. Met coal is challenged by the retreat of Chinese steel output over the medium to longer term. LT pricing of both to be more closely tied to marginal cost.

EVIDENCE

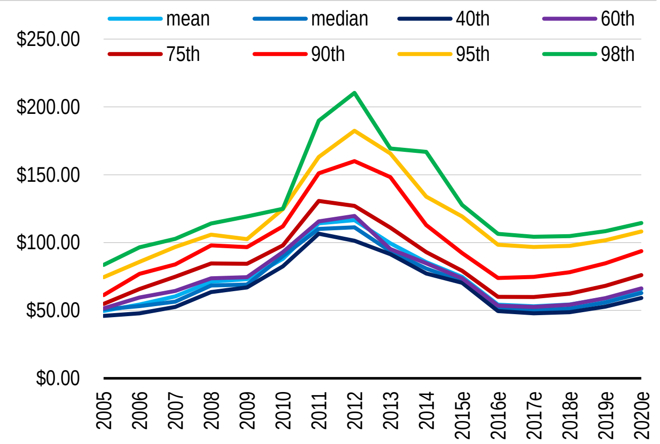
Seaborne coal trade is falling, as coal demand growth weakens: Trade of both seaborne thermal and met coal is down ~5%-10% from peak levels as China retreats from the trade. Prices have fallen, pressuring margins down and eliciting significant cost compression already. Meanwhile demand looks shaky as global momentum against carbon (thermal coal) builds, and as China's steel production eases from peak levels. It is hard to find broad bullish structural demand catalysts for either seaborne coal.

Figure 3: Seaborne thermal coal cost curve – key percentile cost levels – US$/t – 2005-2020e



Source: AME Group, company filings, UBS Research.

Figure 4: Seaborne met coal cost curve – key percentile cost levels – US$/t – 2005-2020e



Source: AME Group, company filings, UBS Research.

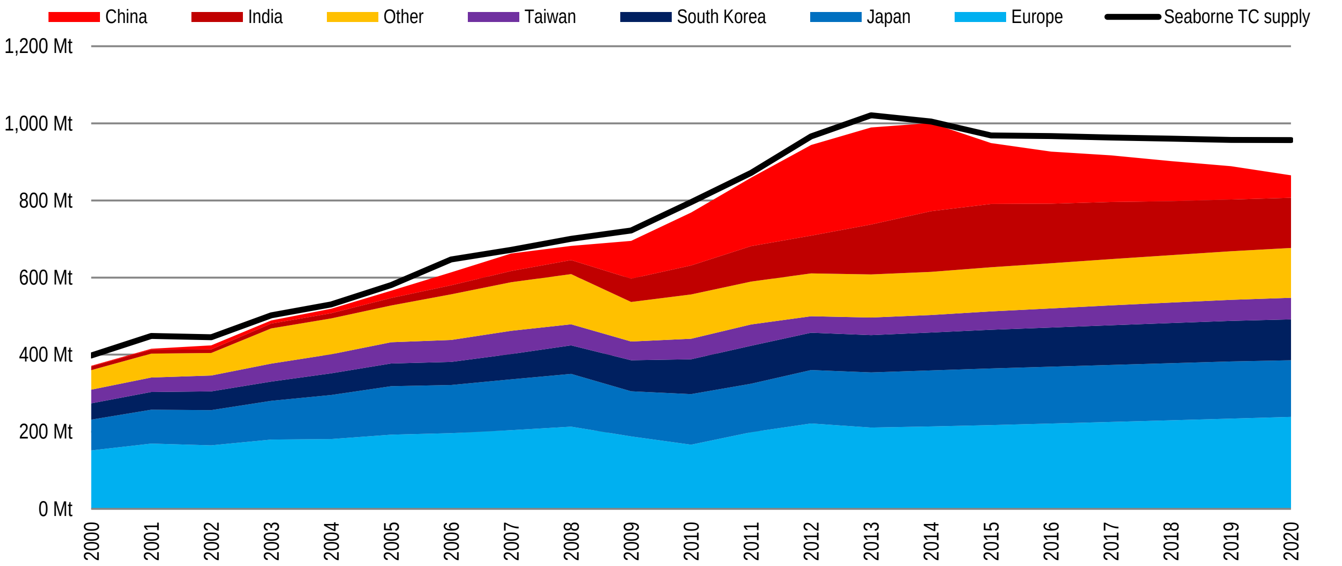
Thermal coal: Prices to remain cool…

Seaborne Thermal Coal Demand

Seaborne thermal coal trade is about 10% off peak levels in 2014 as China's retreat weighs

- Seaborne thermal coal demand has been falling in the last 12-18 months as China's net imports have retrenched. Meanwhile, thermal coal demand into India has continued to rise, along with non-traditional coal importers such as Thailand, Malaysia, Singapore, Mexico & Chile. Overall, though, total seaborne trade is about 10% below highs recorded in 2013 (Figure 5).
- The UBS outlook for seaborne thermal coal demand is further decline as China continues to exit the trade, leaving the market in growing surplus and requiring a combination of further production cuts or new demand sources (Figure 5).

Figure 5: Seaborne thermal coal demand by major importing country/economic block

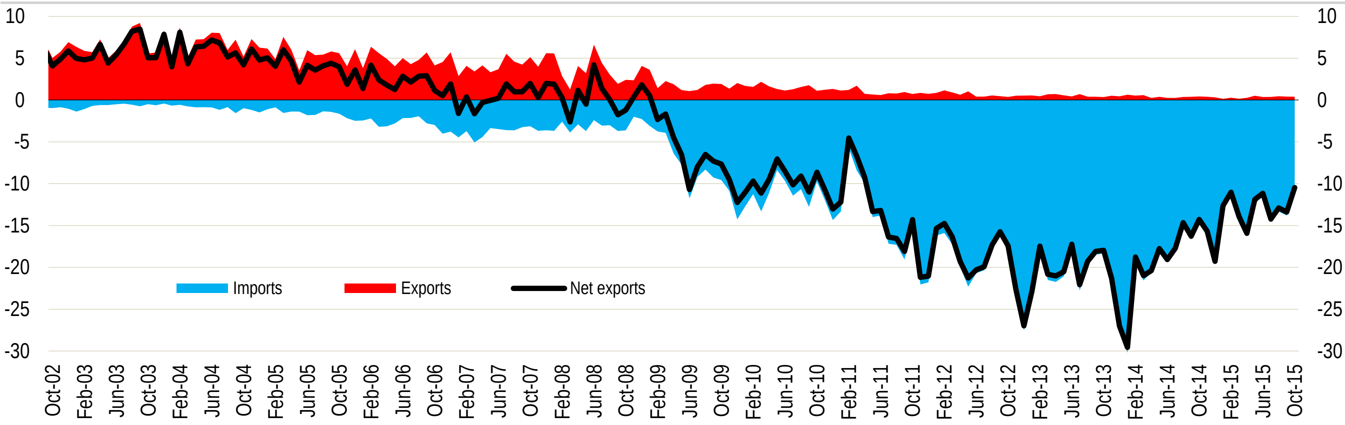


Source: AME Group, TEX report, IHS McCloskey, HDR Salva, Wood Mackenzie, company filings, UBS research.

China - Why are net coal imports in decline?

- China's net imports of thermal coal have fallen dramatically over the last two years. Current net imports (Sep-15) are annualising at 124Mtpa, down almost two-thirds from peak run rates of 354Mtpa in Jan-14.

Figure 6: China thermal coal exports, imports and net exports – Mt/mth



Source: China Customs, IHS McCloskey, UBS Research.

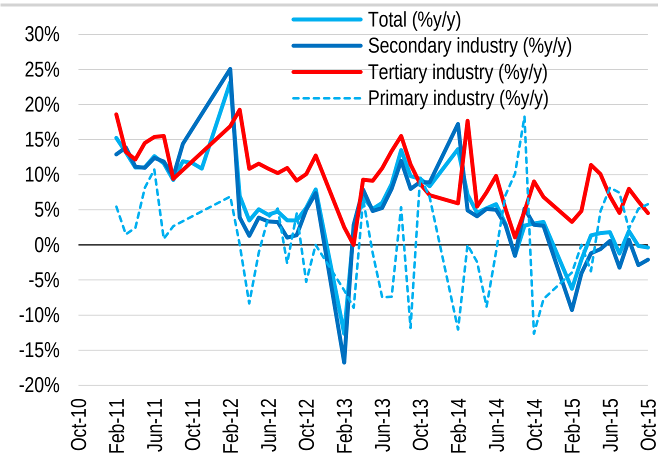
China's thermal coal imports falling due to i) weak power demand, ii) substitution to cleaner fuels, iii) robust domestic supply, iv) coal demand shifting inland and v) replacing direct coal consumption with natural gas

- There are several reasons for this which we consider in detail below:
  - Slowing power demand as the economy transitions to services/consumer,
  - Slower coal demand reflecting substitution away from coal and toward efficiency, natural gas and other energy forms,
  - Relatively stronger domestic coal production compared to imports,
  - A shift in China's thermal coal fired power production inland to central and western provinces in part facilitated by the national grid build out,
  - A shift away from direct coal consumption, particularly in heavily populated coastal provinces, as reticulated natural gas and national grid build out displaces heavily polluting direct coal use.

China's power demand and supply is slowing…

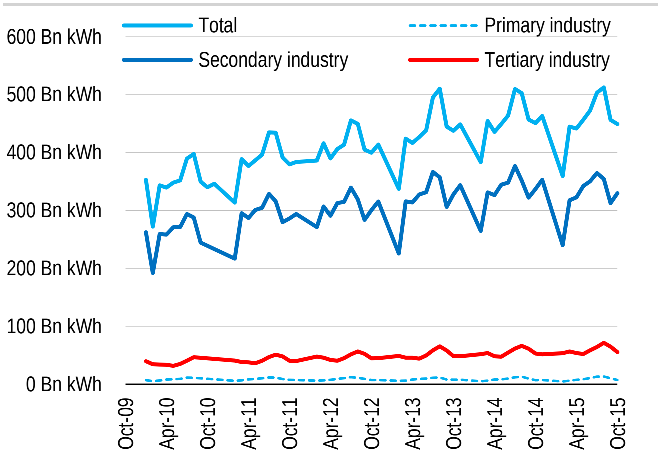
- China's power demand growth has slowed in recent years, from annualised growth typically 10%-15% on average, towards low single digit growth in the last year or so. Electricity production has slowed too as a consequence.

Figure 7: China power demand growth by user - %y/y



Source: China NBS, Bloomberg, UBS Research

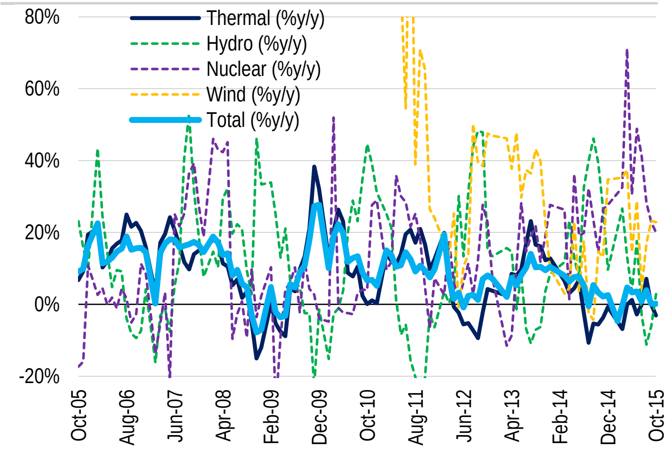
Figure 8: China power demand by user – Bn kWh/mth



Source: China NBS, Bloomberg, UBS Research.

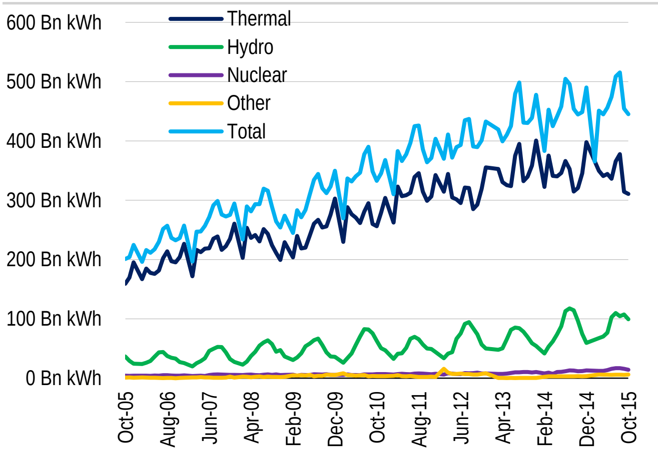
- Hydro power, nuclear & wind generation are all growing more quickly than thermal (and overall supply), but only contribute about one-fifth of all power.

Figure 9: China power supply by source - %y/y



Source: China NBS, Bloomberg, UBS Research.

Figure 10: China power supply by source – Bn kWh/mth



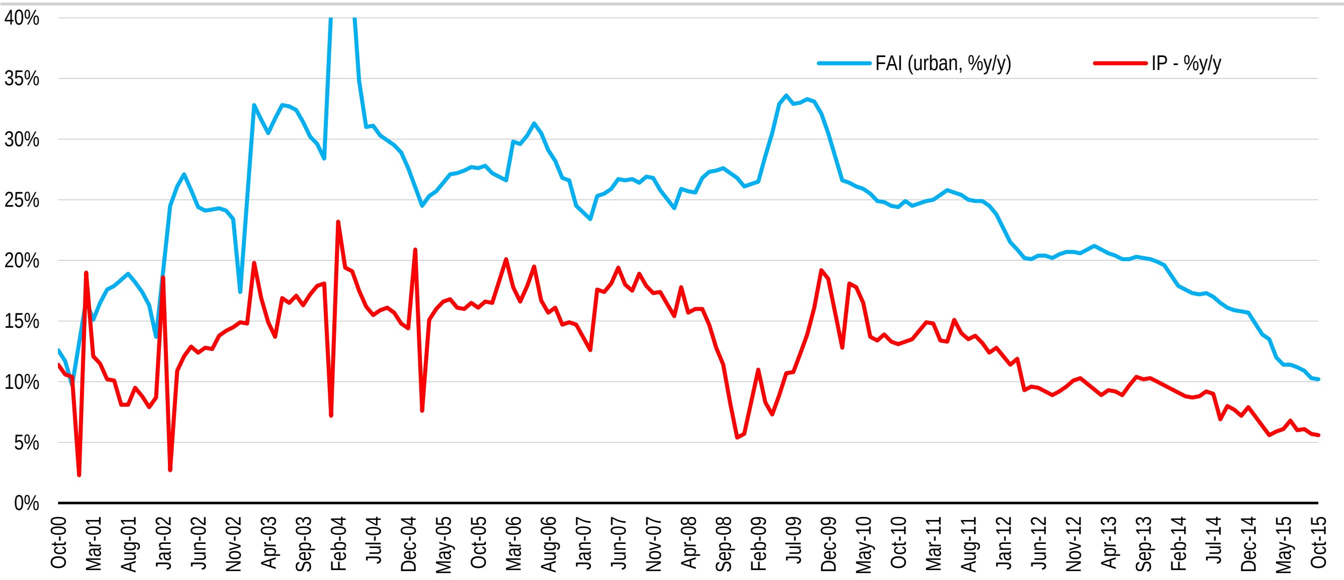
Source: China NBS, Bloomberg, UBS Research.

- Slowing power demand reflects slowing industrial production and fixed asset investment growth – a *quantity* impact. But power demand and supply has slowed more quickly than overall industrial output and investment, implying improving energy efficiency of GDP. This can be described as a *quality* shift.

Slowing power demand reflects both lower absolute growth but improving energy efficiency of growth

- Looking forward, we anticipate China's energy efficiency of GDP to continue improving, implying a continuation of the trend of power demand growth substantively below overall industrial output and GDP growth.

Figure 11: China industrial production and fixed asset investment - %y/y YTD



Source: China NBS, Bloomberg, UBS Research.

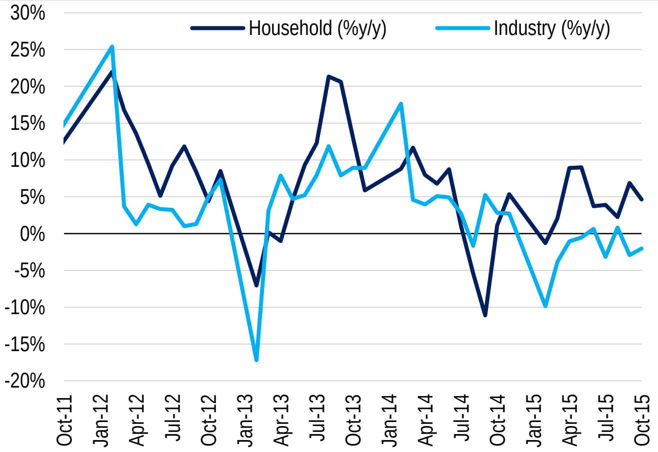
…as the composition of electricity demand shifts away from heavy industry…

- In line with China's growth shifting from construction, investment and heavy industry; power demand growth is shifting too. Figures 12 and 13 show power demand by industry and the household sector, in both levels and growth. Industry power use is 5-6x household use such that even though household

Household power use growing faster than industrial as composition of growth changes

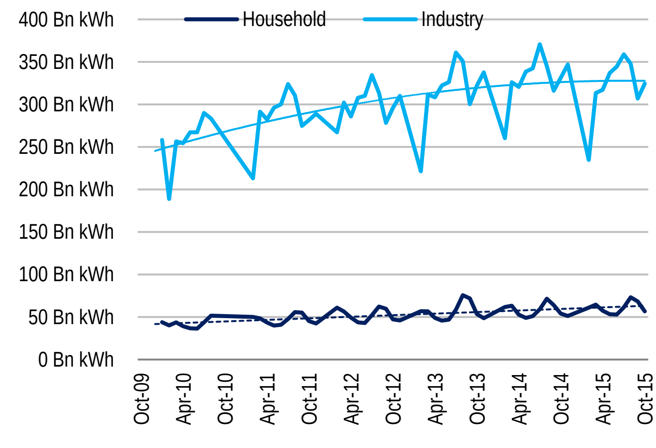
power demand is growing more quickly than industrial demand, overall power demand is flat.

Figure 12: China power use – industry vs h'hold - %y/y



Source: China NBS, Bloomberg, UBS Research

Figure 13: China power use – industry vs h'hold – Bn kWh



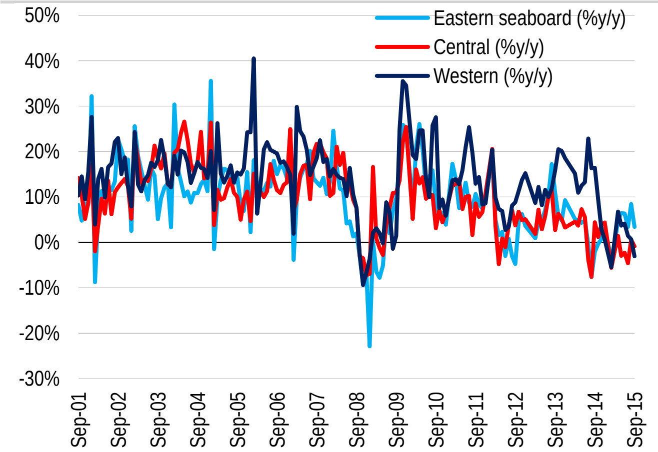
Source: China NBS, Bloomberg, UBS Research

…and away from the coast…

- Within the overall trend of strong then moderating growth in China's electricity output, recent history has shown strong growth in output in western provinces but much more moderate growth in output in central and eastern seaboard provinces.
- This reflects relatively abundant coal, hydro and wind resources in western provinces of China such as Xinjiang, Inner Mongolia, Ningxia, Gansu, Sichuan and Yunnan. It also reflects relative scarcity of energy resources in heavily populated and settled eastern seaboard provinces such as Beijing, Tianjin, Hebei, Shandong, Jiangsu, Zhejiang, Shanghai, Fujian and Guangdong.

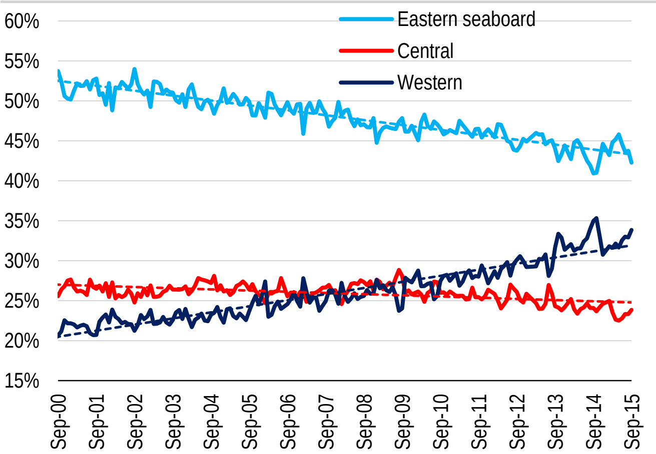
Chinese electricity output is shifting away from the coastal provinces and toward the central and western provinces as industry and massive mine-mouth power development continues

Figure 14: China power output – eastern, central and western provinces – growth – %y/y



Source: China NBS, Bloomberg, UBS Research.

Figure 15: China power output – eastern, central and western provinces - % share of total



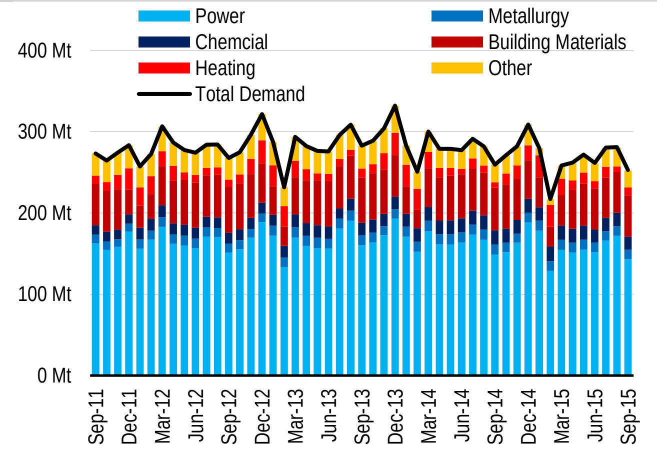
Source: China NBS, Bloomberg, UBS Research.

Thermal <u>coal</u> demand is weaker still than thermal <u>power</u> demand

Coal demand to generate power has been falling for the last 12-18 months

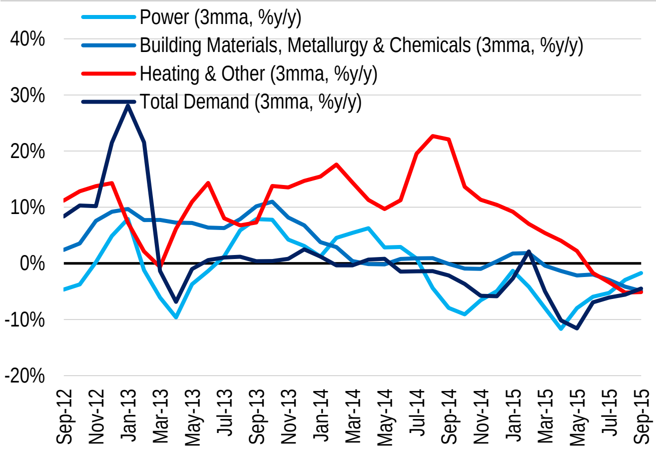
- About three-fifths of China's thermal coal consumption reflects power generation, with another 30% consumed by industrial usage. The remaining 10% or so is used for heating and "other".
- This latter category has declined from seasonal peaks of about one-fifth of total demand as direct coal usage in heating, cooking and other applications continues to be replaced by reticulated natural gas.

Figure 16: China coal demand by end use – Mt/mth



Source: China Coal Resource, UBS Research.

Figure 17: China coal demand by end use – 3mma %y/y



Source: China Coal Resource, UBS Research.

The grid changing location and mix of power supply

The rollout of the National Grid will allow increasing production of power in the central and western provinces, from coal, hydro, wind & solar especially; to be delivered into coastal demand centres – weighing on coastal coal import demand

- The national grid being developed by State Grid Corporation of China features up to 27 long distance ultra-high voltage power lines that, when complete, will transport power (eg: coal fired, hydro, wind, solar) from where it is generated in the West/North-West of the country, to where it is consumed on the east.
- All else unchanged, this will reduce coal usage in the east and impose a more expensive domestic freight task for imported thermal coal.
- China's nuclear build is also back on. There are 26 nuclear power plants under construction to add to the 15 already in operation. Nuclear power supplied is expected to rise from 414Bn KWh in 2014 to 800Bn KWh in 2020.

Figure 18: China power map – development of UHV long distance transmission and new nuclear capacity

UBS

China's Power Map

Major Interprovincial Ultra-High Voltage Transmission

	Name	Type	Commission date	Capacity (GW)
	Jindongnan - Jingmen 1000kV	AC	Jan 2009	5
	Xiangjiaba - Shanghai 800kV	DC	Jul 2010	6
	Jinping - Sunan 800kV	DC	Jul 2012	7
	Huainan - Zhebei - Shanghai 100kV	AC	Sep 2013	7
	Hami - Zhengzhou 800kV	DC	Jan 2014	8
	Xiluodu - Zhejiangxi 800kV	DC	Jul 2014	8
	Zhebei - Fuzhou 1000kV	AC	Dec 2014	7
	Ningdong - Zhejiang 800kV	DC	Expected Sep 2016	8
	Jiuquan - Xiangtan 800kV	DC	Expected Dec 2016	8
	Zhundong - Eastern China 1,100kV	DC	Expected end 2016	13
	Huainan - Nanjing - Shanghai 1,000kV	AC	Expected Dec 2016	7
	Ximeng - Shandong 1,000kV	AC	Expected 2016	9
	Mengxi - Changsha 1,000kV	AC	Expected 2017	12
	Mengxi - South Tianjin 1,000kV	AC	Expected end 2017	5
	Ximeng - Taizhou 800kV	AC	Expected 2017	10
	Dianxibei - Guangdong 800kV	AC	Expected Dec 2017	5
	Shanghaimiao - Shandong 800kV	DC	Expected 2017	8
	Yuheng - Weifang 1,000kV	DC	Expected 2017	NA
	Mengxian - Hebei 500kV	AC	Expected 2017	NA
	Shanxi - Jiangsu 800kV	DC	Expected 2017	8
	Mengxi - Wuhan 800kV	DC	Expected 2018	NA
	Zhundong - Chengdu 1,100kV	DC	NA	12

Details of the operating or approved nuclear projects in China

Unit	Province	% Owned	Operator	Model Capacity	Installed of operation (MW)	Commencement
Daya Bay Unit 1	Guangdong	75%	CGN Power	M310	984	Feb-1994
Daya Bay Unit 2	Guangdong	75%	CGN Power	M310	984	May-1994
Ling'ao Unit 1	Guangdong	100%	CGN Power	M310	990	May-2002
Ling'ao Unit 2	Guangdong	100%	CGN Power	M310	990	Jan-2003
Lingdong Unit 1	Guangdong	93%	CGN Power	CPR1000	1,087	Sep-2010
Lingdong Unit 2	Guangdong	93%	CGN Power	CPR1000	1,087	Aug-2011
Yangjiang Unit 1	Guangdong	78%	CGN Power	CPR1000	1,086	Mar-2014
Yangjiang Unit 2	Guangdong	78%	CGN Power	CPR1000	1,086	Jun-2015
Yangjiang Unit 3	Guangdong	78%	CGN Power	CPR1000	1,086	Expected H1 2016
Yangjiang Unit 4	Guangdong	78%	CGN Power	CPR1000	1,086	Expected H2 2017
Yangjiang Unit 5	Guangdong	78%	CGN Power	ACPR1000	1,086	Expected H2 2018
Yangjiang Unit 6	Guangdong	78%	CGN Power	ACPR1000	1,086	Expected H2 2019
Taishan Unit 1	Guangdong	51%	CGN Power	EPR	1,750	Expected H1 2016
Taishan Unit 2	Guangdong	51%	CGN Power	EPR	1,750	Expected H2 2016
Hongyanhe Unit 1	Liaoning	38%	CGN Power	CPR1000	1,119	Jun-2013
Hongyanhe Unit 2	Liaoning	38%	CGN Power	CPR1000	1,119	May-2014
Hongyanhe Unit 3	Liaoning	38%	CGN Power	CPR1000	1,119	Jun-2015
Hongyanhe Unit 4	Liaoning	38%	CGN Power	CPR1000	1,119	Expected H2 2015
Ningde Unit 1	Fujian	32%	CGN Power	CPR1000	1,089	Apr-2013
Ningde Unit 2	Fujian	32%	CGN Power	CPR1000	1,089	May-2014
Ningde Unit 3	Fujian	32%	CGN Power	CPR1000	1,089	Jun-2015
Ningde Unit 4	Fujian	32%	CGN Power	CPR1000	1,089	Expected H2 2016
Fuqing unit 1	Fujian	51%	CNNC	CP1000	1089	Nov-2014
Fuqing unit 2	Fujian	51%	CNNC	CP1000	1089	Expected 2015
Fuqing unit 3	Fujian	51%	CNNC	CP1000	1089	Expected 2016
Fuqing unit 4	Fujian	51%	CNNC	CP1000	1089	Expected 2017
Fuqing unit 5	Fujian	51%	CNNC	Hualong 1	1089	Expected 2020
Fuqing unit 6	Fujian	51%	CNNC	Hualong 1	1089	Expected 2020
Qinshan Phase I	Zhejiang	72%	CNNC	CP300	310	Apr-1994
Qinshan Phase II unit 1	Zhejiang	50%	CNNC	CP600	650	Apr-2002
Qinshan Phase II unit 2	Zhejiang	50%	CNNC	CP600	650	May-2004
Qinshan Phase II unit 3	Zhejiang	50%	CNNC	CP600	660	Oct-2010
Qinshan Phase II unit 4	Zhejiang	50%	CNNC	CP600	660	Dec-2011
Qinshan Phase III unit 1	Zhejiang	51%	CNNC	CANDU-6	728	Dec-2002
Qinshan Phase III unit 2	Zhejiang	51%	CNNC	CANDU-6	728	Jul-2003
Fangjiashan unit 1	Zhejiang	72%	CNNC	CP1000	1089	Dec-2014
Fangjiashan unit 2	Zhejiang	72%	CNNC	CP1000	1089	Feb-2015
Sanmen unit 1	Zhejiang	51%	CNNC	AP1000	1250	Expected 2017
Sanmen unit 2	Zhejiang	51%	CNNC	AP1000	1250	Expected 2017
Tianwan unit 1	Jiangsu	50%	CNNC	WWER-1000	1060	May-2007
Tianwan unit 2	Jiangsu	50%	CNNC	WWER-1000	1060	Aug-2007
Tianwan unit 3	Jiangsu	50%	CNNC	WWER-1000	1126	Expected 2018
Tianwan unit 4	Jiangsu	50%	CNNC	WWER-1000	1126	Expected 2018
Changjiang unit 1	Hainan	51%	CNNC	CP600	650	Expected 2015
Changjiang unit 2	Hainan	51%	CNNC	CP600	650	Expected 2016

Nuclear Power Plant

- (green) in operation
- (blue) under construction
- (red) planned but not approved

Source: UBS

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July 2015

Source: UBS Research.

Coal in China's 13th Five Year Plan

China's 13th Five Year Plan will apply from 2016-2020

- China's ruling Communist Party has agreed to the broad terms of the next five year plan (FYP) to apply from 2016-2020. While the specifics won't be available until the plan is ratified by the parliament in March 2016, we can glean general direction and implications for coal from the broad plan priorities.

- We also met with relevant government officials in November 2015 to understand in more detail the implication for coal demand in China. In short, the outlook is poor for thermal coal demand into the medium and longer term.

13th FYP aims to improve the quality of growth ahead of the quantity

- The five year plan has at its heart the objective to improve the quality of growth (and quality of life) for the Chinese people. The emphasis on growth at all costs is being removed, and a strong emphasis on environmental protection and cleaning up pollution is being hard wired into the FYP.

- This encapsulates moves to lower the airborne pollutants (hence horrific smog that envelopes many cities for much of the year) emitted from direct coal consumption by replacing direct coal usage with reticulated natural gas or electricity. Direct coal consumption is about 20% of overall thermal coal demand, or about ~650-700Mtpa.

13th FYP will target particulate pollution and carbon emissions => grim outlook for coal demand

- But it also is likely to encapsulate moves to lower the growth rate of carbon emissions as well. As in many other countries, moves to restrict/reduce carbon emissions will most heavily penalise coal and oil fired power and heat out of the major conventional energy sources.

- What is China doing on these goals? Among many other measures:
  - A plan to reticulate 670 cities with natural gas to replace direct coal consumption (announced in 11th FYP),
  - Likely extension of trial emissions trading schemes to a national emissions trading scheme,
  - Increased supply of compressed natural gas cars (taxis) and trucks, as well as LNG powered long distance trucks,
  - A strong focus on expanding nuclear power capacity from the current 15 power stations by adding 26 new stations and almost doubling nuclear supplied power by 2020 (from 414Bn kWh in 2014 to 800Bn kWh in 2020).

13th FYP signalling is clear: China recognises pollution is a problem; their response is accelerating, implying a poor outlook for coal demand growth into the medium-longer term

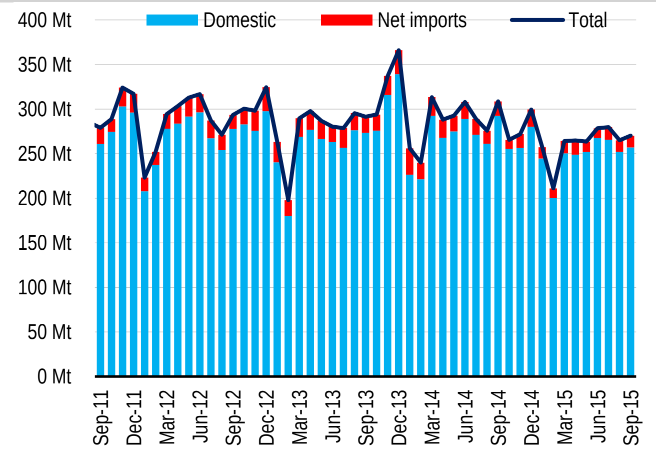
- The signalling from the 13th FYP and the government is clear:
  - China recognises the threat of both airborne particulate pollutants and carbon emission,
  - The government is responding more structurally and aggressively in the 13th FYP, with the implication that,
  - Chinese coal demand is likely to flat line and head lower over the medium to longer term.

China's domestic thermal coal supply is replacing imports…

- China's domestic thermal & met coal sector produces almost 4 billion tonnes of coal per annum, is a very large employer, bank borrower and contributor to provincial finances, as local government typically keep 60-70% of the 17% VAT sales tax.
  - As such, it is a key strategic industry beyond its pivotal role as provider of three-quarters to four-fifths of energy to China's power, industrial and heating users.
- As power demand has slowed, and coal demand slowed more, China's government has introduced a range of measures that bias against imported coal in support of domestic suppliers. This has resulted in a reversal of the lift of thermal coal import dependence from peak rates of 8-10% of total supply in 2013 back toward 5% now.

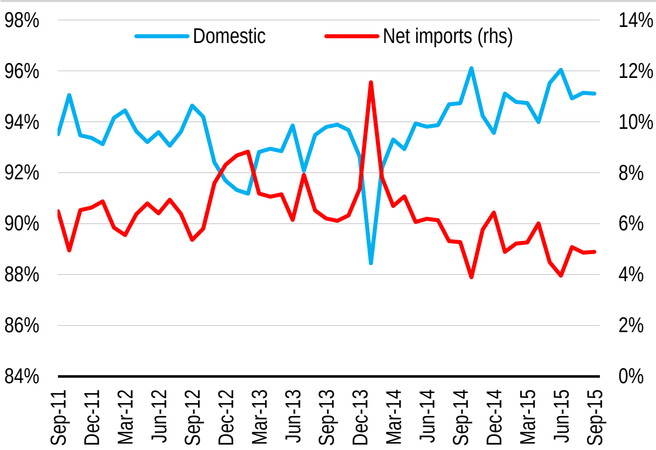
China's coal mining sector is a huge employer, bank borrower and contributor of sales tax revenues to cash-strapped local governments

Figure 19: China thermal coal supply – domestic and net imports – Mt/mth



Source: China Coal Resource, UBS Research.

Figure 20: China thermal coal supply – domestic and net imports - % share of total supply



Source: China Coal Resource, UBS Research.

Conclusion: China's thermal coal import retrenchment likely to continue – net exports on the horizon?

- We conclude that China's net thermal coal imports are likely to continue contracting toward arbitrage levels at best, and potentially a return to net exports (as per early 2000's) at worst.
- This presents a huge change for the seaborne market.

Seaborne thermal coal markets are in for major upheaval as China exits the trade

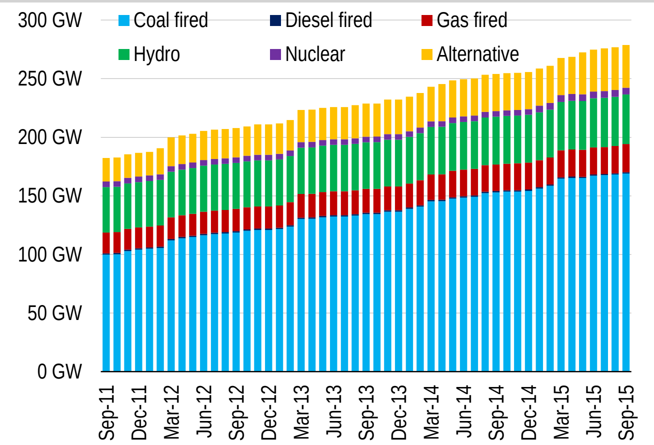
India – The saviour of the thermal coal market? Not so fast…

- India is often held up as the potential saviour for long term seaborne thermal coal demand. With relatively low power consumption per capita, low industrial penetration per capita (relative to income per capita), many see it inevitable that India's coal demand will grow strongly into the medium and long term.

Indian seaborne thermal coal demand potential may not be the coal market panacea it's often held out to be

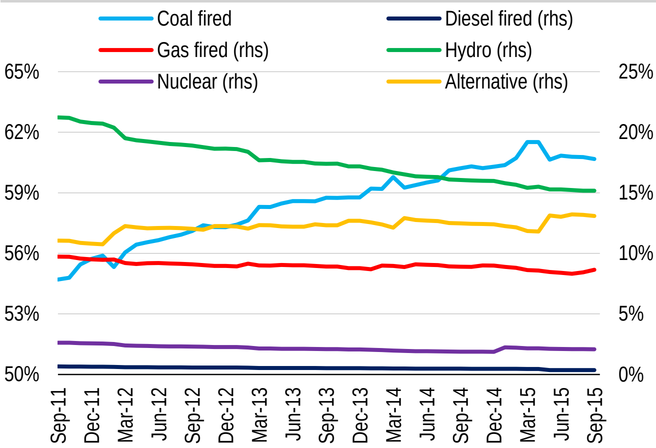
- We agree in part – India's power demand will grow strongly under the aspirations and policy pronouncements of the Modi government. And as it stands today, about three-fifths of India's power sector capacity is coal-fired.

Figure 21: India electricity capacity (GW)



Source: Bloomberg, UBS Research.

Figure 22: India electricity capacity - %share



Source: Bloomberg, UBS Research.

- However, it's not clear to us that India's thermal coal demand will grow exponentially as a result. Here's why.
  - India wants to grow all power supply; not just coal.
  - This means the government is encouraging coal fired power, but also natural gas, nuclear, hydroelectric, wind and, significantly, solar.

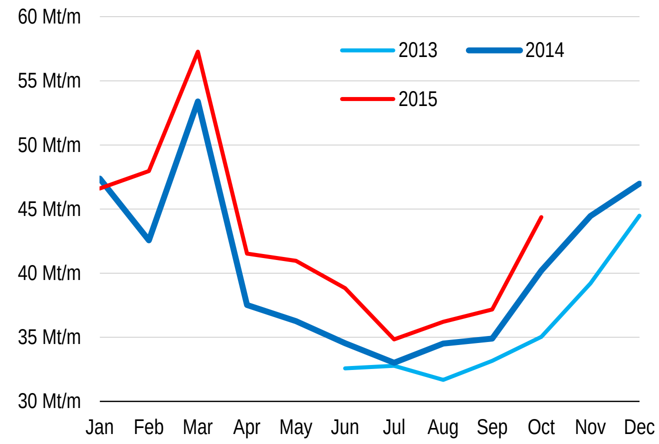
The Indian government wants all power supply, including from efficiency and reducing grid losses, to grow strongly (not just coal)

Domestic coal supply lift a clear threat

- The government is also encouraging domestic coal development, with aggressive targets to lift domestic coal output to about 1.5Bn per annum by 2021-22 from ~700Mtpa in 2014.
- Coal India, the largest coal miner in the world, has been set a target to lift output from ~500Mtpa to 1Btpa by 2021-22.

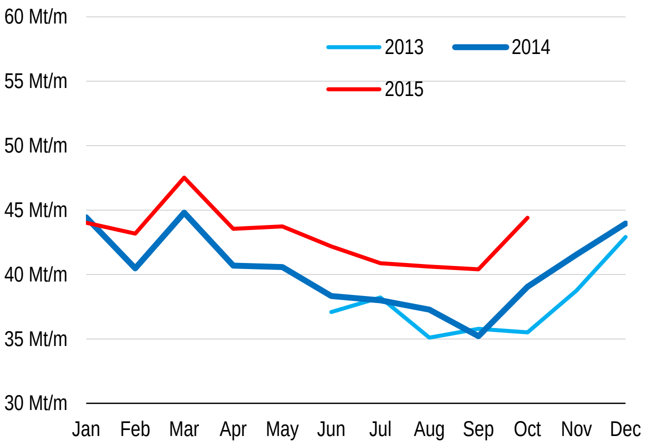
Domestic coal supply growth a clear risk to import demand prospects

Figure 23: Coal India coal production – Mt/mth



Source: Coal of India, UBS Research

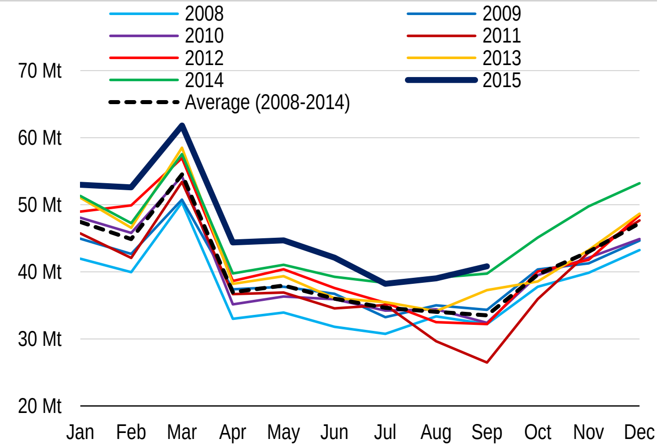
Figure 24: Coal India coal offtake – Mt/mth



Source: Coal of India, UBS Research.

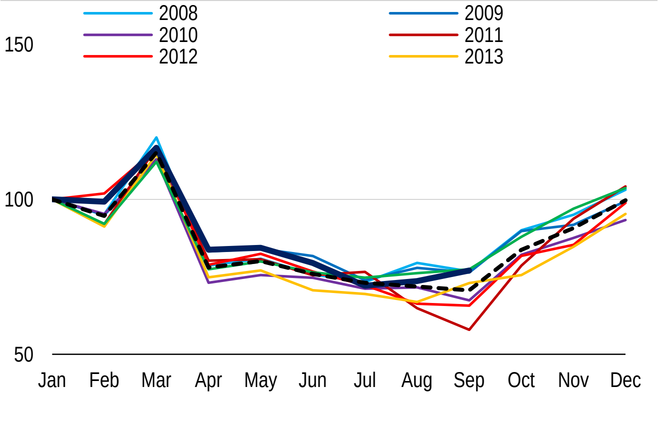
- The trend of rising domestic output also manifests at the national level.

Figure 25: India total thermal coal output – Mt/mth



Source: HDR, UBS Research.

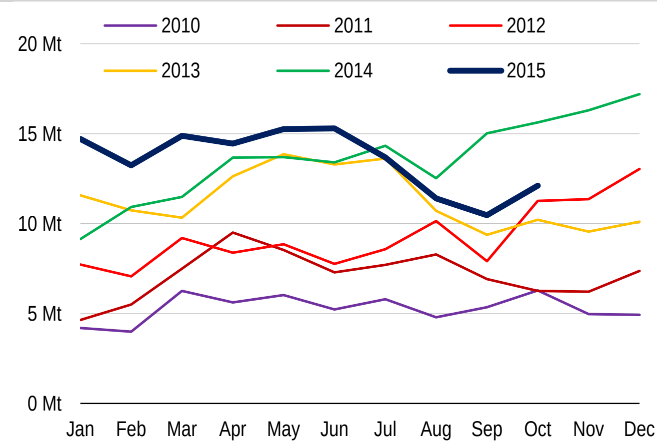
Figure 26: India total thermal coal output – Jan=100



Source: HDR, UBS Research.

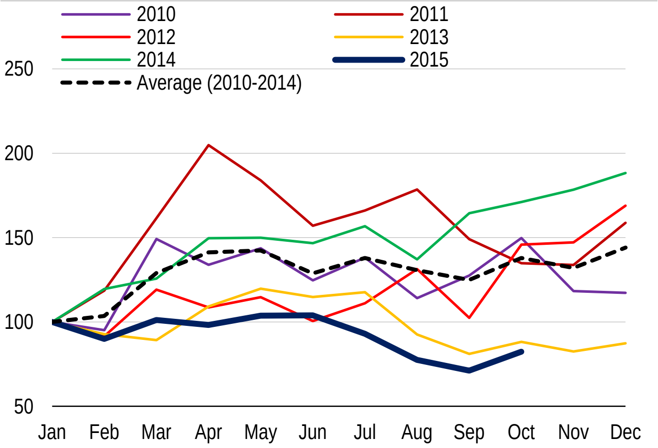
- Rising Indian domestic output has weighed on thermal coal imports this year.

Figure 27: India thermal coal imports - mthly



Source: HDR, UBS Research.

Figure 28: India thermal coal imports – Jan=100



Source: HDR, UBS Research.

El Nino about to impact India's power sector?

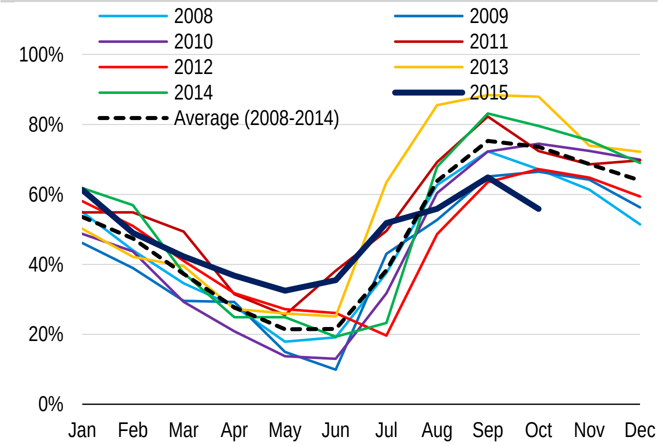
- The Indian monsoon has been unusually weak this year due to the development of the strong El Nino weather pattern. This has meant that, as of latest data, India's hydro capacity load factor is abnormally low for this time of year. This might lead to a higher reliance on coal fired power into India's dry season than usual.

Weak Indian monsoon leaves hydro storage low

- Already, load factors at coal fired plants have picked up from abnormally low levels, and coal inventories at ports, mines and power plants have started to fall. Perhaps thermal coal markets may tighten temporarily due to the weather? Although if domestic supply lifts to meet higher potential coal demand, imports won't benefit. We maintain a watching brief here.

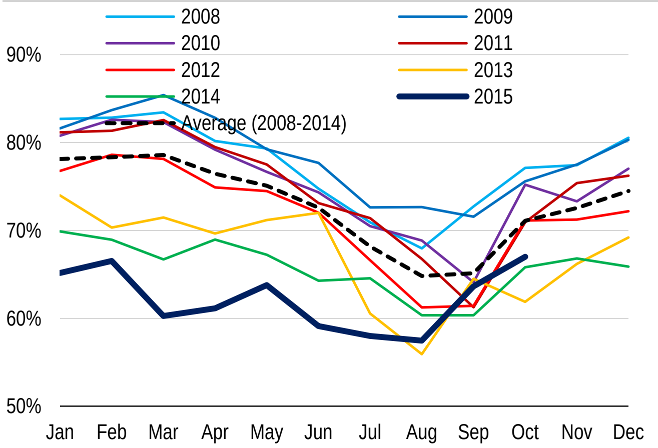
Stronger growth for Indian coal fired power likely – will domestic or imported coal meet higher demand? We wait and see…

Figure 29: India hydro capacity load factor - % capacity



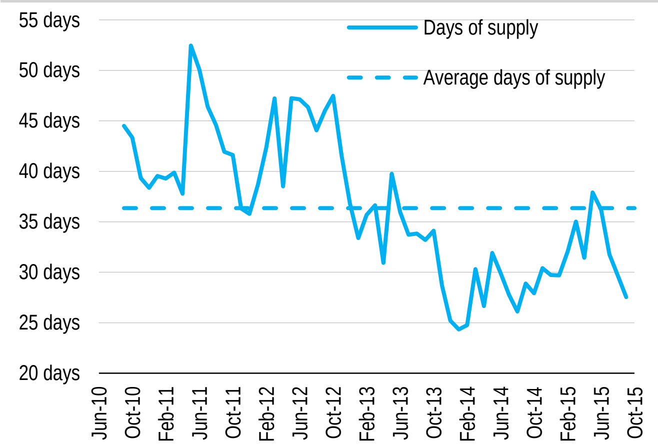
Source: HDR, UBS Research

Figure 30: India coal fired power load factor - % capacity



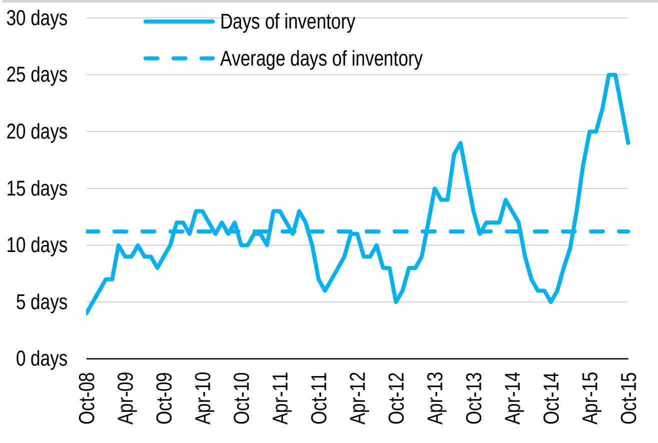
Source: HDR, UBS Research.

Figure 31: India thermal coal inventories at mine & port



Source: HDR, UBS Research.

Figure 32: India thermal coal inventories at power plants



Source: HDR, UBS Research.

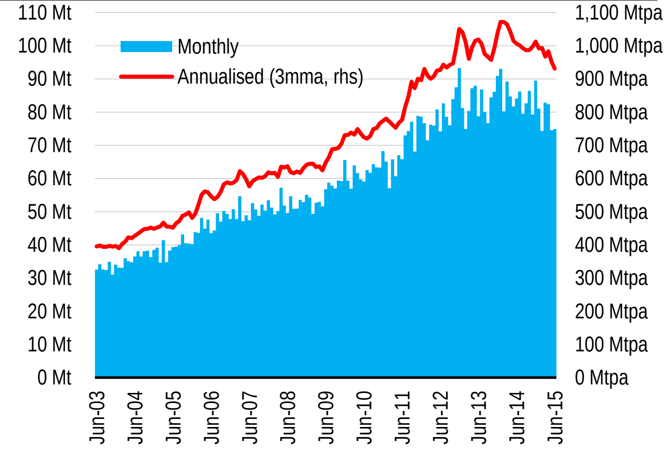
Conclusion: India thermal coal imports won't be coal market panacea

Developments in India's power market – abstracting from temporary weather events – are neutral to bearish seaborne coal demand, in our view

- What does this all mean for India's thermal coal import demand? Neutral to downside risk, in our view.
- The government has stated its aim to reduce thermal coal imports to zero in 2-3 years, but that will definitely be a stretch. However, it is entirely possible that thermal coal imports flat line and may in fact decline in trend terms over a longer time period.
- This would remove substantial seaborne thermal coal import demand, again requiring new sources of demand to absorb tonnes currently finding a home in India.

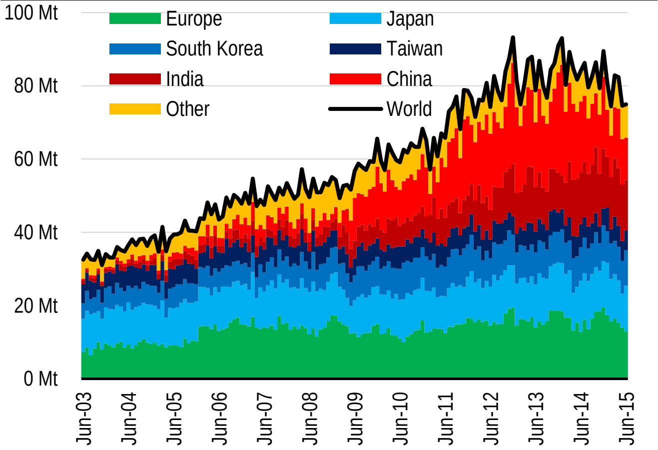
Key seaborne thermal coal demand charts

Figure 33: World thermal coal imports (mthly & annualised)



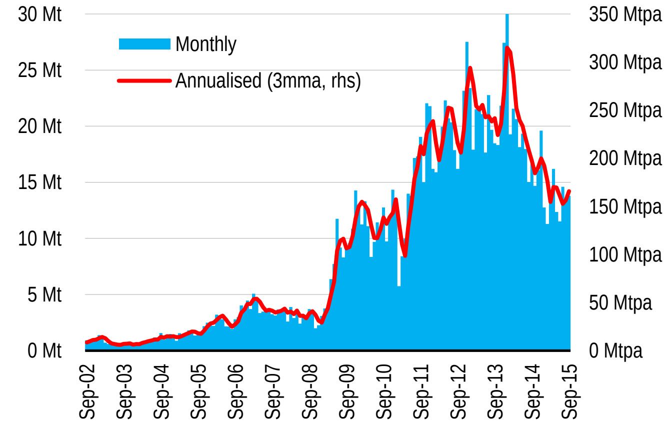
Source: IHS, UBS Research.

Figure 34: World thermal coal imports by origin



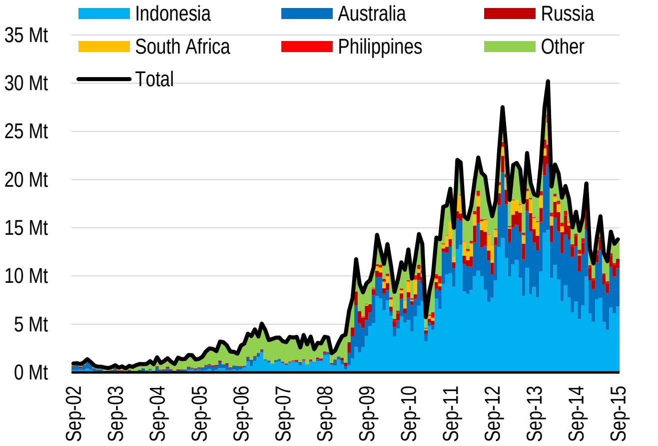
Source: IHS, UBS Research.

Figure 35: China thermal coal imports (mthly & annualised)



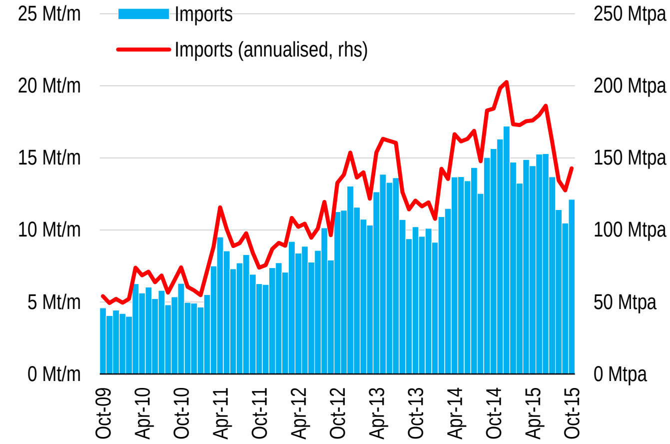
Source: IHS, UBS Research.

Figure 36: China thermal coal imports by origin



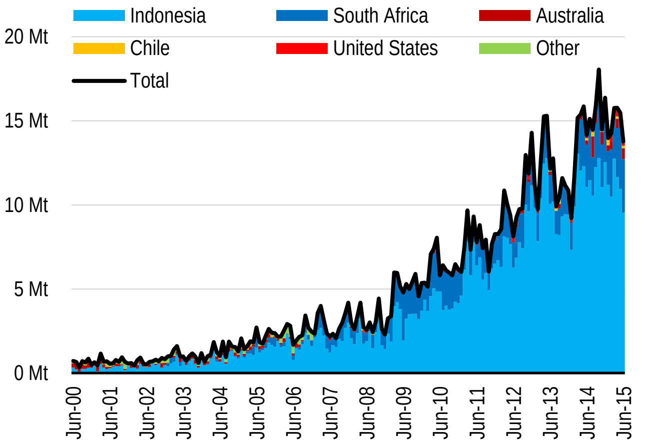
Source: IHS, UBS Research.

Figure 37: India thermal coal imports (mthly & annualised)



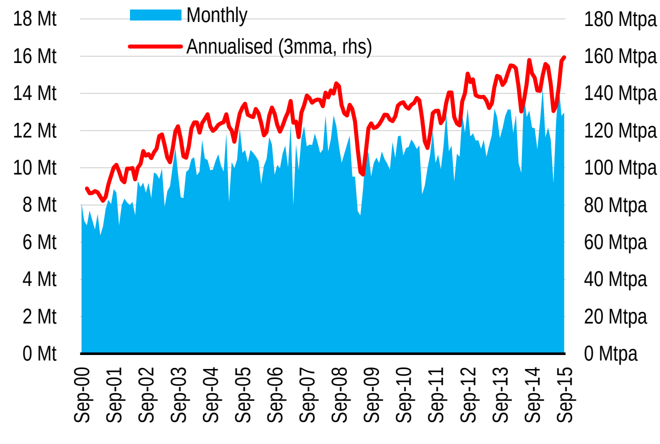
Source: IHS, UBS Research.

Figure 38: India thermal coal imports by origin



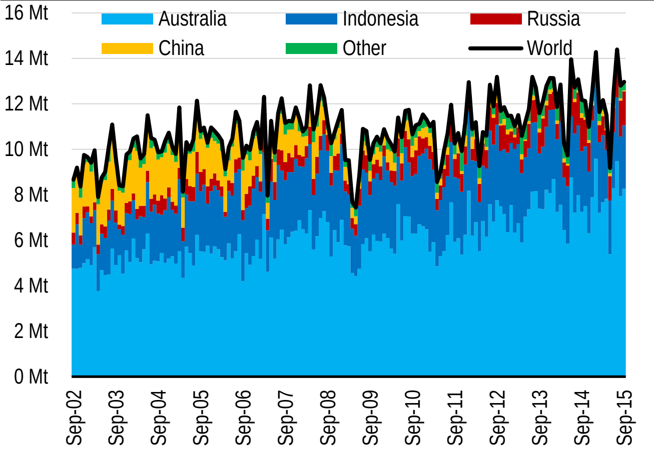
Source: IHS, UBS Research.

Figure 39: Japan thermal coal imports (mthly & annualised)



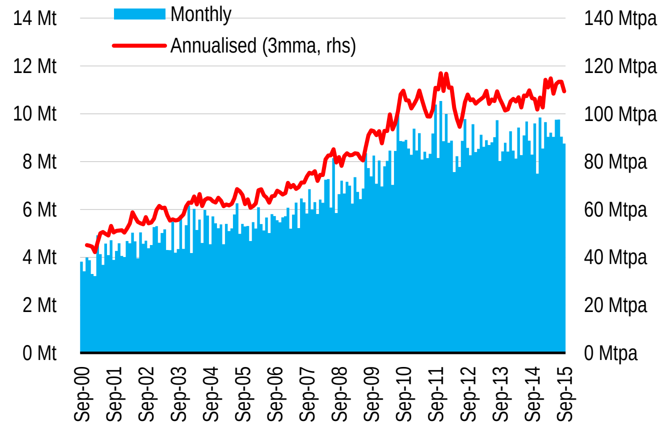
Source: IHS, UBS Research

Figure 40: Japan thermal coal imports by origin



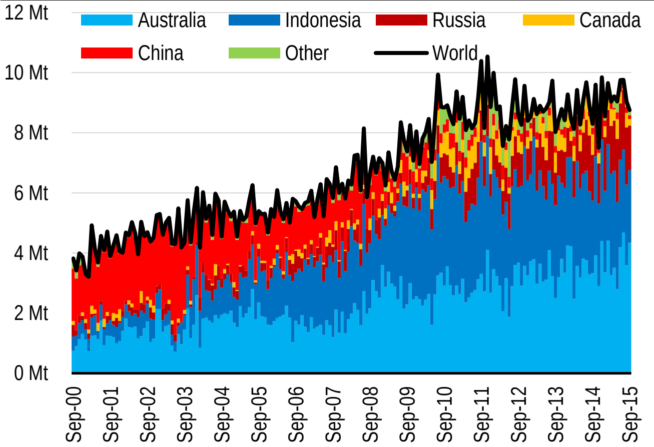
Source: IHS, UBS Research

Figure 41: South Korea thermal import (mthly & annualised)



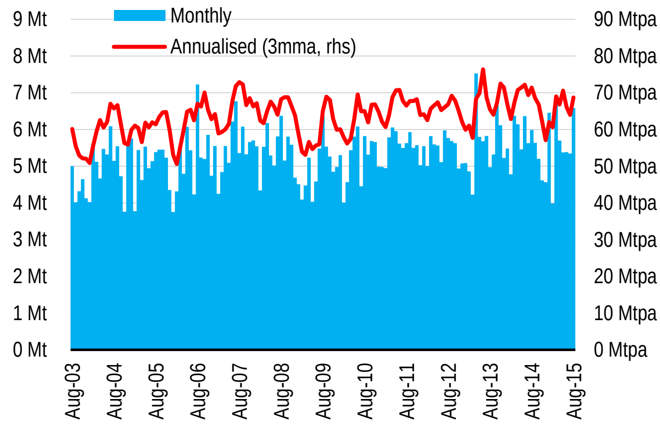
Source: IHS, UBS Research

Figure 42: South Korea thermal imports by origin



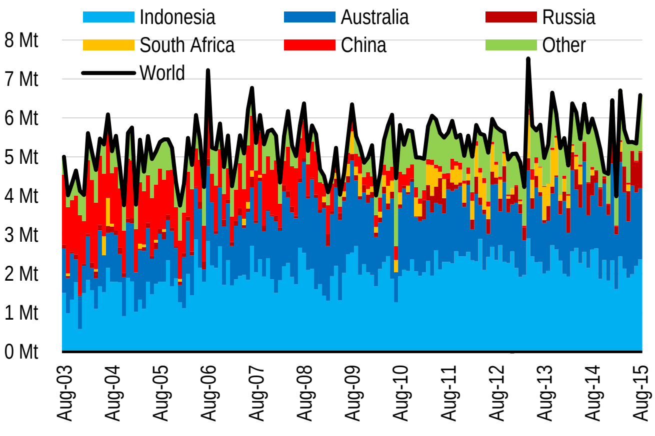
Source: IHS, UBS Research

Figure 43: Taiwan thermal coal import (mthly & ann'd)



Source: IHS, UBS Research

Figure 44: Taiwan thermal coal imports by origin



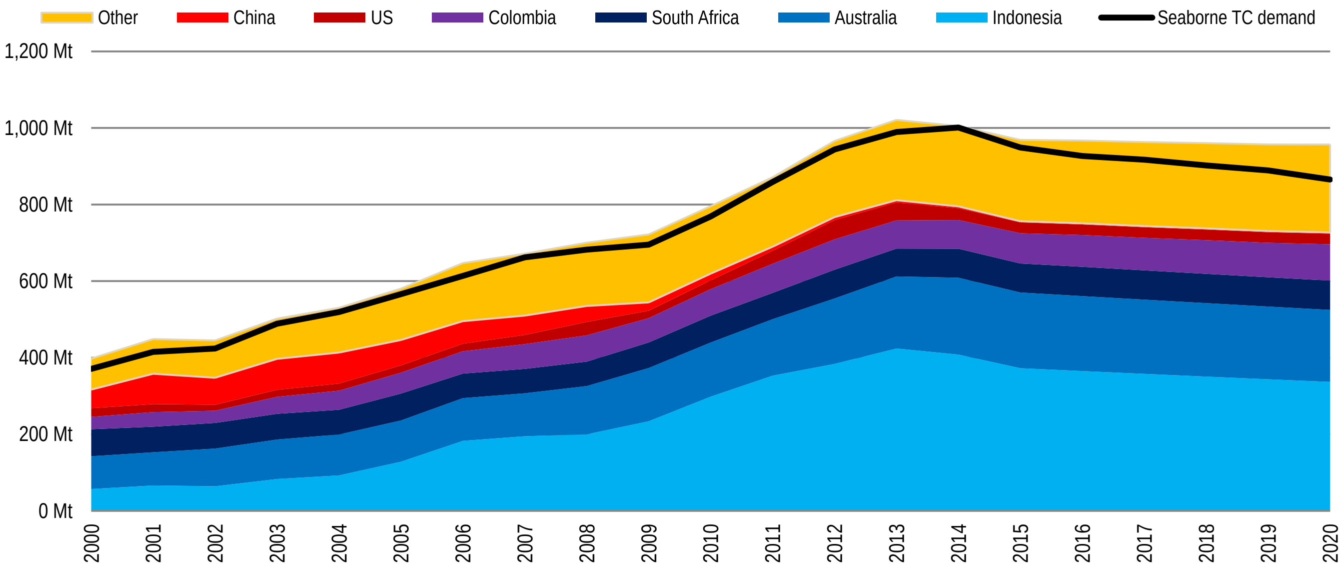
Source: IHS, UBS Research

Seaborne Thermal Coal Supply

- Seaborne thermal coal supply has traditionally been dominated by Indonesia and Australia, with moderately important volumes also being delivered into the market from South Africa, Columbia, Russia, Canada and the US. More recently, falling seaborne demand has resulted in substantial falls in supply from Indonesia.

Seaborne thermal coal supply off peak levels; traditionally has been dominated by Indonesia, Australia, South Africa & Colombia

Figure 45: Seaborne thermal coal supply – total & by major exporter



Source: AME Group, TEX Report, UBS Research.

Indonesia – swinging to rebalance

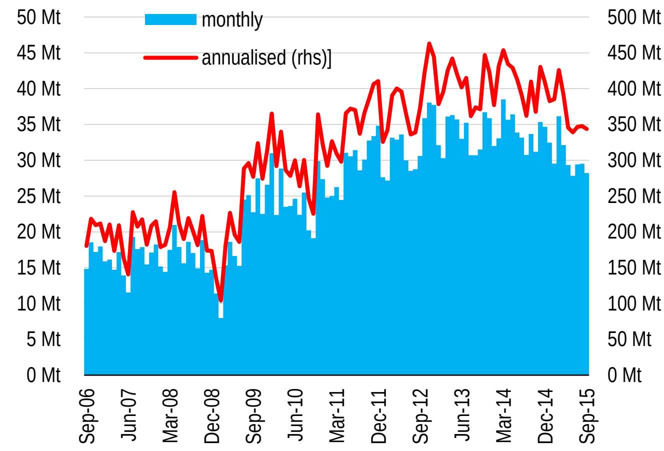
- Indonesia is the world's largest supplier of seaborne thermal coal, having exported at peak rates about 450Mtpa. Trade has now fallen substantially, by about 100Mtpa, to around 350Mtpa based on latest data.

- The fall in Indonesia's coal export has come via the retrenchment of China plus flat lining / slight decline of shipments into India. China has used quality regulations and product testing to make the import trade stricter. Controls on ash, sulphur and energy content of imported coals have reduced trade of both Indonesian and Australian coals.

Indonesian thermal coal exports have fallen 100Mtpa from peak rates of 450Mtpa thanks to China's retreat and general trade weakness

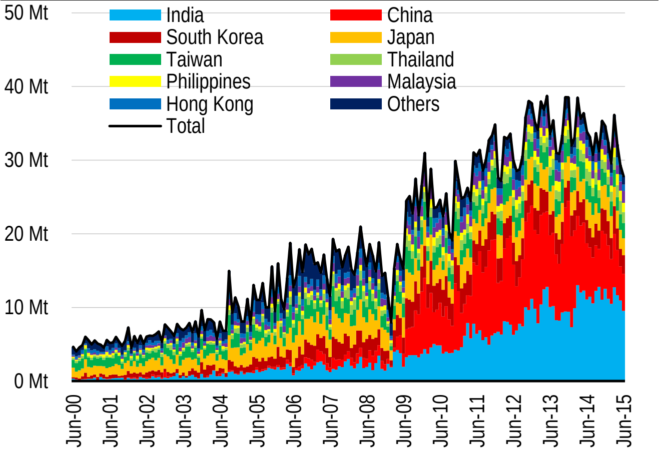
- But it is the more general stalling of coal demand growth in China combined with protection of the domestic industry which has driven Indonesian exports to China lower.

Figure 46: Indonesia thermal coal export (mthly & ann'd)



Source: HDR, IHS, UBS Research.

Figure 47: Indonesia thermal coal export by dest'n



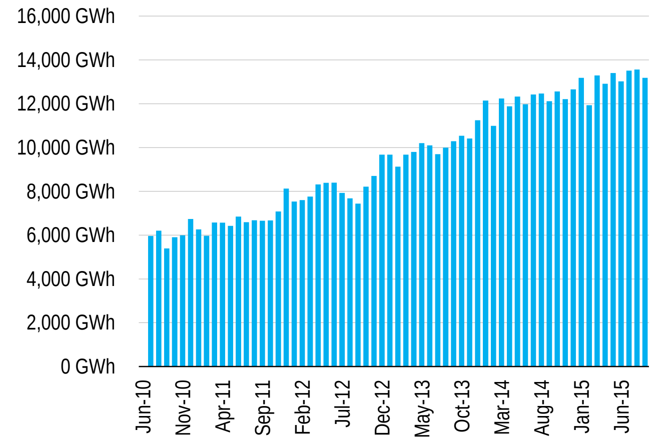
Source: HDR, IHS, UBS Research.

Indonesia's growing domestic power sector

- Growth in Indonesia's coal fired power sector has the scope to absorb some quantity of displaced export coal. Figures 48 and 49 show coal fired power supply in levels and % change.

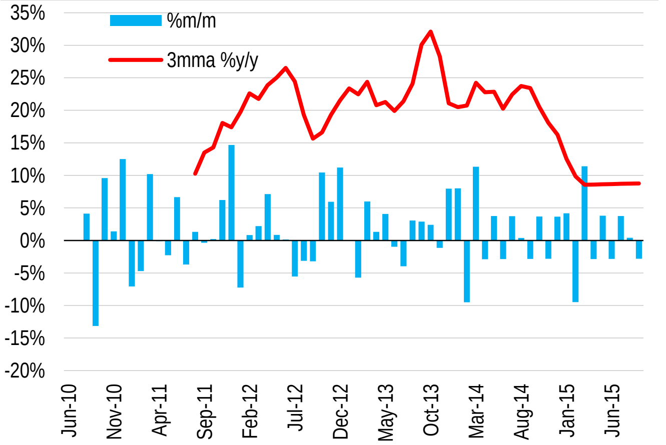
Indonesia's domestic coal fired power sector growing steadily to absorb displaced export tonnes

Figure 48: Indonesia coal fired power – GWh/mth



Source: HDR, UBS Research.

Figure 49: Indonesia coal fired power - %m/m & 3mma%



Source: HDR, UBS Research.

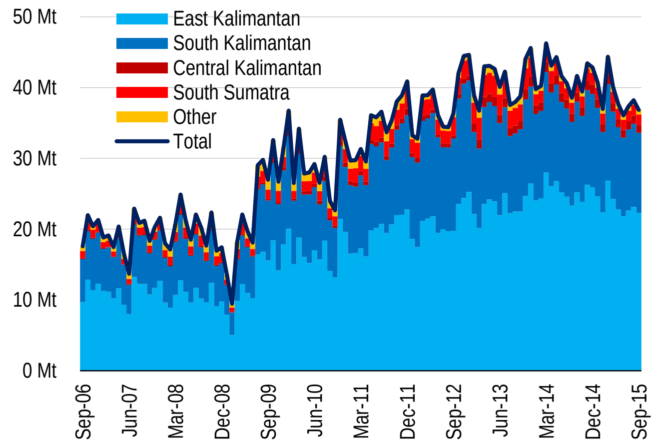
El Nino rainfall anomaly threatens coal shipments?

- Much of Indonesia's thermal coal is produced from the island of Kalimantan and relies on long distance high capacity barging to be delivered from the mine site to transhipment barges and then scale bulk freighters for shipment to market.

- With the current strong El Nino affecting rainfall patterns across the tropics, Kalimantan has endured substantial rainfall anomalies in recent months. Very low seasonal rainfall is good for mining operations, but it might threaten the ability to barge thermal coal downstream and deliver into the market. This is not an issue right now but it could very easily reduce Indonesian thermal coal supply and tighten markets in the short term.

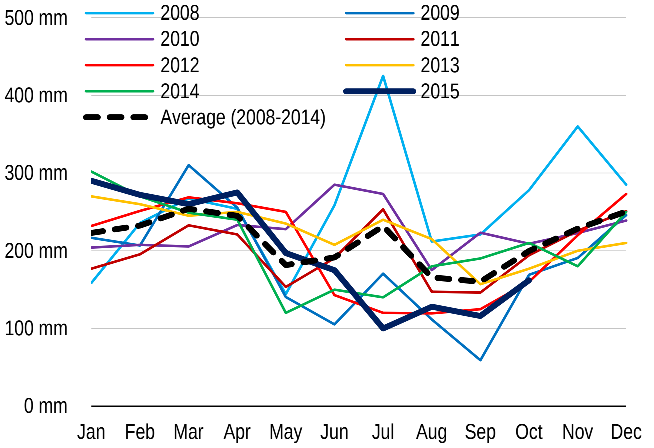
El Nino may reduce coal shipments from Kalimantan if river barging operations are impacted by low rainfall => bullish

Figure 50: Indonesian coal production by state



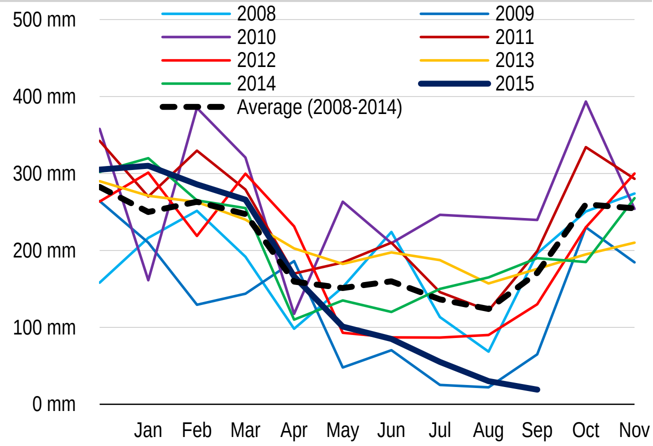
Source: HDR, UBS Research.

Figure 51: East Kalimantan rainfall - mthly



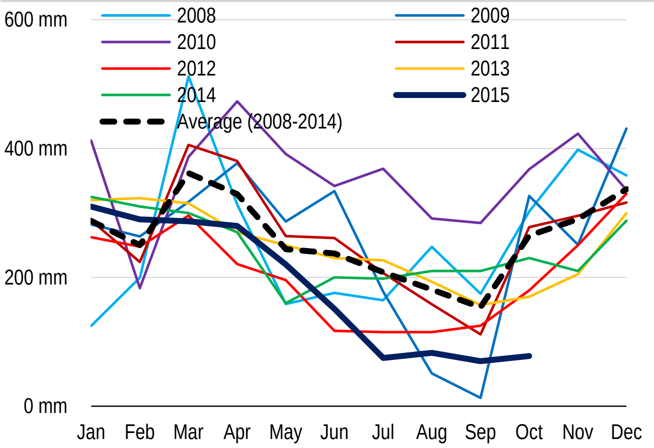
Source: HDR, UBS Research.

Figure 52: South Kalimantan rainfall - mthly



Source: HDR, UBS Research.

Figure 53: Central Kalimantan rainfall - mthly



Source: HDR, UBS Research

Australia – supply steady on FX, costs, take-or-pay

Australian thermal coal exports holding steady ~200Mtpa as producers cut costs, get FX benefits, lift productivity and struggle to exit due to fixed infrastructure charges

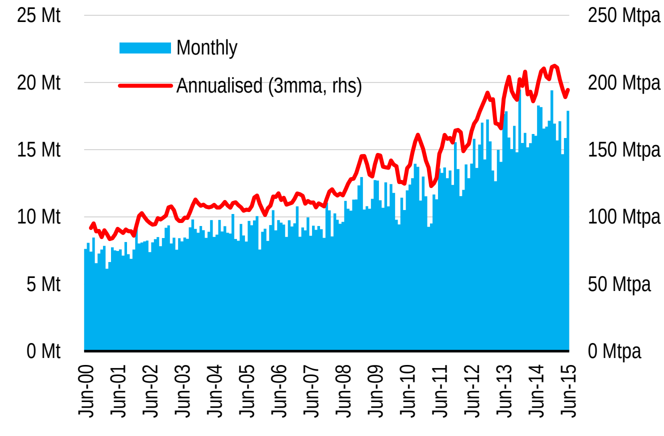
- Australian thermal coal exports have held steady over the last year or so around the 200Mtpa mark, reflecting:
  - a weaker local currency,
  - lower energy costs,
  - success in lifting productivity and reducing costs, and
  - high exit costs for many by way of elevated take-or-pay rail & port costs; and closure/rehabilitation costs; have all combined to keep most of Australia's thermal coal production on line.
- Some smaller, higher cost mines have shut, but these have typically been replaced by newer, capital-sunk, lower operational cost mines coming on line.

- By destination, Japan remains Australia's single most important thermal coal customer. South Korea and Taiwan also maintain an important share of Australian thermal coal offtake.
- But it is the rise of exports into China (typically on average lower energy coals) that has driven much of the growth in Australian exports in the last 5 years.

The rise and fall of thermal coal shipments to China presents greatest downside volume risk for Australia; new markets will offset in part

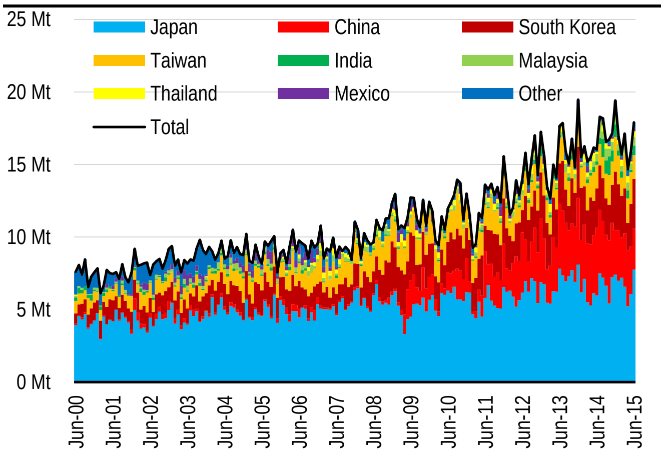
- The potential retreat of China from the trade does, therefore, threaten Australian thermal coal export volumes to some degree. However, there are offsets, with a larger quantity of Australian thermal coals finding customers in South East Asia, India and parts of Latin America.

Figure 54: Australia thermal coal exports (mthly & ann'd)



Source: HDR, IHS, UBS Research.

Figure 55: Australia thermal coal exports by dest'n



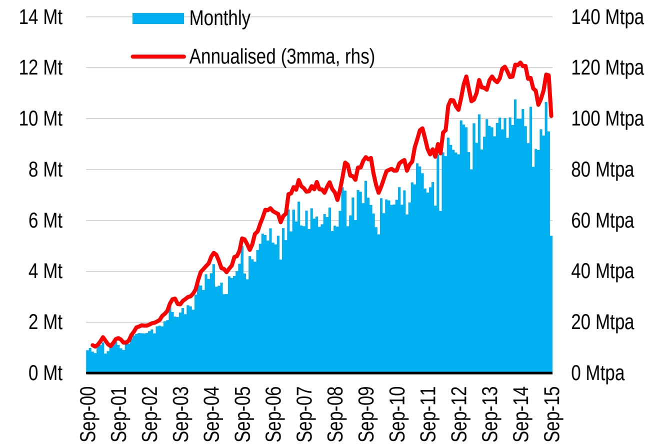
Source: HDR, IHS, UBS Research.

Russia – From Russia with love…

Russian thermal coal exports have grown tenfold in 15 years to ~100Mtpa, serving buyers both East & West of the country; the weak Ruble will support shipments from here

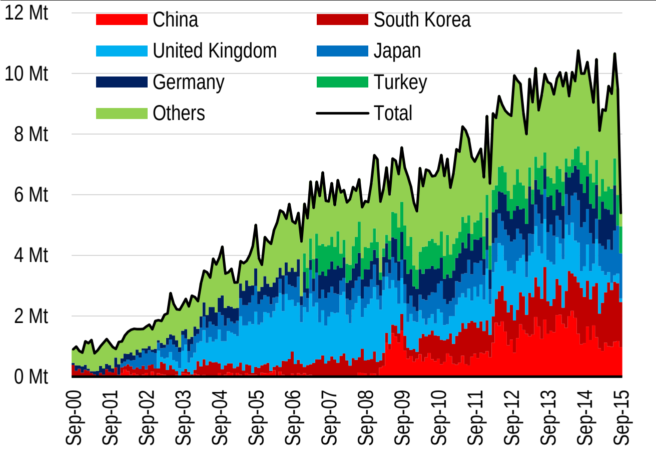
- Russian thermal coal exports have grown dramatically over the last decade, with a weak economy, weak Ruble and abundant resources enabling a significant lift in coal shipments to both Europe and into Asia. As it stands at the moment, thermal coal exports are annualising around 100Mtpa, notwithstanding a weak September figure.
- The lift in trade has been to traditional consumers, namely China, South Korea, Japan in Asia, plus Germany, the United Kingdom and Turkey (at least) in the Eurozone. Plus there is significantly trade into Eastern Europe and Central Asia too.
- Russian thermal coals are clearly enjoying advantage from the weak Ruble and should continue to do so into the future. We expect more Russian coals to capture market share over coming years as expensive material from North America and Indonesia exits the market.

Figure 56: Russia thermal coal exports (mthly & ann'd)



Source: IHS, UBS Research.

Figure 57: Russia thermal coal exports by dest'n



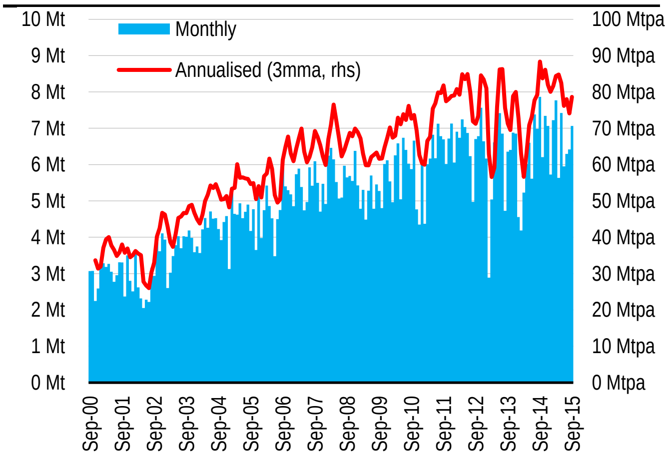
Source: IHS, UBS Research.

Colombia – Steady

Colombia's thermal coal exports annualised ~75Mtpa, with Europe dominating offtake

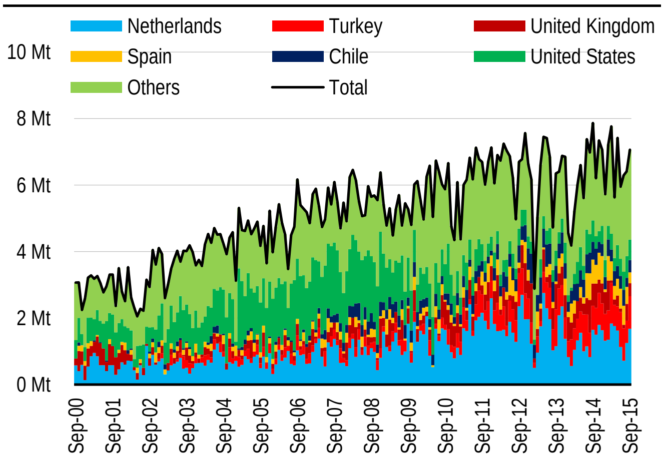
- Colombia's thermal coal exports are currently running around 75-80Mtpa, which is a little below peak levels of a year or so ago but still quite strong given the dislocation being felt in the North Atlantic market over recent years.
- Breaking down Colombia's exports by destination, it's apparent that weaker trade into the US, Spain & the Netherlands has been offset by increased shipments into Turkey, the UK and "other".

Figure 58: Colombia thermal coal exports (mthly & ann'd)



Source: IHS, UBS Research.

Figure 59: Colombia thermal coal exports by dest'n



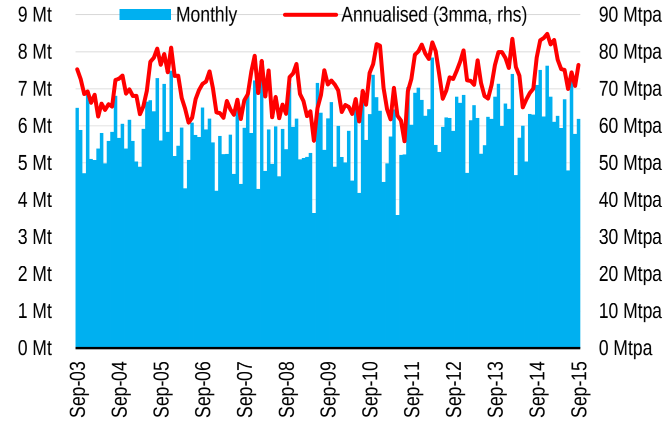
Source: IHS, UBS Research.

South Africa – Steady to up

South African shipments steady ~70-80Mtpa, split between Asia and European markets

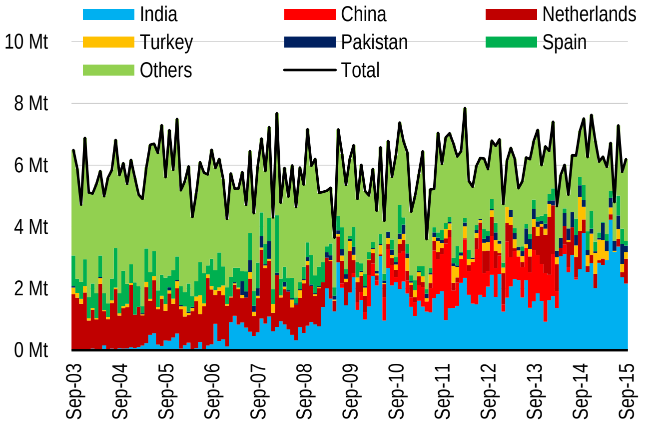
- South Africa's thermal coal exports have held steady in the 70-80Mtpa range for years now, notwithstanding month to month variation.
- In terms of major customers for South African thermal coal exports, India continues to rise in prominence perhaps reflecting proximity. Shipments into Europe have eased, as have shipments to China.

Figure 60: South Africa thermal exports (mthy & ann'd)



Source: IHS, UBS Research.

Figure 61: South Africa thermal exports by dest'n



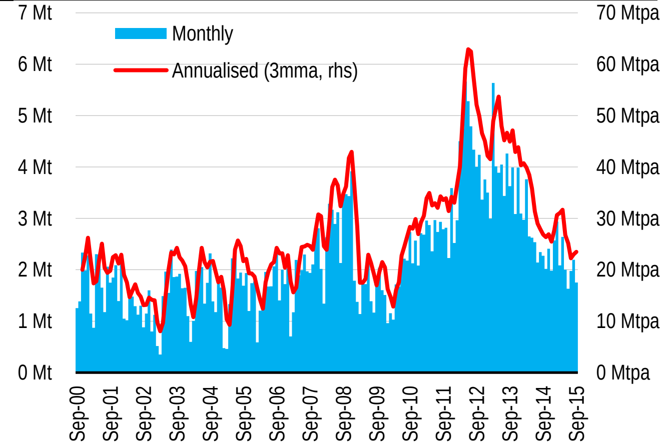
Source: IHS, UBS Research.

US thermal coal exports – Dire Straits

US thermal coal exports return to pre-China levels as high US$ costs push producers out of the market

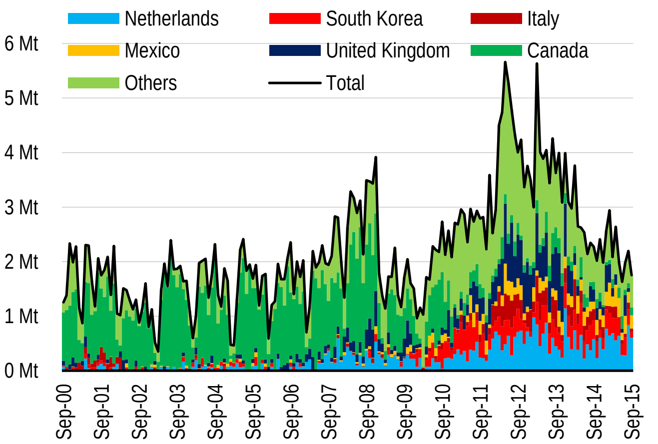
- US thermal coal exports have collapsed from peak annualised run rates of ~60Mtpa to current run rates of 20-25Mtpa, a more than halving of the trade. This retrenchment is made all the worse still given that with the US EPA regulations cutting US domestic coal demand dramatically, exports would have been one way US coal producers could have survived.
- But clearly this has not been the case, given that many US thermal coal exporters are quite high cost, and have not enjoyed currency gains like peers in Australia, Colombia, South Africa and Indonesia. We expect US thermal coal trade to stabilise at pre-China levels or fall further still.

Figure 62: US thermal coal exports (mthly & ann'd)



Source: IHS, UBS Research.

Figure 63: US thermal coal exports by dest'n



Source: IHS, UBS Research.

Figure 64: UBS global thermal coal demand & supply model

		2012	2013	2014	2015e	2016e	2017e	2018e	2019e
Global Power Generation	TWhr	21,532	21,954	22,671	23,038	23,631	24,155	24,707	25,388
YoY growth	%	*2%*	*2%*	*3%*	*2%*	*3%*	*2%*	*2%*	*3%*
Coal-fired power (global)	%	*39%*	*40%*	*40%*	*40%*	*39%*	*39%*	*38%*	*38%*
Total traded thermal coal demand	Mt	944	989	1,001	949	911	897	881	868
YoY growth	%	*9.9%*	*4.8%*	*1.2%*	*-5.2%*	*-4.0%*	*-1.5%*	*-1.9%*	*-1.5%*
Japan imports	Mt	139	143	145	147	147	148	148	148
India imports	Mt	98	129	157	164	154	148	140	134
EU imports	Mt	65	49	42	38	42	44	47	49
US imports	Mt	7	7	9	9	9	9	9	9
Total traded thermal coal supply	Mt	966	1021	1005	969	967	963	960	957
YoY growth	%	*10.9%*	*5.7%*	*-1.6%*	*-3.6%*	*-0.2%*	*-0.4%*	*-0.3%*	*-0.4%*
Indonesia exports	Mt	384	424	408	373	365	358	351	344
Australia exports	Mt	171	188	201	198	196	194	192	190
South Africa	Mt	75	73	76	76	76	76	76	76
Colombia	Mt	79	74	75	79	83	85	88	90
EU exports (incl. Russia)	Mt	157	162	172	179	179	181	183	185
US exports	Mt	50	46	31	28	27	27	27	27
China net exports	Mt	-227	-246	-224	-155	-117	-98	-80	-62
Balance	Mt	22	32	4	20	56	66	80	89
US total utility year-end inventories	Mt	217	179	184	182	183	182	183	183
Export thermal coal JFY contract price	US$/t	119	100	85	71	63	60	61	62
Newcastle spot (CY avg)	US$/t	95	84	70	59	55	56	57	58
Richards Bay spot (CY avg)	US$/t	93	80	73	59	55	56	57	58

Source: TEX Report, AME Group, IHS, UBS Research.

Metallurgical coal: China steel decline makes it hard for met…

- Metallurgical coal is primarily used to make pig iron in a blast furnace. As such, global steel demand prospects are the key driver of met coal demand.

Met coal demand mostly driven by steel production, quality, efficiency factors are important too

- Other demand side factors that are relevant relate to quality and efficiency. Larger blast furnaces typically need more high quality coking coal, as it is only these coals which give the resulting coke the physical strength to support the charge inside larger, taller blast furnaces

- Coke rates can be reduced/optimised via changing the mix of coke/coking coal with low volatile pulverised injection coal. The latter can supply relatively more heating value and enough coking properties resulting in reduced need for coking coal (eg: falling Japanese coke rates) per unit of steel output.

- The UBS house view on steel is grim. We expect global steel production to only grow by 0.2% CAGR 2015-2020 as Chinese output falls from 830Mt in 2014 to 773Mt in 2020.

UBS forecasts Chinese steel output to fall from 830Mtpa in 2014 to 773Mtpa in 2020e; Global steel output lifts barely 2% over the next five years

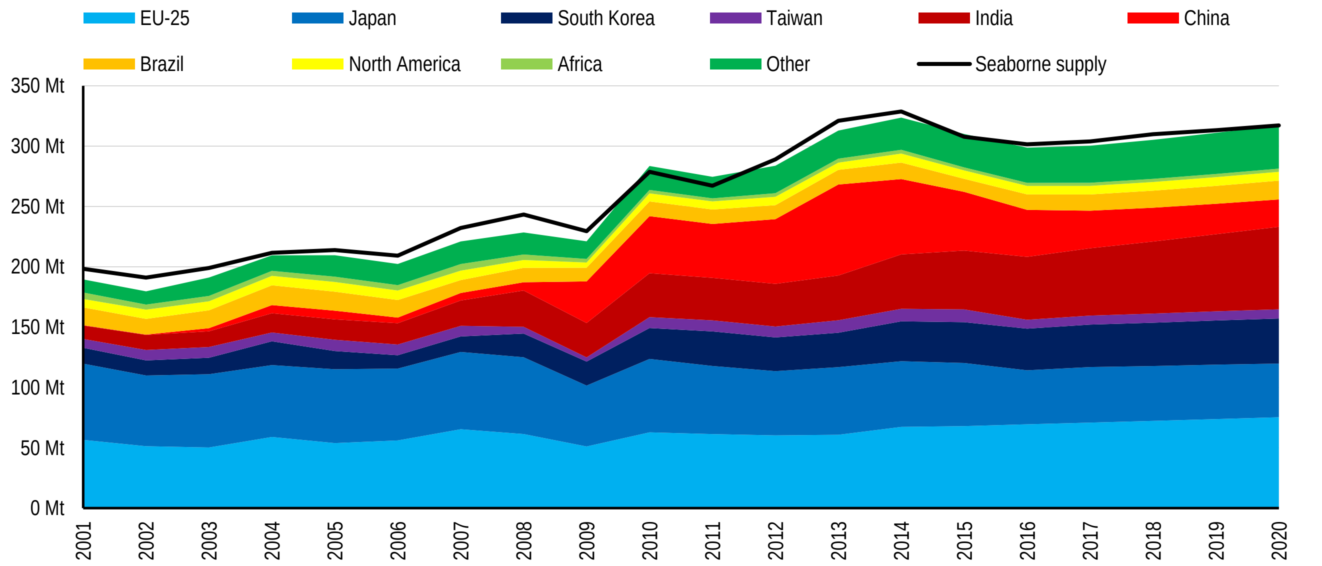
  - As China's steel output falls, this will displace Chinese direct met coal demand. But as we also anticipate Chinese steel exports – either directly or indirectly via manufacture capital and consumer goods – to remain at relatively elevated levels, met coal demand elsewhere (eg: North America, Europe, South East Asia, the Sub-Continent) will be displaced too.

Seaborne met coal demand: flat-lining

- Figures 65 show global met coal imports, both in aggregate then split by destination country. Global met coal import demand is currently running around 280-300Mtpa, down from peak levels into the low 300Mtpa levels. The retreat of trade has been managed by cutting export supply from the US, Canada particularly, with Australian tonnes gaining market share.

Seaborne met coal trade peaked in 2014; no recover seen before next decade

Figure 65: Seaborne met coal demand – total and by major importer



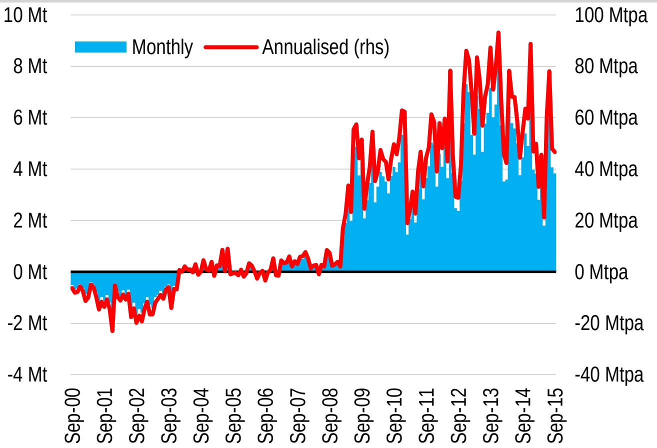
Source: TEX Report, AME Group, company filings, UBS Research.

China: Imports retreat in line with steel slowdown

- China's met coal trade has shifted from net exporter 10-15 years ago to a substantial net importer 2-3 years ago. Now net imports are falling as China's steel output (met coal demand) slows and domestic supply gains market share.
- Imports are currently running around 50Mtpa, down from peak annualised import rates of ~80Mtpa.
- The trade into China was quite diversified a few years ago, but as Mongolian material has dropped out of the market, and overall net imports have fallen, Australian supply has gained market share.

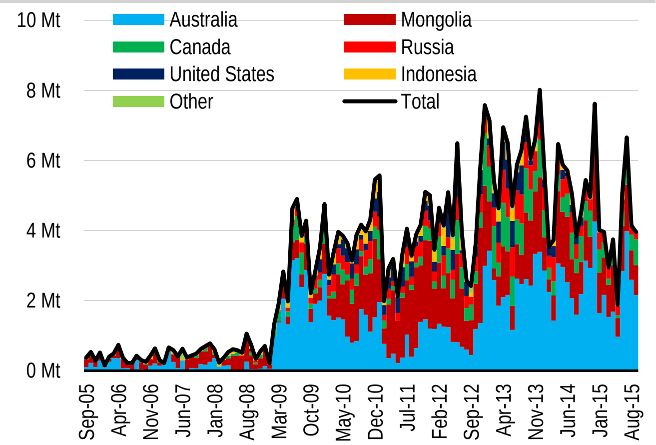
China net met coal imports running ~50mtpa currently, down from ~80Mtpa peak rates. Australia has increased import share into China.

Figure 66: China net met coal imports – mthly & ann'd



Source: IHS, UBS Research.

Figure 67: China met coal imports – mthly by source



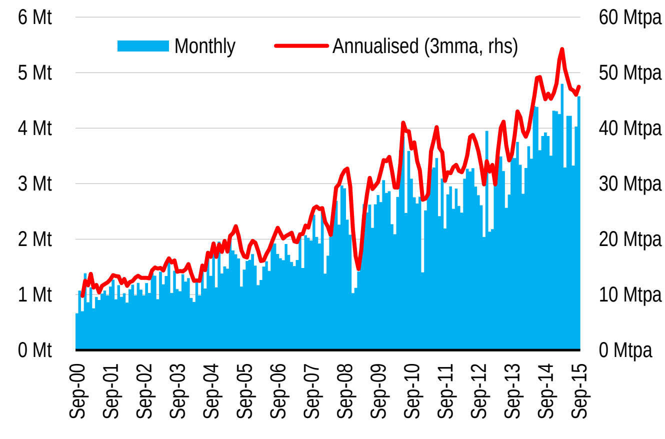
Source: IHS, UBS Research.

India met coal imports to trend higher

- India's met coal imports have climbed strongly in recent times, with almost all material coming from Australia, and typically of a higher quality type.
- The country is not renowned for a deep resource of higher quality met coal, but it does have a reasonable base of lower grade met coal production, with figure 69 showing almost half of apparent demand is sourced domestically.

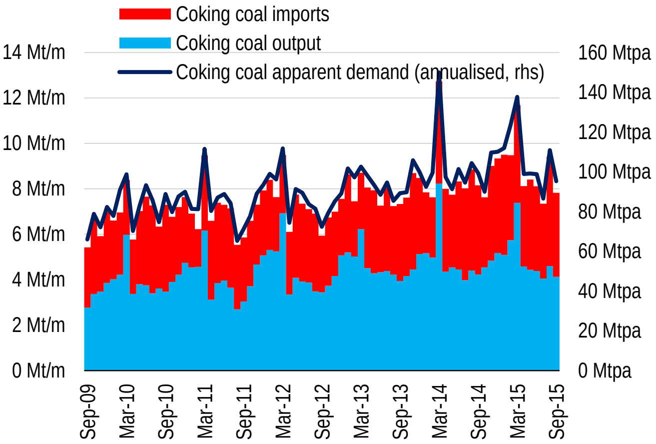
Indian met coal imports annualising ~50Mtpa after strong growth recently. Australian high quality met coals dominate import share.

Figure 68: India met coal imports – mthly & ann'd



Source: IHS, UBS Research.

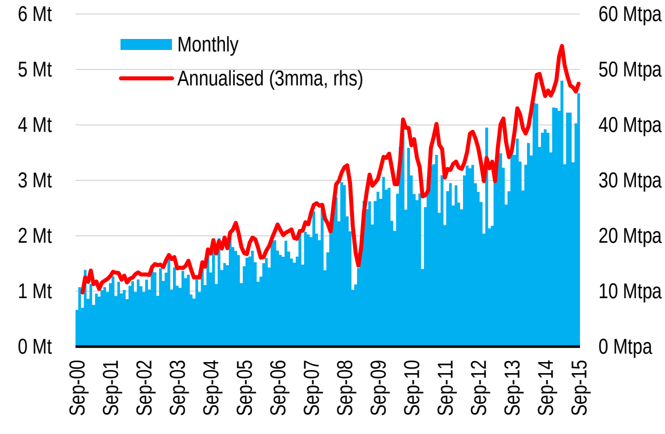
Figure 69: India domestic met coal output – mthly & ann'd



Source: IHS, UBS Research.

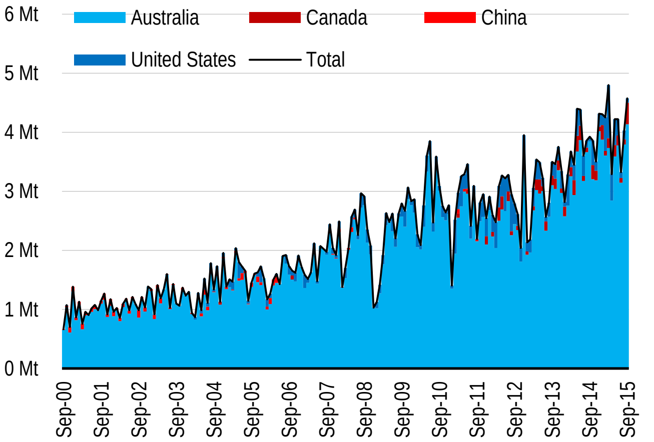
- In terms of the numbers, India's import of met coal is annualising around 50Mtpa currently, having grown strongly in recent years as steel output has risen. Almost all of India's imported met coal originates from Australia, thanks to the relatively high quality, which then provided flexibility for consumers in India to blend with lower grade domestic material.

Figure 70: India met coal imports – mthly & ann'd



Source: IHS, UBS Research.

Figure 71: India met coal imports – mthly by source



Source: IHS, UBS Research.

Japan met coal imports – trending lower in sync with falling coke ratio

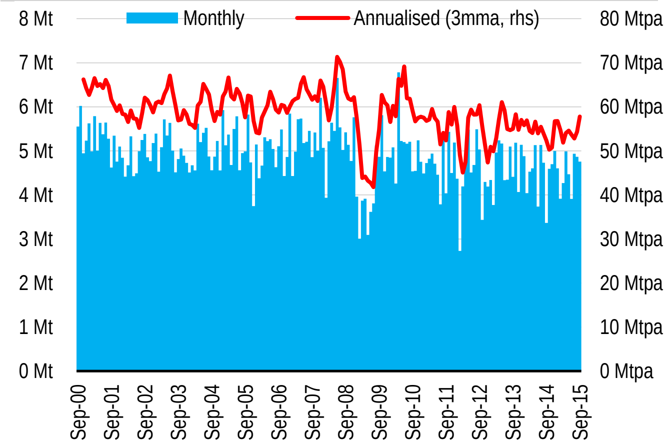
Japanese met coal imports currently annualising ~55Mtpa, down from ~60-65mtpa 10-15 years ago. Australia dominates supply.

- Japan's import of met coal is currently running at about 60Mtpa, having fallen slightly in trend terms from run rates ~75mtpa 10-15 years earlier. Steel production has been broadly stable to slightly higher, so it's not outright volumes going against met coal imports.

- Rather, falling coke ratios in blast furnaces plus potentially higher imports of coke, can be seen as factors weighing on met coal imports.

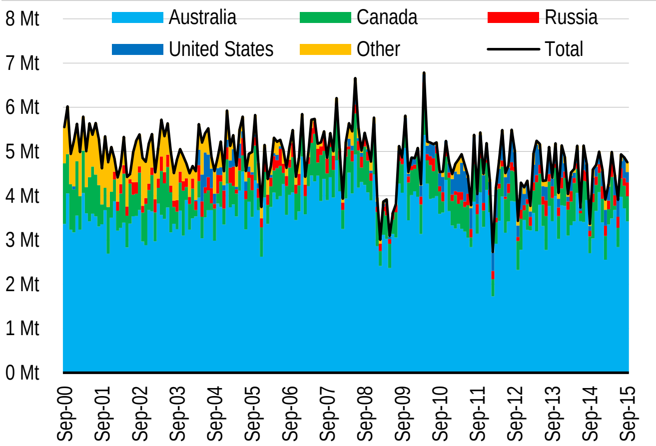
- Australia dominates the supply of met coal into Japan, given Japanese steel mills' preference for high quality coals with low impurities and high CSR values. Canada is perhaps the next most important supplier. The ongoing rationing from the trade of US and, to a lesser extent, Canadian supply, presents opportunity for Australian and Russian coals to lift market share.

Figure 72: Japan met coal imports – mthly & ann'd



Source: IHS, UBS Research.

Figure 73: Japan met coal imports – mthly by source



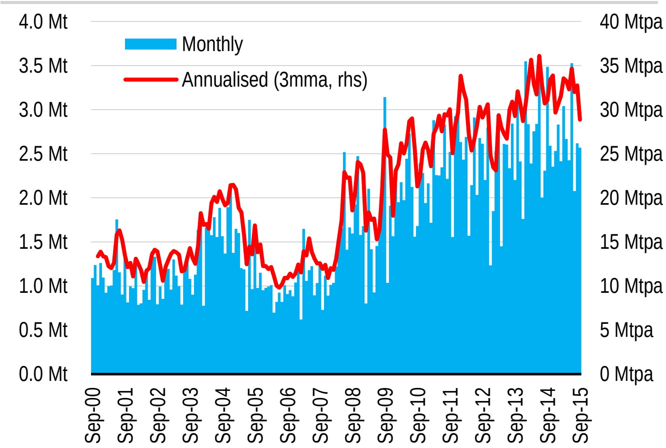
Source: IHS, UBS Research.

South Korea met coal imports – stable to down

South Korean met coal imports annualising ~30-35Mtpa, mostly from Australia & Canada

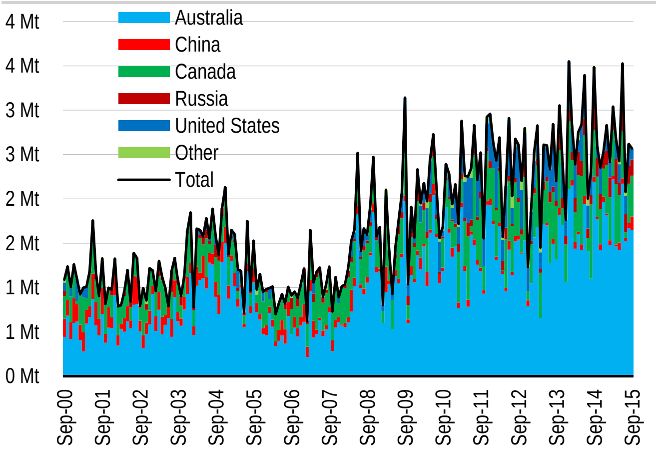
- South Korea's met coal import demand has flat-lined for the best part of two years and is now just starting to edge lower as steel output rates slow and coke rates also fall.
- The majority of South Korea's met coal supply comes from Australia, with reasonable tonnage also taken from Canada. The exit of mines out of the trade from the US and Canada presents an opportunity for Australian and Russian coals to capture market share.

Figure 74: Sth Korea met coal imports – mthly & ann'd



Source: IHS, UBS Research.

Figure 75: Sth Korea met coal imports – mthly by source



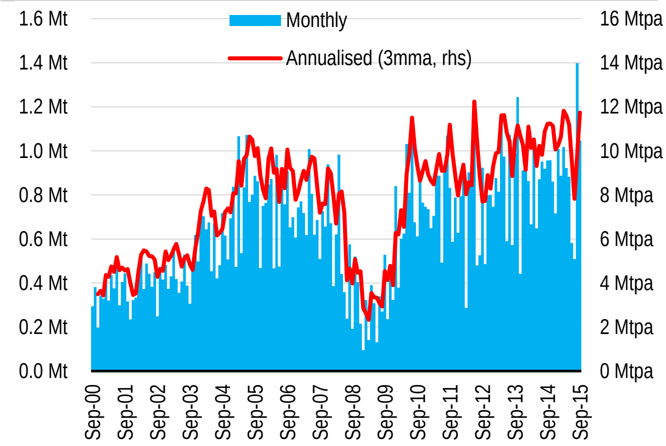
Source: IHS, UBS Research.

Taiwan met coal imports – holding steady

Taiwan met coal imports steady ~12mtpa, mostly from Australia

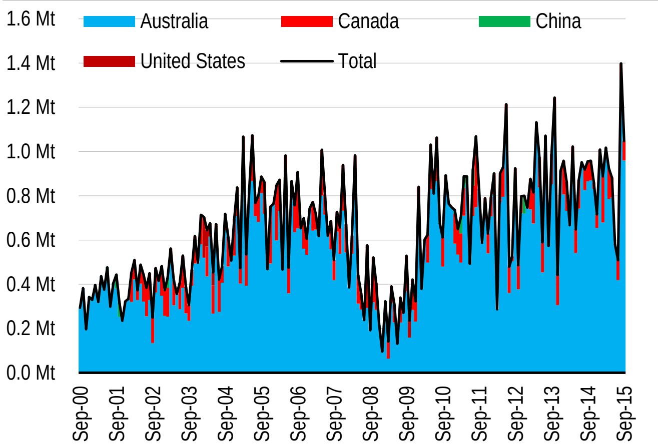
- Taiwan's met coal imports are annualised around 10-12mtpa currently, holding quite steady at the 1-1.2Mt/mth level.
- Most of Taiwan's met coal is sourced from Australia, which if anything, has consolidated slightly its domination of met coal market share.

Figure 76: Taiwan met coal imports – mthly & ann'd



Source: IHS, UBS Research

Figure 77: Taiwan met coal imports – mthly by source



Source: IHS, UBS Research.

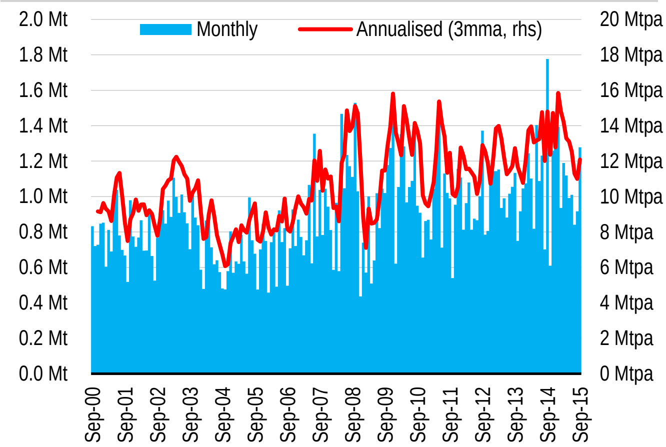
Brazil met coal imports – On the march higher with steel production

- Brazil's met coal imports have, in recent years, run around the 10-16mtpa annualised rate and have been broader flat through this range for 5-6 years now. Risks exist that if Brazil's steel output falls due to broader macroeconomic problems, met coal demand will fall too. We have not factored notable downside into our Brazil import numbers as of yet.

Brazil's met coal imports ~12-16Mtpa, mostly from the US and Australia. Risks from macro slowdown

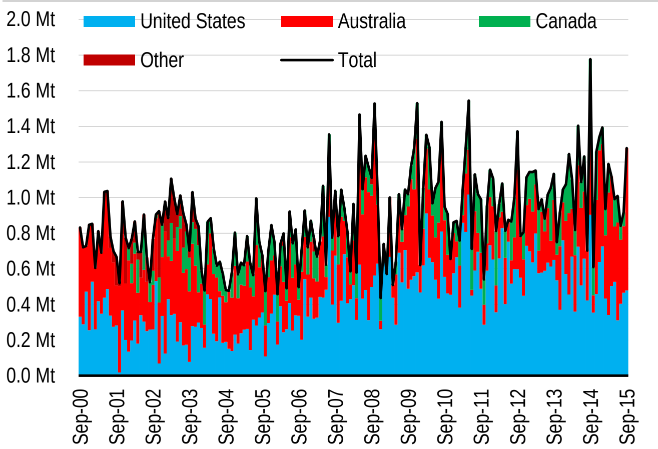
- The major suppliers to Brazil are the US and Australia. To the extent US tonnage leaves the seaborne market, Australian tonnage may capture additional market share.

Figure 78: Brazil met coal imports – mthly & ann'd



Source: IHS, UBS Research.

Figure 79: Brazil met coal imports – mthly by source

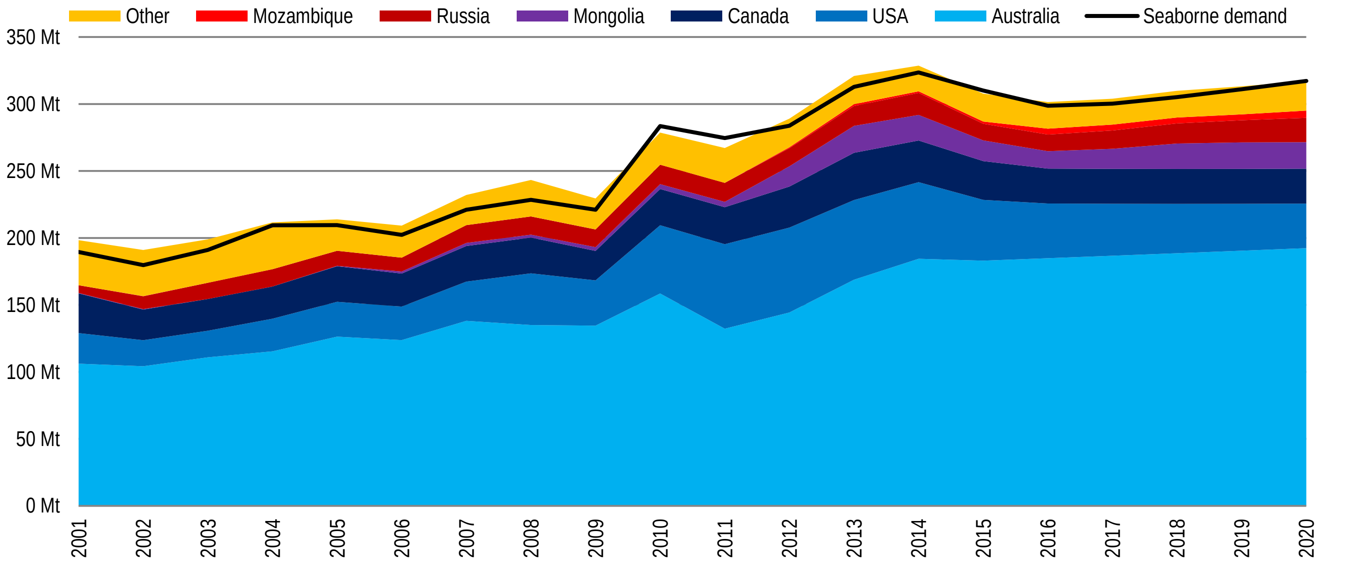


Source: IHS, UBS Research.

Seaborne Met Coal Supply

- Australia dominates the supply of met coals to the market, followed by the US, Canada, Russia and Mongolia (in so much as exports here displace Chinese domestic production and/or Chinese imports). Recently, met coal shipments from North America have fallen significantly as market prices have driven increasing losses and production curtailment.

Figure 80: Seaborne met coal exports – total and by major supplying country



Source: TEX Report, AME Group, UBS Research.

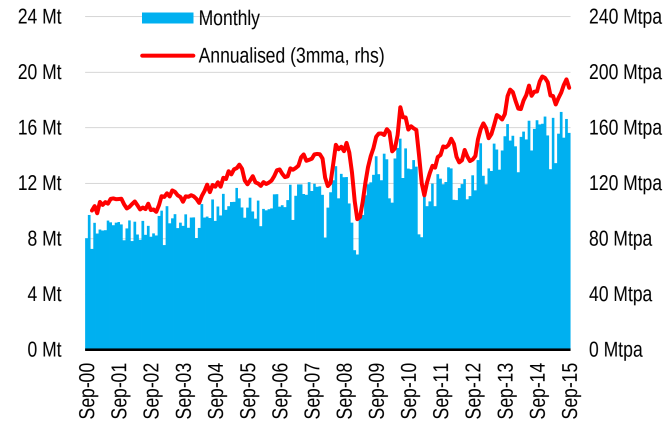
Australia – Met coal exports hanging on

Australia dominates seaborne met coal supply, shipping at almost 200Mtpa currently. Japan, India, South Korea, China and Taiwan dominate as export destinations

- Australia dominates the supply of seaborne met coal, particularly across the premium hard coking coal grades. Current run rates are close to 200Mtpa on an annualised basis.
- Australian export supply has remained resilient to falling prices thanks to:
  - the falling Australian dollar,
  - high closure costs thanks to infrastructure take-or-pay agreements,
  - completion of a number of new low cost or capital-sunk projects that has offset lower shipments from selected small mine closures, and
  - success from operators in reducing costs.
- Most of Australia's met coal ships to Japan, India, China, South Korea and Taiwan. Yet within the "other" category are substantial shipments into Europe & Latin America.

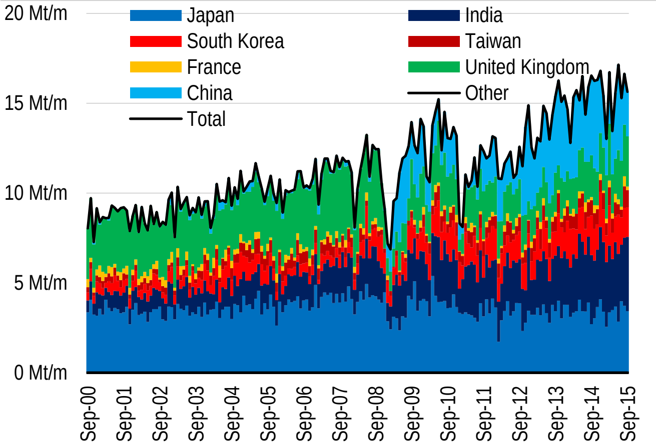
Australian shipments resilient to falling prices due to i) FX, ii) closure costs, iii) high fixed freight costs, and iv) strong operational cost improvement

Figure 81: Australia met coal exports – mthly & ann'd



Source: IHS, UBS Research.

Figure 82: Australia met coal supply – mthly by dest'n



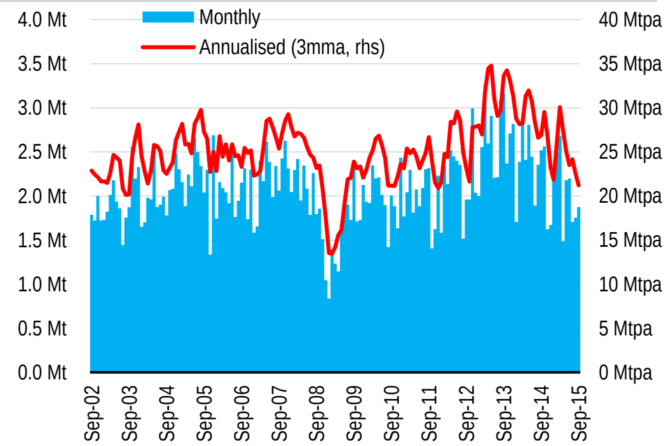
Source: IHS, UBS Research.

Canada – Met coal shipments feeling the heat

- Canadian met coal exports are currently annualising around 20-25Mtpa currently, having fallen from annualised rates at peak export levels of about 30-35Mtpa.
- The fall in Canadian supply is mostly accounted for by lower Chinese demand, as can be seen in the chart of exports by destination. Shipments to non-China north east Asia still remain relatively stable overall.
- We would not be surprised to see Canada's met coal exports drift lower from here thanks to ongoing relentless price and margin pressure.

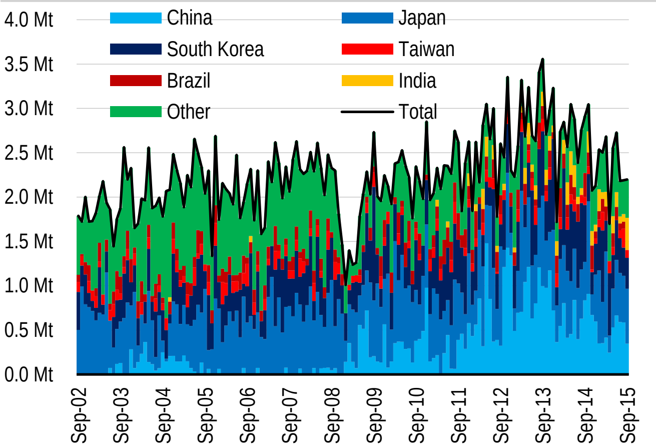
Canada met coal exports annualising ~10Mtpa lower than peak at 20-25Mtpa. Shipment to China have collapsed

Figure 83: Canada met coal exports – mthly & ann'd



Source: IHS, UBS Research.

Figure 84: Canada met coal exports – mthly by dest'n



Source: IHS, UBS Reearch.

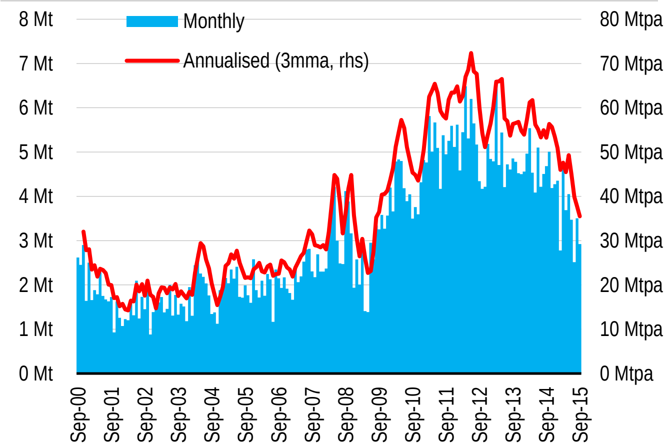
United States – Bearing the brunt of price / margin pressure

- United States is a net met coal exporter. At peak levels, the US exports typically 60-70Mtpa but that run rate has collapsed dramatically as the unrelenting fall in prices has pressured many of the higher cost met coal mining regions into recession / retrenchment. Current net export run rates are around half of peak levels, roughly 35Mtpa.

US met coal producers are bearing the brunt of closure pressures => exports halve

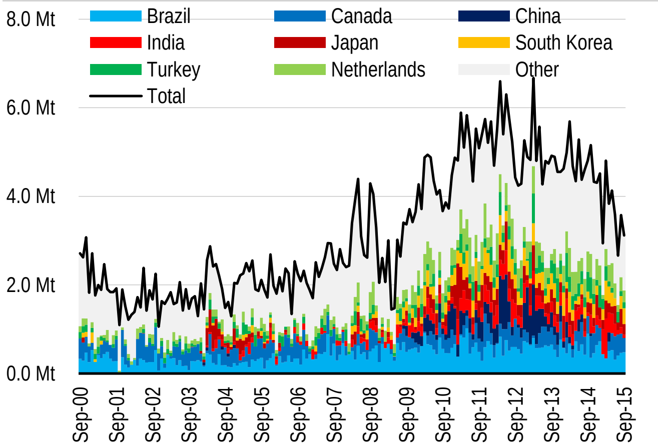
- The impact on met coal production and exports in the US has been pronounced, given the high cost nature of much of the US' premier met coal regions eg: Appalachia. Here, the geology, geography and mining methods don't lend themselves to significant and real cost cutting and productivity benefits compared with Australia, for example.
- It's also the case that the relatively strong US dollar has weighed against producers there when compared to producers in Australia, Canada and Russia, for instance, whom have enjoyed significant competitive boosts from local currency devaluation against the US dollar.
- By destination, the pattern of US trade has changed as Chinese imports of US met coal have collapsed. Trade with Japan and the Netherlands has also fallen.

Figure 85: US net met coal exports – mthly & ann'd



Source: IHS, UBS Research.

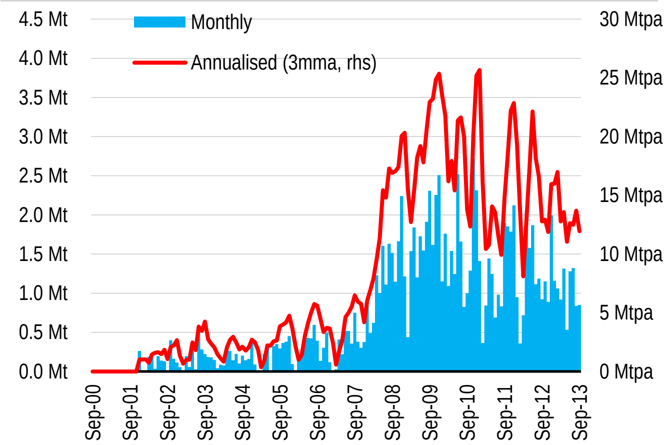
Figure 86: US met coal exports – mthly by dest'n



Source: IHS, UBS Research.

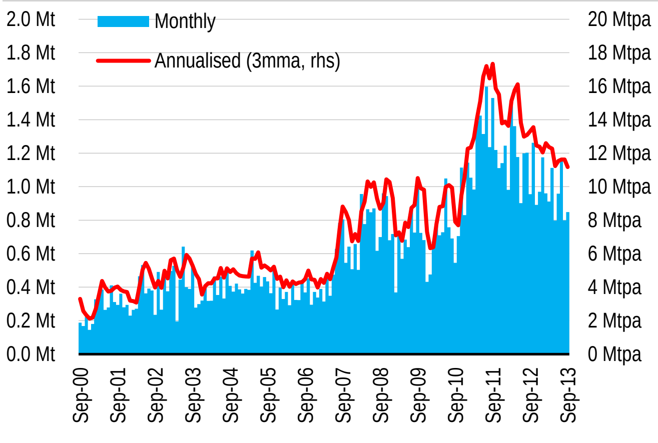
Mongolia, Russian coking coal exports slip

Figure 87: Mongolia met coal exports – mthly & ann'd



Source: IHS, UBS Research.

Figure 88: Russia met coal exports – mthly by dest'n



Source: IHS, UBS Research.

Figure 89: UBS global met coal supply & demand model

		2012	2013	2014	2015e	2016e	2017e	2018e	2019e
Global crude steel production	Mt	1,559	1,649	1,673	1,644	1,683	1,684	1,689	1,691
growth	%	*1.4%*	*5.8%*	*1.5%*	*-1.7%*	*2.4%*	*0.1%*	*0.3%*	*0.1%*
Total traded met-coal demand	Mt	284	313	324	310	299	300	305	311
YoY growth	%	*3.3%*	*10.3%*	*3.4%*	*-4.2%*	*-3.7%*	*0.5%*	*1.6%*	*1.9%*
Japan imports	Mt	53	56	54	52	45	46	45	45
YoY growth	%	*-5.7%*	*5.3%*	*-2.9%*	*-3.9%*	*-14.5%*	*2.9%*	*-1.3%*	*-0.8%*
Europe net imports	Mt	55	54	60	64	67	68	69	69
YoY growth	%	*6.6%*	*-1.8%*	*11.7%*	*7.0%*	*3.7%*	*1.6%*	*1.5%*	*0.9%*
India imports	Mt	35	37	45	49	52	56	60	64
YoY growth	%	*0.4%*	*4.8%*	*21.6%*	*8.1%*	*7.0%*	*7.0%*	*7.0%*	*7.0%*
Brazil net import trend	Mt	12	12	14	11	13	13	14	15
YoY growth	%	*-3.4%*	*4.9%*	*12.2%*	*-20.7%*	*18.5%*	*5.0%*	*5.0%*	*5.0%*
China net import trend	Mt	52	74	62	48	38	30	26	23
growth	%	*27%*	*42%*	*-17%*	*-23%*	*-21%*	*-21%*	*-11%*	*-12%*
Total traded met-coal supply	Mt	289	321	329	308	301	304	310	313
YoY growth	%	*8.2%*	*11.0%*	*2.4%*	*-6.4%*	*-2.0%*	*0.8%*	*1.9%*	*1.1%*
Australia exports	Mt	144	169	184	183	185	187	189	190
Canada exports	Mt	31	35	31	29	26	26	26	26
US exports	Mt	63	59	57	45	41	39	37	35
Balance	Mt	5	8	5	-2	3	4	5	2
Market's product split: HCC	%	*67%*	*70%*	*69%*	*67%*	*64%*	*63%*	*62%*	*61%*
Market's product split: LV-PCI	%	*14%*	*12%*	*13%*	*14%*	*16%*	*16%*	*17%*	*18%*
Market's product split: SSCC	%	*19%*	*18%*	*18%*	*19%*	*20%*	*21%*	*21%*	*22%*
Hard coking coal price (CY, JBM)	US$/t	209	159	126	102	85	89	95	105
LV-PCI price (CY, JBM)	US$/t	153	125	104	84	67	71	75	82
premium HCC vs. PCI	%	*37%*	*26%*	*21%*	*22%*	*27%*	*26%*	*27%*	*28%*
Semi-soft coking coal price (CY, JBM)	US$/t	131	113	92	78	65	67	69	73
premium HCC vs. SSCC	%	*59%*	*40%*	*36%*	*31%*	*31%*	*33%*	*38%*	*44%*

Source: TEX Report, AME Group, IHS, UBS Research.

Downgrading (Long Term) Prices

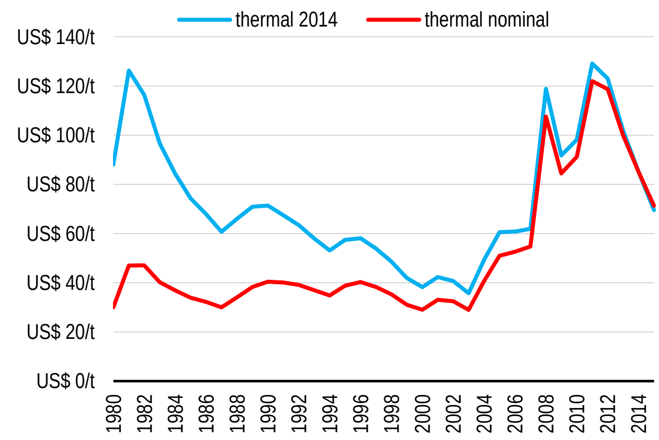
We cut LT met and thermal coal prices reflecting weaker demand and further cost compression

- We move to downgrade long term prices for seaborne thermal and metallurgical coal in this review, reflecting:
  - Expected flat to falling seaborne thermal and met coal demand over the medium term,
  - Expected falling capital and opex intensity over the short to medium term, resulting in both falling cost curves and falling incentive prices required for (lower quantities of) new supply to be built.
- We explore these price drivers below, after looking at historical prices to place current prices and our proposed new prices into some context.

Long term nominal and real coal prices

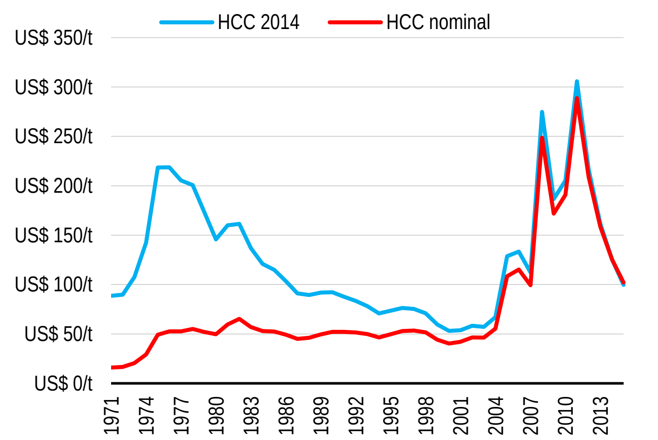
- We show long term nominal and real prices for met and thermal coal and period averages for entire history, up to 2005 and 2005-2015.

Figure 90: Thermal coal long term real and nominal prices (2014 dollars)



Source: TEX Report, ABARE, BREE, Platts, AME Group, UBS Research.

Figure 91: Hard coking coal long term real and nominal prices (2014 dollars)



Source: TEX Report, ABARE, BREE, Platts, AME Group, UBS Research.

- What stands out is the long term real deflation in coal prices from the time of the oil price shocks of the late 1970s and concomitant global inflation/stagflation, right through to 2005 when the impact of China shifting from a net coal exporter to a net coal importer was first felt.

Real prices can fall for extended periods of time, absent market tightening demand or supply shocks

- In other words, absent some significant demand or supply induced positive price shock, real prices can fall for extended periods of time, reflecting:
  - Geology (falling coal quality, rising strip ratios, higher seam dip, more faulted seams) and geography (longer distance from ports, more challenging site conditions) tend to pressure costs higher over extended periods of time.
  - However, operator skill and experience plus the relentless pursuit of more productive operations tends to put downward pressure on real unit costs over time, as operators pursue better margins.

- Overlaying our demand side outlook which might be described as muted at best, and pressure to reduce real unit costs remains. In summary, we are not uncomfortable with falling real unit costs projected into the future.

Figure 92: Long term thermal and coking coal prices – nominal and real (2014 $) – average prices for selected periods

	1980-2015	1980-2005	1985-2005	2005-2015
Thermal coal (fob Aust, contract CY)				
Average				
Nominal	US$ 51.35/t	US$ 36.94/t	US$ 36.15/t	US$ 85.35/t
Real (2014 $)	US$ 73.14/t	US$ 65.09/t	US$ 56.21/t	US$ 91.01/t
	1971-2015	1971-2005	1985-2005	2005-2015
Coking coal (HCC, fob Aust, contract CY)				
Average				
Nominal	US$ 76.06/t	US$ 48.94/t	US$ 51.66/t	US$ 165.27/t
Real (2014 $)	US$ 125.94/t	US$ 109.89/t	US$ 79.83/t	US$ 177.27/t

Source: TEX Report, ABARE, BREE, Platts, AME Group, UBS Research.

- We have included long term average prices to 2005 so that we avoid the terms of trade boom period in which coal prices rose dramatically as demand outstripped supply. When we do this, we see that average thermal and met coal prices in real terms were US$65/t and US$110/t, respectively.

- When we adjust for the oil price shock and resultant global inflation/stagflation in the late 1970s/early 1980s, average thermal and met coal prices in real terms were US$56/t and US$80/t.

Long term average real thermal & met coal prices excluding the China boom are US$65/t and US$110/t respectively

- It is our contention that real pricing should be anchored in a way that relates realistically to long term price trends. The China terms of trade coal price boom seems unlikely to repeat. Hence, including this period in average long term prices may overstate a 'through cycle' price.

  - Real long term average prices of US$110t/ and US$65/t for hard coking and thermal coal, respectively, *seem a reasonable starting point* for consideration.

  - This compares against earlier UBS real long term price estimates of US$132/t and US$82/t for hard coking and thermal coal, respectively.

Bias to long term historical averages? Down

The outlook for broadly flat or falling seaborne demand suggests any bias toward LT through cycle average prices should be to downside

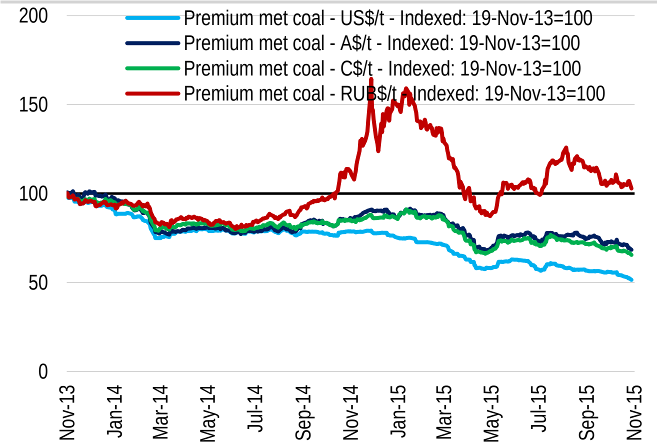
- When we consider that seaborne thermal coal trade has declined and, in our view, is likely to remain under volume pressure for some time as China continues to retreat, India grows domestic supply and a host of countries continue to enact carbon reduction policies that bias against coal; we take a view here that bias to long term average prices should be to the negative.

- In terms of met coal, the key structural driver at play here is whether or not China's steel demand has peaked and is entering trend structural decline. The UBS view is yes, China's steel output has peaked. More so, to the extent that Chinese exports of steel and steel-containing manufacturing goods (made with Chiense domestic coking coal) displace steel production (coking coal demand) elsewhere, global met coal trade is in our view set for a period of very modest growth. Hence our bias to long term real average prices is slightly to downside here as well.

How have exchange rates impacted thermal and met coal markets?

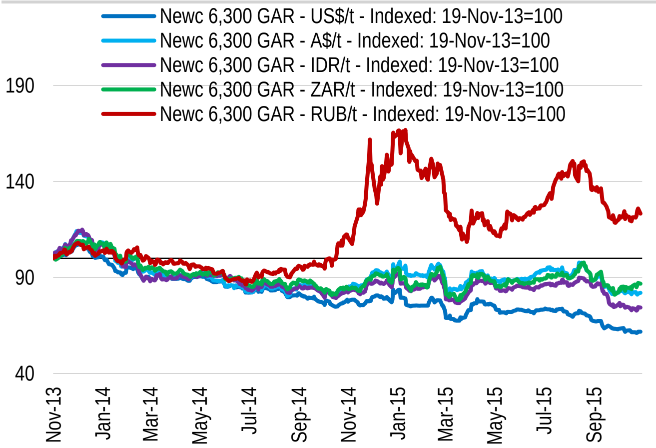
- Much of the recent influence on met and thermal coal markets has come from changes in producer exchange rates against the US dollar.
- Currencies across the market have fallen, in some cases very substantially, against the US dollar, which has allowed local producers to remain competitive against falling US dollar prices, based on the proportion of costs denominated in local currency.
- To illustrate, below find premium met coal and thermal coal prices expressed in key supplier currencies all indexed to 100 two years ago. This way it's apparent which currencies have shifted the most.
- What emerges is that the large fall in the Ruble has boosted local currency coal prices, therefore incentivising Russian exports ahead of US producers. Falls in the AUD, CAD, ZAR and INR have had the same but lesser magnitude impact as the lower RUB.
- Falling currency and oil prices have accounted for a large share of cost compression so far. Further falls in currency would continue to aid US$ cost compression.

Figure 93: Met coal prices – selected producer FX – indexed Nov-13=100



Source: Bloomberg, Platts, UBS Research.

Figure 94: Thermal coal prices – selected producer FX – indexed Nov-13-100



Source: Bloomberg, Platts, UBS Research

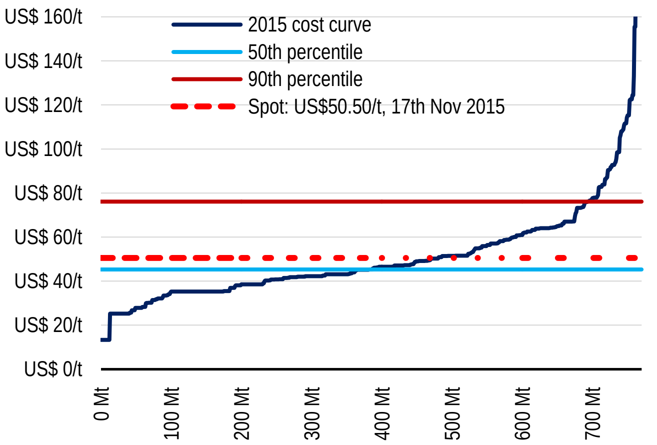
What are the cost curves telling us about the cycle?

- In a seaborne market for both thermal and met coal where volumes are flat to down on peak levels 2-3 years ago, and total seaborne demand growth is broadly flat, the market does not need significant new capacity in the medium term. Hence the role of an incentive price in setting long term real prices should be reduced, while the weighting of marginal cost pricing should be increased.

Current spot thermal and met coal are trading around the 65th and 5oth percentile, respectively

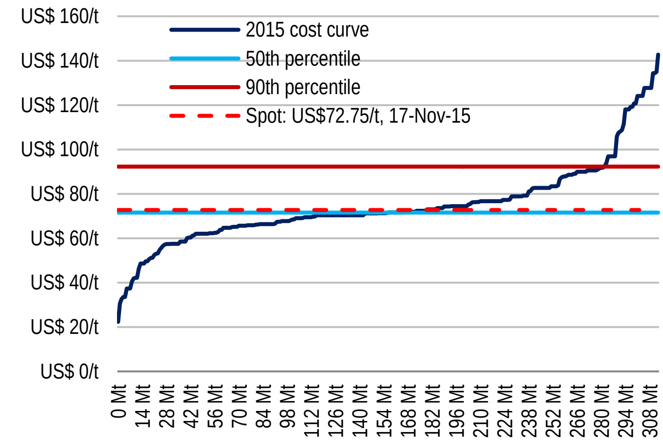
- Here the challenge is to form a view on how cost curves / industry costs will trend in future, therefore setting cost curves and providing a guide as to where prices should trade.
- Figures 95 & 96 present the current thermal and met coal cost curves, showing where spot intersects, as well as the 50th and 90th percentiles. Current spot thermal (US$50.50/t) trades around the 65th percentile, while current spot met (US$72.75/t, HCC) trades just above the 50th percentile.

Figure 95: Seaborne thermal coal cost curve, 50th & 90th percentile and spot



Source: AME Group, Platts, company reports, UBS Research.

Figure 96: Seaborne met coal cost curve, 50th & 90th percentile and spot (HCC)



Source: AME Group, Platts, company reports, UBS Research.

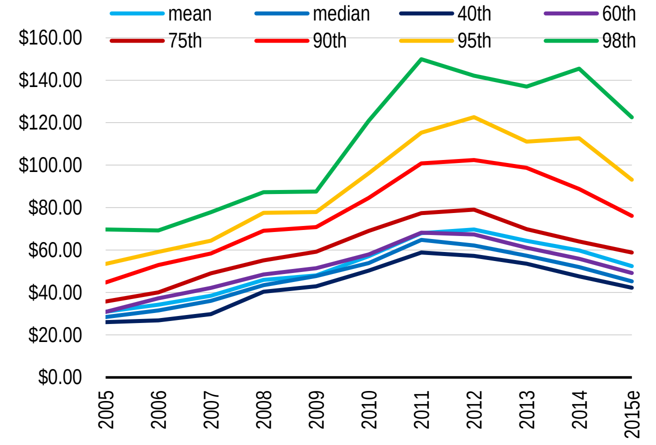
- Figures 97 & 98 show the evolution of the seaborne thermal and met coal cost curves, as seen from the level of percentile points along the curve.
- As such, this allows us to gauge both the evolution of costs over the last decade, but also as evidenced by the difference between the percentile cost levels, the slope of the curve.

Cost curves rose and steepened during the China boom as operators spared no cost to maximise volumes

- We show how coal cost curves rose through the China boom as miners spent more money to ship volumes at any cost, but also how more expensive, lower quality assets entered the market to meet excess demand.
- More recently, costs have been falling, following prices lower, while the curves have been flattening as marginal high cost suppliers have exited the trade.

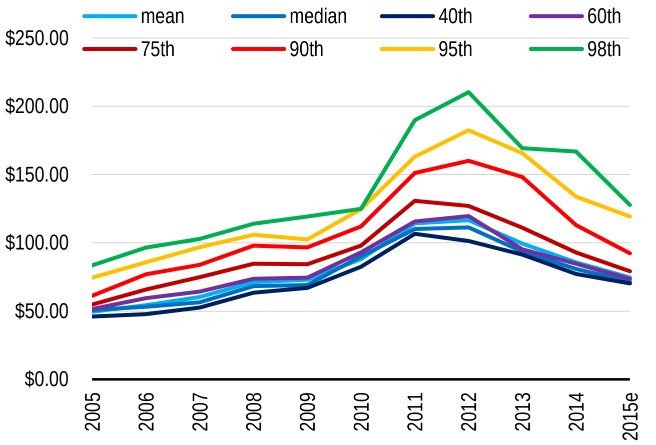
Now curves are falling and flattening as operator emphasis has shifted to maximising margins

Figure 97: Seaborne thermal coal cost curve – 2005-2015e – key percentile costs – US$/t fob



Source: AME Group, UBS Research.

Figure 98: Seaborne met coal cost curve – 2005-2015e – key percentile costs – US$/t fob

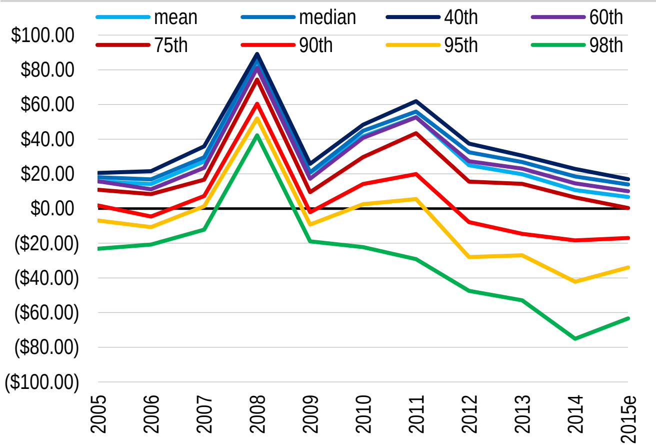


Source: AME Group, UBS Research.

- Another way to look at coal trade is margins. Figures 99 & 100 map out the historical cost curve data in Figures 97 & 98 and calculates a cash margin, based on Newcastle benchmark prices in the case of thermal coal, and a weighted average of hard coking, semi-soft coking and LV PCI coals in the case of seaborne met coal.
  - This measure of margin does not necessarily account well for coal quality differentials, realised pricing and a range of other site and operator specific metrics, so the absolute levels should not be relied upon. But the analysis is useful for understanding margins across the curve and through time.

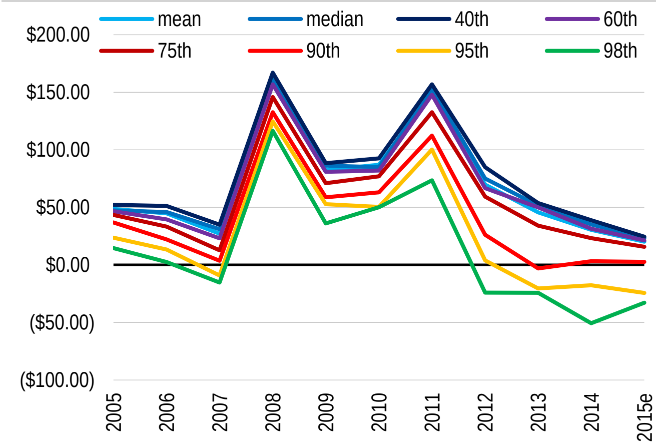
Margin curves show how industry profitability has changed through the cycle

Figure 99: Seaborne thermal coal cost curve – 2005-2015e – key percentile margins – US$/t fob



Source: AME Group, Platts, UBS Research.

Figure 100: Seaborne met coal cost curve – 2005-2015e – key percentile margins – US$/t fob



Source: AME Group, Platts, UBS Research.

- Unsurprisingly, the margin curves presented here show general margin expansion during the China coal price boom – excluding the commodity price rout in 2009 – before more recent margin contraction as price falls have not been matched by cost compression even as costs have been coming out of these businesses as evidenced in figure 24.

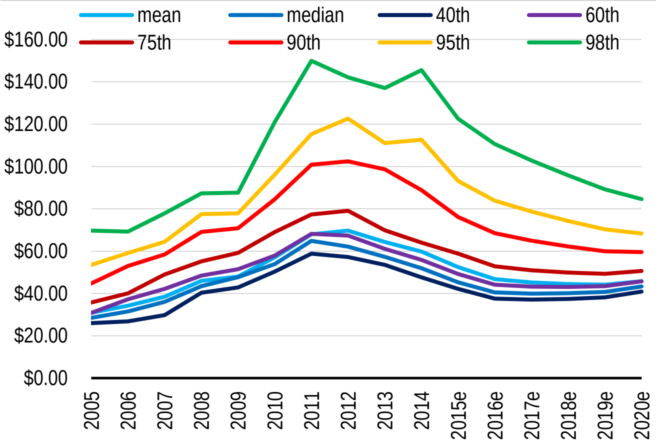
So what do UBS' new coal price forecasts factor in for future margins and cost compression?

- Taking UBS' updated coal price forecasts to 2020, and assuming that nominal coal margins return to levels judged appropriate mid-cycle margins, we can back calculated what cost compression is implied by our price forecasts.

UBS' new LT coal prices allow margins to normalise with modest further cost compression

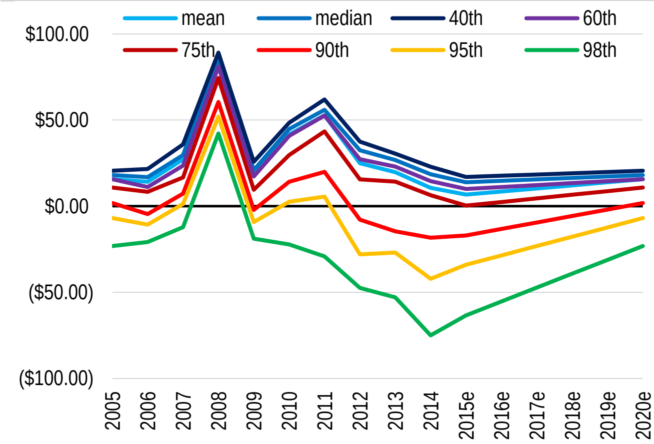
- **Seaborne thermal coal** – relatively minor cost compression from here across most of the curve sees seaborne margins returning to 2005 levels (nominal US$/t) by 2020.

Figure 101: Seaborne thermal coal – key percentile cost implied under UBS price & margin scenario



Source: AME Group, Platts, company filings, UBS Research.

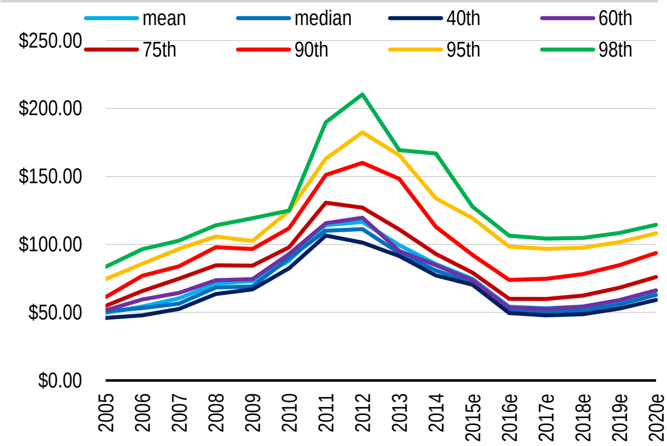
Figure 102: Seaborne thermal coal – key percentile margins implied under UBS price and cost scenario



Source: AME Group, Platts, company filings, UBS Research.

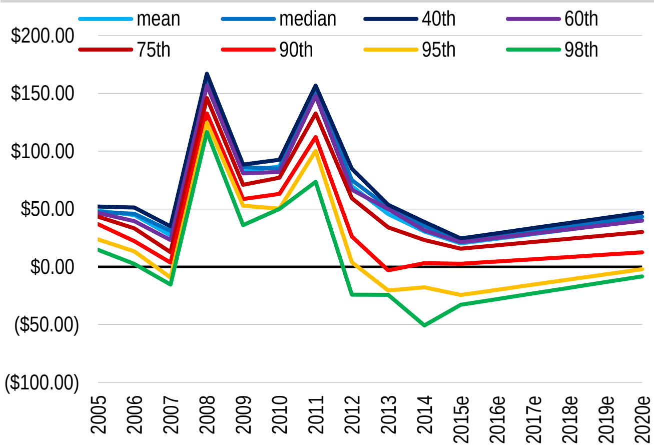
- **Seaborne met coal** – further cost compression from 2015e into 2016e then stable costs for a year or two before costs begin to lift toward 2020e. Margins return to levels consistent with average margins recorded in 2005, 2007 and 2013 (the China boom and flood impacted windfall margin years, as well as the more recent down cycle low margin years, have been left aside for the purposes of this analysis).

Figure 103: Seaborne met coal – key percentile costs implied under UBS price & margin scenario



Source: AME Group, Platts, company filings, UBS Research.

Figure 104: Seaborne met coal – key percentile margins implied under UBS' price & cost scenario



Source: AME Group, Platts, company filings, UBS Research.

- Calculations are shown in Appendix A

Is UBS' new price & implied cost & margin scenario realistic?

- For both thermal and met coal, 2020 implied nominal cost percentiles are about flat to slightly down in real terms, with CAGR of cost percentiles measured from 2005 to 2020 rising ~2%-2.5% per annum (Figure 105). Is this reasonable?

Figure 105: Cost trends – changes in nominal costs implied by our scenarios

CAGR of nominal costs, 2005-2020e	mean	median	40th	60th	75th	90th	95th	98th
Seaborne thermal coal	2.7%	2.8%	3.1%	2.7%	2.3%	1.9%	1.6%	1.3%
Seaborme met coal	1.9%	1.4%	1.7%	1.7%	2.2%	2.9%	2.5%	2.1%

Source: AME Group, company filings, UBS Research.

  - On the one hand, rising strip ratios, deteriorating quality, increasing logistics / freight task, increasing regulatory burden may all be said to be structural cost factors in support of rising costs through time.
  - Yet real prices and costs for almost all commodities tend to fall through time as operators embrace more productive and efficient production methods.
  - In terms of the cycle, we still believe that factor cost deflation is yet to and still needs to filter through coal supply chains (eg: labour costs).
- So on balance, we think stable real costs, when we look through the China boom, are defensible.

UBS' new LT coal prices imply broadly stable real costs from 2005-2020e, balancing inflationary pressure from geology, logistics & regulation against deflationary pressure from falling factor costs and productivity

How do new projects fare at US$55/t thermal and US$105/t met long term? Reviewing incentive price analysis

Reduced role for long term incentive price with flat/falling demand

- In a scenario of falling to flat seaborne met and thermal coal demand there is only a requirement for new supply to replace part/all of depletion, hence the role of an incentive price in setting a long run price is reduced.
- Nevertheless, we update our incentive price work here to indicate the extent to which new projects are sanctioned in the period ahead under our new long term thermal coal price of US$55/t and premium met coal price of US$105/t.
- We include 31 thermal coal and 29 met coal projects across a range of countries and project scope.
  - We were not able to source appropriate data on new coal mine projects in India and China. It is likely that capex and opex intensity, as well as required rates of return, would be lower in these countries than in traditional coal mining jurisdictions for projects funded on a commercial basis.

Current capex and opex intensity estimates likely lagging the cycle, overestimating required incentive prices

- Estimates of project capex and opex are taken from the most recent available information from project promoters and/or consultants. However, given the stage of the cycle, it is likely capex and opex intensity estimates are deflating as factor costs are falling.
  - Hence, we also run some scenarios of both capex and/or opex deflation to illustrate approximate orders of magnitude changes in the required incentive price to generate a commercial rate of return.
- We also include a hypothecated incentive price generated at average mid-cycle capex and opex intensity which reflects the average capex and opex intensity recorded in the last 5 long term incentive price reviews conducted by UBS (Figures 106 & 107).

Figure 106: Thermal coal incentive price analysis - capex and opex intensity over time

LT price review	# projects	Total tonnes (Mt)	Weighted average capex intensity (US$/t)	Weighted average opex intensity (US$/t)
Sep-2007	43	306	$43.61	$33.15
Sep-2008	50	414	$51.29	$52.62
Oct-2010	32	307	$127.39	$61.60
Jan-2014	30	315	$103.65	$52.57
Jan-2014 (ex Galilee)	28	253	$92.68	$52.38
Oct-2015	33	342	$158.09	$62.21
Oct-2015 (ex Galilee)	29	187	$111.57	$63.30
Average			$96.12	$52.42
Average (ex Galilee)			$85.31	$52.61

Source: AME Group, Wood Mackenzie, company filings, UBS Research.

Figure 107: Met coal incentive price analysis – capex and opex intensity over time

LT price review	# projects	Total tonnes (Mt)	Weighted average capex intensity (US$/t)	Weighted average opex intensity (US$/t)
Sep-2007	28	108	$77.80	$46.45
Sep-2008	30	131	$109.65	$71.88
Oct-2010	37	162	$149.81	$102.74
Jan-2014	39	151	$223.64	$99.19
Oct-2015	29	157	$147.16	$89.14
Average			$141.61	$81.88

Source: AME Group, Wood Mackenzie, company filings, UBS Research.

Thermal coal base case

- Figure 108 shows the updated incentive price figures for thermal coal projects. Only two projects account for 5% of included volumes generate attractive returns at our new long term thermal coal price of US$55/t.

Figure 108: Thermal coal projects – recent and prospective – incentive price analysis

Thermal Coal projects - Incentive Prices											
Project	Owner/s	Count.	Start	Cap.	Cash Cost	Capex		Sust.	IRR	Incentive Price	Breakeven Price
				kt	US$/t	US$m	US$/t	US$/t	Hurdle	US$/t	US$/t
Carmichael	Adani Group	Australia	2022	55,000	71	13,988	254	5.1	15%	126	76
Galilee (China First)	Mineralogy	Australia	2023	40,000	26	7,932	198	4.0	15%	68	29
Alpha	GVK	Australia	2022	30,000	62	7,500	250	5.0	15%	116	67
Kevin's Corner	GVK	Australia	2020	30,000	88	3,785	126	2.5	15%	116	91
Wandoan	Xstrata/Itochu/Sumitomo	Australia	2022	22,000	55	5,000	227	4.5	15%	104	60
Grootegeluk-Medupi	Exxaro Resources	South Africa	2015	14,600	35	640	44	0.9	15%	44	36
Vista	Coalspur	Canada	2019	12,000	58	444	37	0.7	15%	66	59
Pakar	Kangaroo Resources	Indonesia	2018	11,550	47	1,000	87	1.7	15%	65	49
Maules Creek	Whitehaven	Australia	2014	11,000	59	460	42	0.8	15%	68	60
Byerwen	Qcoal Limited	Australia	2018	10,000	94	1,584	158	3.2	15%	128	97
Mount Pleasant	Coal & Allied	Australia	2019	8,400	74	756	90	1.8	15%	94	76
Tweefontein	Xstrata	South Africa	2013	7,900	78	553	70	1.4	15%	93	79
Springsure Creek	Bandanna Energy	Australia	2019	7,000	90	770	110	2.2	15%	114	92
Zibulo	Anglo Coal	South Africa	2012	6,600	50	517	78	1.6	15%	67	52
Boikarabelo (Ledjadja)	Resource Generation	South Africa	2016	6,000	49	630	105	2.1	15%	71	51
Lublin Project	Prairie Mining	Poland	2020	6,000	36	720	120	2.4	15%	60	39
Moolaben	Yancoal Australia	Australia	2014	6,000	46	420	70	20.0	15%	74	66
Watermark	China Shenhua	Australia	2018	6,000	68	900	150	3.0	15%	100	71
Teresa	United Mining	Australia	2023	5,120	84	475	93	1.9	15%	104	86
Elimatta	New Hope Corporation	Australia	2022	5,000	83	934	187	3.7	15%	123	86
The Range	Stanmore Coal Ltdd	Australia	2022	5,000	72	600	120	2.4	15%	98	74
Unst Khudag	Banpu	Mongolia	2022	5,000	62	315	63	1.3	5%	67	63
Ellensfield	Vale	Australia	2025	4,680	95	640	137	2.7	15%	125	98
Talwood	Baosteel	Australia	2025	3,600	118	631	175	3.5	15%	156	122
GPK Project	Kangaroo Resources	Indonesia	2020	3,500	68	424	121	2.4	15%	93	70
Codrilla	Peabody, Marubeni, Sojitz	Australia	2025	3,200	76	451	141	2.8	15%	106	78
Newstan Extension	Banpu Coal	Australia	2023	3,200	55	227	71	1.4	15%	71	57
Thar Coalfield Block VI	Oracle Coalfields	Pakistan	2014	3,000	36	180	60	1.2	15%	49	37
Orion Downs	U&D Coal Ltd	Australia	2018	1,500	69	42	28	0.6	15%	75	70
TCM	Universal Coal Resources	Indonesia	2018	1,500	45	150	100	2.0	15%	65	47
Cypress	Solid Energy	New Zealand	2022	500	79	60	120	2.4	15%	104	81
Mid cycle				10,802	50	1,046	97	1.9	15%	71	52
Mid-cycle (ex Galilee)				6,661	50	568	85	1.7	15%	68	52
weighted average (total)				334,850	62	52,727	157	3		96	65
weighted average (ex Galilee)				179,850	63	19,522	109	3		86	66

Source: AME Group, company filings, UBS Research.

Met coal base case

- Figure 109 shows that based on the base case data we have available to us, several projects accounting for just 28% (44Mtpa) of included projects would generate sufficient returns to be sanctioned at our long term coking coal price of US$105/t.

Figure 109: Met coal projects – recent & prospective – incentive price analysis

Met Coal projects - Incentive Prices											
Project	Owner/s	Count.	Start	Cap. kt	Cash Cost US$/t	Capex US$m	Capex US$/t	Sust. US$/t	IRR Hurdle	Incentive Price US$/t	Breakeven Price US$/t
Byerwen	Qcoal Limited	Australia	2018	10,000	94	1,584	158	3.2	15%	128	97
Belvedere	Vale	Australia	2025	7,500	75	2,818	376	7.5	15%	156	83
Eagle Downs	Vale, Aquila Resources	Australia	2019	4,500	94	1,254	279	5.6	15%	154	100
Codrilla	Sojitz Corporation	Australia	2025	3,200	76	450	141	2.8	15%	106	79
Ellensfield	Vale	Australia	2025	4,680	95	640	137	2.7	15%	125	98
Grosvenor	Anglo American	Australia	2016	5,000	75	1,885	377	7.5	15%	157	83
Grosvenor West	Carabella Resources	Australia	2022	3,600	90	500	139	2.8	15%	120	93
Moranbah South	Anglo American, Exxaro	Australia	2021	14,000	94	2,000	143	2.9	15%	125	97
Red Hill	BHP Mitsubishi Alliance	Australia	2023	12,000	98	2,750	229	4.6	15%	147	102
Talwood U/G	Baosteel	Australia	2025	3,200	116	631	197	3.9	15%	159	120
Teresa	United Mining	Australia	2023	5,120	84	475	93	1.9	15%	104	86
Vickery	Whitehaven Coal	Australia	2021	5,000	90	412	82	1.6	15%	107	91
Washpool	Aquila Resources	Australia	2021	2,900	74	335	116	2.3	15%	99	76
Watermark	China Shenhua	Australia	2018	6,000	68	900	150	3.0	15%	100	71
Mmamabula	Jindal Steel & Power	Botswana	2020	4,700	75	106	23	0.5	15%	80	76
Belcourt Saxon	Anglo American, Walter Er	Canada	2019	3,200	110	250	78	1.6	15%	126	111
Carbon Creek Complex	Cardero	Canada	2023	3,500	128	217	62	1.2	15%	141	129
Donkin	Cline Mining Corporation	Canada	2019	2,750	63	75	27	20.0	15%	82	83
Groundhog	Atrum Coal NL	Canada	2018	3,300	82	596	181	3.6	15%	120	86
Raven	Itochu Corp	Canada	2025	1,100	105	206	187	3.7	15%	145	109
Suska Lossan	Glencore, Nippon	Canada	2021	1,500	100	50	33	0.7	15%	107	101
Bumi Burito	Cokal Ltd	Indonesia	2018	2,000	97	75	38	0.8	15%	105	98
Ovoot O/C	Aspire Mining	Mongolia	2020	10,000	91	144	14	0.3	15%	94	91
Revuboe	Talbot Group, Nippon	Mozambique	2023	8,000	96	500	63	1.3	15%	110	97
Zambeze	Government	Mozambique	2022	16,000	102	2,000	125	2.5	5%	111	105
Lublin Project	Prairie Mining	Poland	2020	6,000	36	720	120	2.4	15%	60	39
Amaam North	Tigers Realm	Russia	2018	1,370	64	52	38	0.8	15%	71	65
Amaam Project	Tigers Realm	Russia	2019	5,000	96	1,344	269	5.4	15%	148	101
Kodiak	Atilla Resources	United States	2018	2,000	91	153	76	1.5	15%	108	92
Mid cycle				5,418	82	767	142	2.8	15%	113	85
weighted average (total)				157,120	89	23,122	147	3		119	92
Australia				86,700	89	16,634	192	4		130	92
Canada				15,350	98	1,394	91	5		120	103
Mongolia				10,000	91	144	14	0		94	91
Russia				6,370	89	1,396	219	4		132	93

Source: AME Group, company filings, UBS Research.

Capex and Opex deflation scenarios provide the catalysts for more new projects to be sanctioned and developed

Prospective modest to moderate capex and opex deflation allows projects to proceed at lower incentive prices

- We run several scenarios flexing capex and opex deflation, remembering that many of the total capex and opex figures we have been able to source likely lag current and near term prospective deflation trends in the industry. Therefore we argue deflationary scenarios are defensible.

- Figure 110 shows capex and opex deflation scenarios for **thermal coal**. Under a scenario of 25% capex deflation and 25% opex deflation from figures in the analysis, the weighted average incentive price required to see half of the ~350Mt of new capacity examined is US$56/t.

Figure 110: Thermal coal incentive price – capex and opex deflation scenarios

		Weighted Average Capex	Weighted Average Cash Costs	Weighted Average Incentive Price	Weighted Average (ex top 50% high cost)
Base Case: Capex 0%, Cash Cost 0%, IRR 15%	Scenario 1	158.1	60.6	107.7	74.6
Capex -5%, Cash Cost -5%, IRR 15%	Scenario 2	150.2	57.6	102.3	70.9
Capex -10%, Cash Cost -10%, IRR 15%	Scenario 3	142.3	54.5	97.0	67.2
Capex -15%, Cash Cost -15%, IRR 15%	Scenario 4	134.4	51.5	91.6	63.4
Capex -20%, Cash Cost -20%, IRR 15%	Scenario 5	126.5	48.5	86.2	59.7
Capex -25%, Cash Cost -25%, IRR 15%	Scenario 6	118.6	45.4	80.8	56.0
Capex -30%, Cash Cost -30%, IRR 15%	Scenario 7	110.7	42.4	75.4	52.2
Capex -35%, Cash Cost -35%, IRR 15%	Scenario 8	102.8	39.4	70.0	48.5

Source: AME Group, company reports, UBS Research.

- It's a similar story for **met coal** too – Figure 111 shows prospective capex and opex deflation allows a significant portion of projects examined to be sanctioned and generate attractive returns.

Figure 111: Met coal incentive price – capex and opex deflation scenarios

		Weighted Average Capex	Weighted Average Cash Costs	Weighted Average Incentive Price	Weighted Average (ex top 50% high cost)
Base Case: Capex 0%, Cash Cost 0%, IRR 15%	Scenario 1	147.2	86.0	128.7	110.1
Capex -5%, Cash Cost -5%, IRR 15%	Scenario 2	139.8	81.7	122.2	104.6
Capex -10%, Cash Cost -10%, IRR 15%	Scenario 3	132.4	77.4	115.8	99.1
Capex -15%, Cash Cost -15%, IRR 15%	Scenario 4	125.1	73.1	109.4	93.6
Capex -20%, Cash Cost -20%, IRR 15%	Scenario 5	117.7	68.8	102.9	88.1
Capex -25%, Cash Cost -25%, IRR 15%	Scenario 6	110.4	64.5	96.5	82.6
Capex -30%, Cash Cost -30%, IRR 15%	Scenario 7	103.0	60.2	90.1	77.1
Capex -35%, Cash Cost -35%, IRR 15%	Scenario 8	95.7	55.9	83.6	71.6

Source: AME Group, company reports, UBS Research.

Risks

- We consider here the main risks to our base case. Some risks are unidirectional, some are balanced while some may have nil net impact on coal trade.

Risks fall into two categories: Those impacting industry wide costs, and those impacting coal demand

- **Industry cost compression**. Costs have been falling across the coal industry for years now. Our base case factors in further modest cost compression from here but uncertainty surrounds this expectation. A possible end to cost compression presents a **bullish risk**. But on the other hand, and given broader context of weak demand, costs may continue to fall further than we expect – a **bearish risk**.
- **China's coal usage**. A more aggressive shift away from thermal coal in respect of particulate pollution and carbon emissions would pressure net imports toward balance trade or net exports faster and in larger magnitude than currently expected. **Bearish**.
- **India's domestic thermal coal output**. A faster ramp up in India's domestic coal output and consumption presents downside risk to India's thermal coal import demand – **bearish risk**. But a failure to execute on ambitious government plans to grow the domestic coal sector presents **bullish risk** around thermal coal demand.
- **Global steel output**. UBS' view is that global steel output is set for an extended period of low growth, led by falling Chinese output, translating to weak met coal demand. The prospect of stable Chinese output into the medium term presents **bullish risks** to our met coal base case.
- **Chinese steel exports**. UBS' view is for China's exports of steel to remain relatively elevated near current levels into the medium term, which is displacing met coal demand outside of China. A larger fall in exports presents **bullish risk** to met coal as steel production (and met coal demand) outside of met coal self-sufficient China would likely be higher than otherwise.
- **Growth capacity (and incentive price) may not be needed**. A faster, more aggressive shift away from coal fired power and heat may result in no need for new thermal coal growth capacity and only new projects to replace some part of depletion, if at all. **Bearish risk** to thermal coal especially.

Chinese structural reform presents offsetting risks

- **Chinese structural reform**. Should China's government embark on more ambitious structural reform of domestic excess capacity across steel making, power generation and coal mining, the trade will likely feel impacts. The extent of these depends on which industries are targeted how. For instance:
  - Close steel making over capacity / over production => **bearish** met coal demand, but if accompanied by closures of met coal over capacity / over production, **bullish** met coal. In sum, **risks balanced**.
  - Close over capacity in coal fired power and heat generation => **bearish** thermal coal demand, but if accompanied by closures of thermal coal over capacity, **bullish** thermal coal. In sum, **risks balanced**.

Upside & Downside Scenarios

- We provide readers with both an upside and downside scenario here to frame consideration of the coal price outlook.

Upside: Cost deflation ends & demand bounces

Upside scenario designed to reflect i) no further cost compression, and ii) stronger thermal & met coal demand

- In the upside scenario, we factor in:
  - Cost deflation comes to an end as operators reach the practical limits of their ability to reduce costs, and,
  - Stronger coal demand, leading to tighter market balances than otherwise.

Downside: Cost deflation extends & demand retreats further

Downside scenario designed to reflect i) further cost compression than UBS base case, and ii) more aggressive contraction in seaborne demand

- In the downside scenario, we factor in:
  - An extension to cost deflation as the industry proves more effective at reducing costs, thereby pulling the cost curve lower over the medium term, and
  - An extension of the retreat in seaborne demand as China trends towards net exporter, India too, and South East Asia's growth disappoints against base case.

Figure 112: Seaborne thermal coal base, upside & downside price scenarios

	downside	base case	upside
JFY	US$/t	US$/t	US$/t
2015E	68	68	68
2016E	61	61	63
2017E	55	60	66
2018E	55	61	68
2019E	55	62	69
LT price (nom. 2020)	56	62	69
LT price (real 2015)	49	55	61

Source: UBS Research.

Figure 113: Seaborne met coal (HCC) base, upside & downside price scenarios

	downside	base case	upside
	US$/t	US$/t	US$/t
2015E	102	102	102
2016E	81	85	87
2017E	82	89	97
2018E	87	95	109
2019E	96	105	121
LT price (nom. 2020)	107	118	129
LT price (real 2015)	95	105	115

Source: UBS Research.

Appendix A

- Figures 114 & 115 show historical thermal and met coal cost curve percentile cost levels and those implied under UBS' new thermal & met coal price profiles assuming:
  - margins in 2020 return to those in 2005 for thermal coal, and
  - margins in 2020 return to an average of those in 2005, 2007 and 2013 for met coal.

Figure 114: Seaborne thermal coal cost curves – key percentile cost levels – 2000-2020e – US$/t

Seaborne Thermal Coal - Costs												
US$/t (nominal)			Cost curve percentiles						Memo items: Spot price, FX and energy			
	mean	median	40th	60th	75th	90th	95th	98th	Newcastle spot	USD TWI	AUD/USD	Brent crude oil
2005	$30.92	$28.48	$26.02	$30.86	$35.76	$44.74	$53.48	$69.70	$46.56	84	0.762	54
2006	$34.24	$31.54	$26.84	$37.29	$40.07	$52.95	$59.10	$69.20	$48.41	83	0.754	66
2007	$38.50	$36.03	$29.77	$42.17	$49.01	$58.41	$64.38	$77.86	$65.67	78	0.839	72
2008	$45.94	$43.47	$40.37	$48.48	$55.15	$69.06	$77.52	$87.29	$129.53	74	0.852	100
2009	$48.02	$47.73	$42.89	$51.47	$59.18	$70.79	$77.88	$87.58	$68.67	78	0.793	62
2010	$57.08	$53.88	$50.32	$57.92	$69.02	$84.50	$96.16	$120.91	$98.70	75	0.921	79
2011	$67.97	$64.82	$58.83	$68.21	$77.35	$100.86	$115.27	$149.90	$120.77	71	1.033	95
2012	$69.69	$62.17	$57.21	$67.38	$79.04	$102.42	$122.59	$142.14	$94.64	74	1.036	94
2013	$64.32	$57.30	$53.53	$61.09	$69.81	$98.68	$111.06	$137.01	$84.08	76	0.968	98
2014	$59.81	$51.93	$47.59	$55.87	$64.06	$88.78	$112.64	$145.48	$70.45	78	0.902	93
2015e	$52.44	$45.27	$42.21	$49.18	$58.81	$76.12	$93.14	$122.53	$59.15	90	0.760	56
2016e	$46.75	$40.53	$37.59	$44.14	$52.82	$68.46	$83.83	$110.58	$55.25		0.748	58
2017e	$45.22	$39.94	$37.12	$43.24	$50.98	$64.95	$78.66	$102.78	$55.50		0.700	70
2018e	$44.43	$40.10	$37.40	$43.09	$49.88	$62.19	$74.25	$95.73	$56.50		0.710	75
2019e	$44.14	$40.76	$38.18	$43.45	$49.29	$59.93	$70.33	$89.18	$58.00		0.725	80
2020e	$45.78	$43.34	$40.88	$45.72	$50.62	$59.60	$68.34	$84.56	$61.42		0.740	79
2005 to 2015e												
Minimum	$30.92	$28.48	$26.02	$30.86	$35.76	$44.74	$53.48	$69.20	$46.56	71	0.754	54
Maximum	$69.69	$64.82	$58.83	$68.21	$79.04	$102.42	$122.59	$149.90	$129.53	90	1.036	100
2015e	$52.44	$45.27	$42.21	$49.18	$58.81	$76.12	$93.14	$122.53	$59.15	90	0.760	56
Change:												
chg (min to max)	$38.78	$36.34	$32.81	$37.35	$43.28	$57.69	$69.11	$80.70	$82.97	20	0.282	45
% chg (min to max)	125%	128%	126%	121%	121%	129%	129%	117%	178%	28%	37%	83%
chg (max to 2015e)	($17.25)	($19.55)	($16.62)	($19.03)	($20.23)	($26.30)	($29.45)	($27.37)	($70.38)	0	-0.276	-44
% chg (max to 2015e)	-25%	-30%	-28%	-28%	-26%	-26%	-24%	-18%	-54%	0%	-27%	-44%
2015e to 2020e												
Change:												
chg 2015e to 2020e	($6.66)	($1.93)	($1.33)	($3.46)	($8.19)	($16.52)	($24.80)	($37.97)			-0.019	
% chg max to 2020e	-34%	-30%	-29%	-32%	-36%	-42%	-44%	-41%			-29%	
CAGR												
max to 2015e	-9%	-9%	-8%	-8%	-9%	-9%	-9%	-5%	-15%	7%	-10%	-16%
2015e to 2020e	-3%	-1%	-1%	-1%	-3%	-5%	-6%	-7%	1%		-1%	7%

Source: AME Group, UBS Research.

Figure 115: Seaborne met coal cost curves – key percentile cost levels – 2000-2020e – US$/t

Seaborne Met Coal - Costs US$/t (nominal)	mean	median	40th	60th	75th	90th	95th	98th	Memo items: Spot price, FX and energy — Coking coal price (weighted average)	USD TWI	AUD/USD	Brent crude c
			Cost curve percentiles									
2005	$49.59	$50.83	$46.01	$51.55	$54.76	$61.25	$74.47	$83.52	$98.19	84	0.762	54
2006	$54.29	$53.18	$47.82	$59.51	$65.82	$76.90	$85.78	$96.56	$99.07	83	0.754	66
2007	$60.36	$56.40	$52.59	$64.32	$74.84	$83.89	$96.74	$102.80	$87.48	78	0.839	72
2008	$71.19	$68.34	$63.52	$73.69	$84.63	$97.88	$105.87	$114.03	$230.55	74	0.852	100
2009	$73.01	$69.06	$66.95	$74.54	$84.36	$96.63	$102.54	$119.28	$155.34	78	0.793	62
2010	$88.08	$90.07	$82.44	$93.00	$97.98	$111.97	$124.67	$124.92	$175.00	75	0.921	79
2011	$114.17	$110.09	$106.55	$115.59	$130.73	$151.09	$163.08	$189.84	$263.36	71	1.033	95
2012	$116.53	$111.26	$101.36	$119.63	$126.97	$160.06	$182.39	$210.32	$186.24	74	1.036	94
2013	$99.48	$93.56	$91.40	$95.21	$111.04	$148.19	$165.66	$169.30	$145.12	76	0.968	98
2014	$85.59	$80.88	$77.24	$84.70	$92.94	$112.88	$133.84	$166.83	$116.13	78	0.902	93
2015e	$74.67	$71.55	$70.32	$73.60	$79.17	$92.27	$119.22	$127.71	$94.86	90	0.760	56
2016e	$54.26	$51.19	$49.49	$53.52	$59.94	$73.93	$98.40	$106.44	$78.50		0.748	58
2017e	$53.03	$50.00	$47.83	$52.61	$59.89	$74.77	$96.75	$104.35	$81.32		0.700	70
2018e	$54.31	$51.34	$48.69	$54.22	$62.35	$78.13	$97.62	$104.77	$86.66		0.710	75
2019e	$58.85	$55.92	$52.80	$59.07	$68.07	$84.74	$101.74	$108.44	$95.25		0.725	80
2020e	$65.67	$62.79	$59.19	$66.22	$76.07	$93.63	$108.15	$114.39	$106.12		0.740	79
2005 to 2015e												
Minimum	$49.59	$50.83	$46.01	$51.55	$54.76	$61.25	$74.47	$83.52	$87.48	71	0.754	54
Maximum	$116.53	$111.26	$106.55	$119.63	$130.73	$160.06	$182.39	$210.32	$263.36	90	1.036	100
2015e	$74.67	$71.55	$70.32	$73.60	$79.17	$92.27	$119.22	$127.71	$94.86	90	0.760	56
Change:												
chg (min to max)	$66.94	$60.43	$60.54	$68.08	$75.97	$98.81	$107.92	$126.80	$175.88	20	0.282	45
% chg (min to max)	135%	119%	132%	132%	139%	161%	145%	152%	201%	28%	37%	83%
chg (max to 2015e)	($41.86)	($39.72)	($36.23)	($46.03)	($51.57)	($67.80)	($63.17)	($82.61)	($168.50)	0	-0.276	-44
% chg (max to 2015e)	-36%	-36%	-34%	-38%	-39%	-42%	-35%	-39%	-64%	0%	-27%	-44%
2015e to 2020e												
Change:												
chg 2015e to 2020e	($9.00)	($8.76)	($11.13)	($7.38)	($3.10)	$1.37	($11.07)	($13.32)			-0.019	
% chg max to 2020e	-44%	-44%	-42%	-45%	-40%	-42%	-41%	-46%			-29%	
CAGR												
max to 2015e	-14%	-10%	-10%	-11%	-15%	-17%	-13%	-9%	-20%	7%	-10%	-16%
2015e to 2020e	-3%	-3%	-3%	-2%	-1%	0%	-2%	-2%	2%		-1%	7%

Source: AME group, UBS Research.

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Company Name	Reuters	12-month rating	Short-term rating	Price	Price date
BHP Billiton Limited[2, 4, 5, 6, 8, 16]	BHP.AX	Buy	N/A	A$20.42	19 Nov 2015
CONSOL Energy, Inc.[16]	CNX.N	Neutral	N/A	US$8.29	18 Nov 2015
Whitehaven Coal Limited[4, 5, 13]	WHC.AX	Buy	N/A	A$1.03	19 Nov 2015

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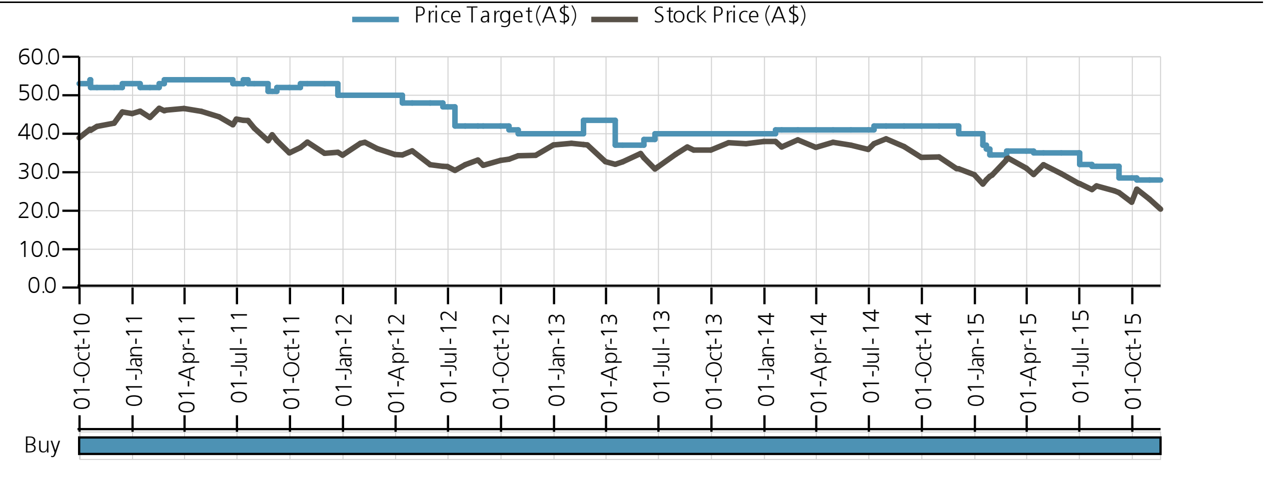

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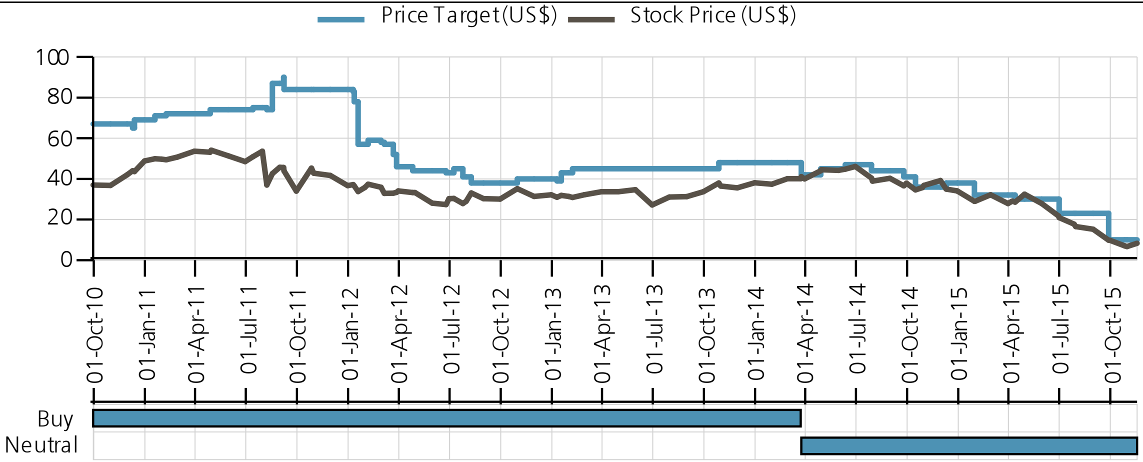
CONSOL Energy, Inc. (US$)



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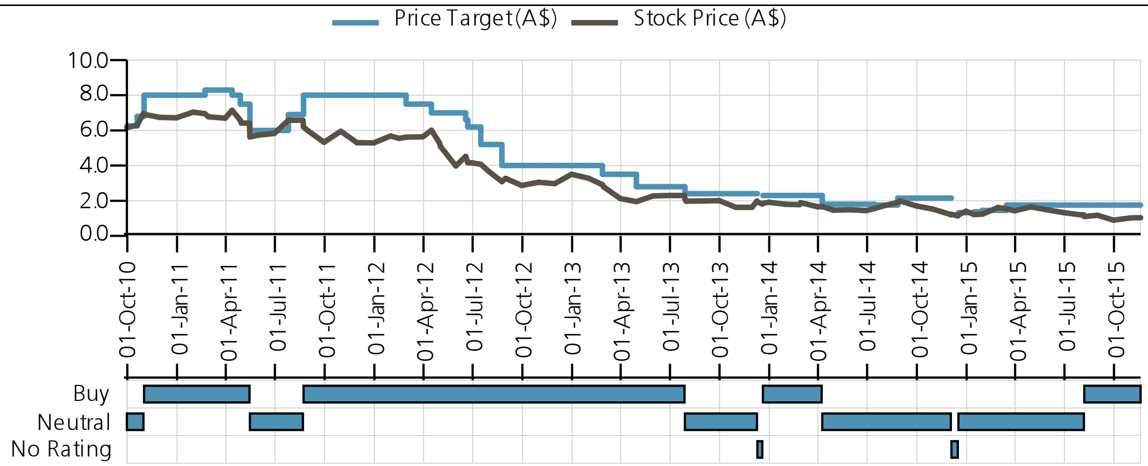
Whitehaven Coal Limited (A$)



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