

## Presentation at CRU World Aluminium Conference 2017

Attached is a copy of a presentation titled, Outlook for the Alumina Market, prepared by Mr Andrew Wood, Group Executive Strategy & Development, for the CRU World Aluminium Conference 2017 held in London, United Kingdom.

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# Outlook for the Alumina Market

4 May 2017

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## ***Past Performance***

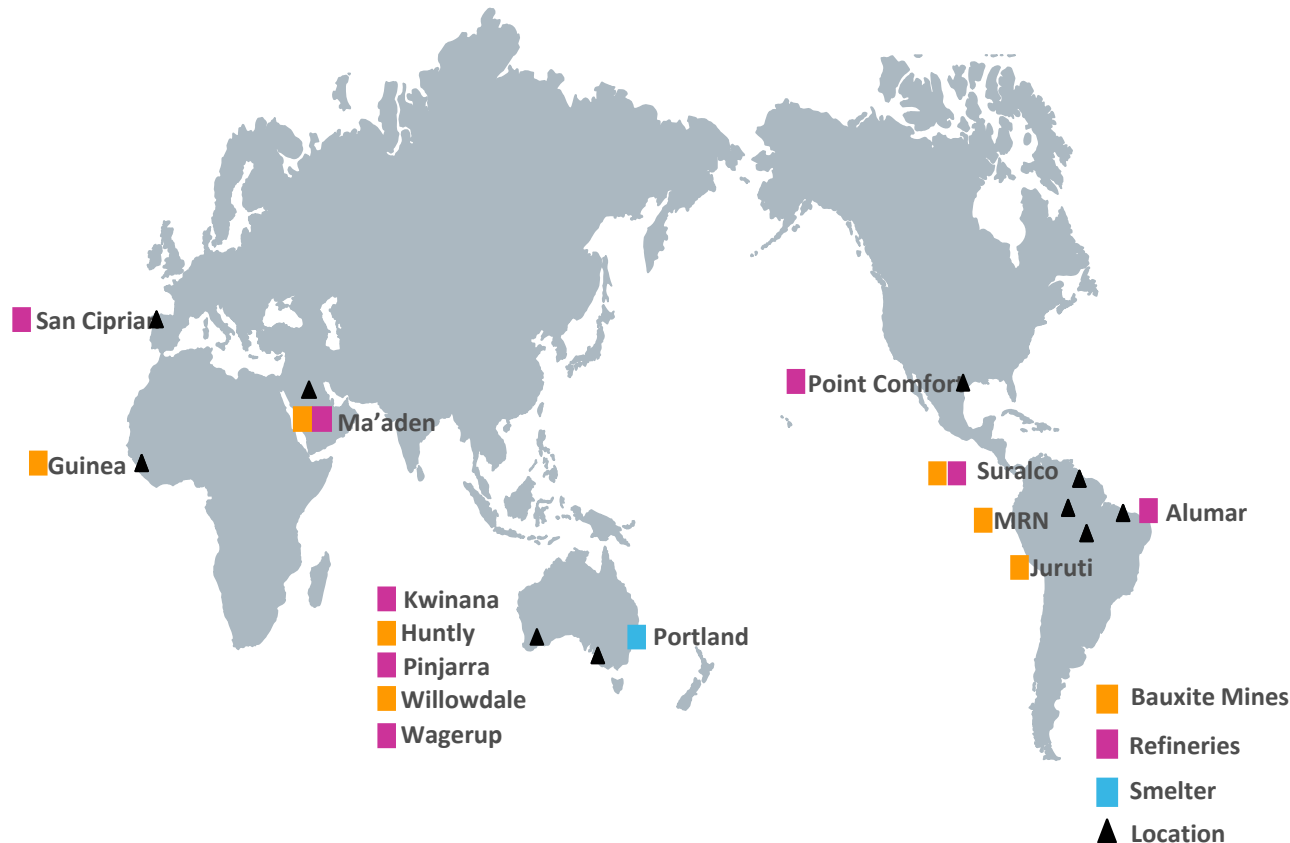
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# AWAC JV: geographically diversified, long-life, tier 1 bauxite mines and alumina refineries

Cash cost of alumina production per tonne<sup>(1)</sup> \$191 (2016 average)



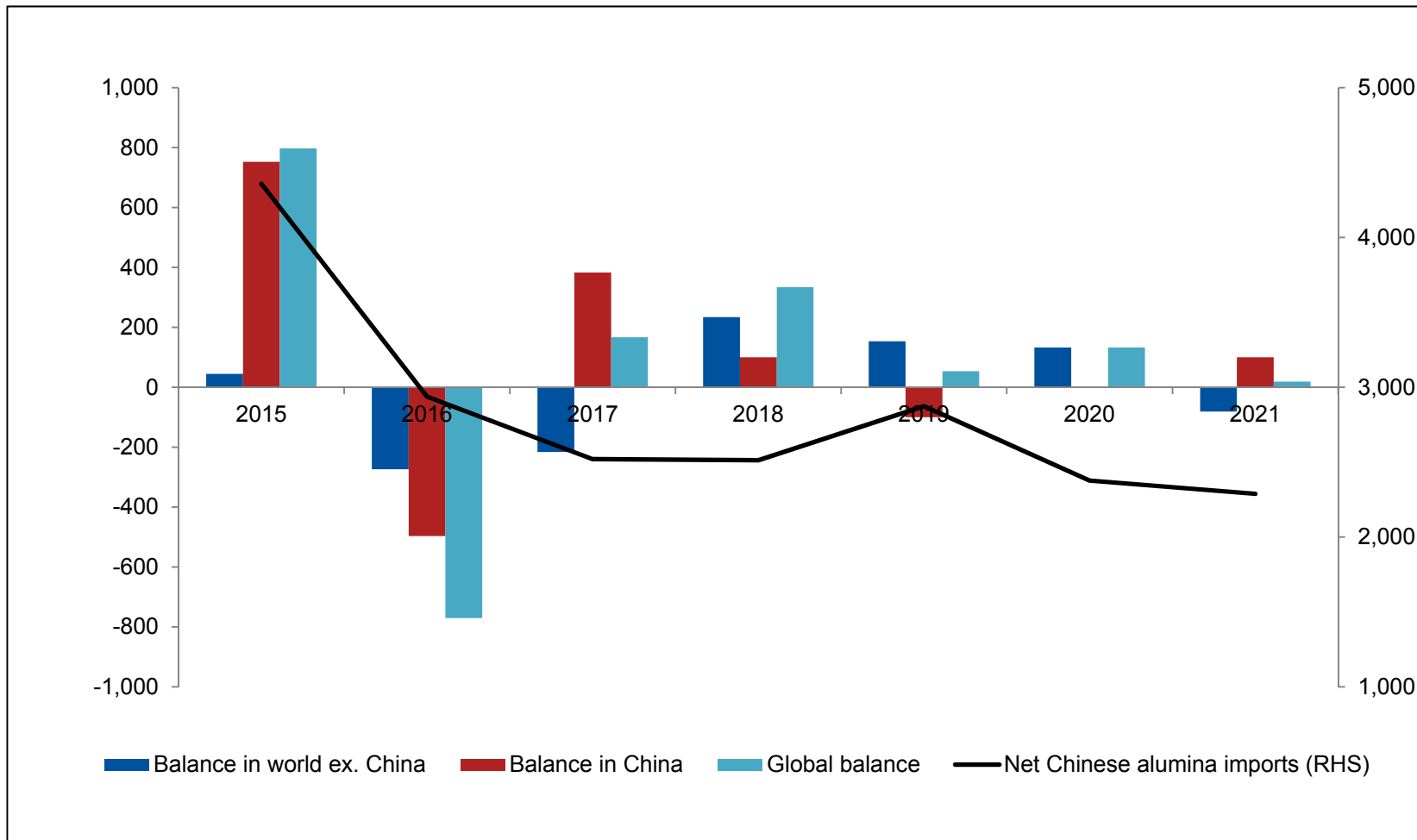
- AWAC 2016 production:
  - **12.6 million t** alumina
  - 163,000 t aluminium
  - **42.7 million t** bauxite (bone dry): 32m t Huntly & Willowdale, 5.2m t Juruti, 5.2m t CBG & MRN
- Ma'aden refinery 2016 output 1.4m t (ramping up)
- Most refineries integrated with mines
- Suriname closed and Point Comfort fully curtailed

(1) Defined as direct materials and labour, energy, indirect materials, indirect expenses, excluding depreciation. Movements can relate to usage, unit costs or combination of both, timing of maintenance, seasonal factors, levels of production and the number of production days and refinery mix. Includes the mining business unit at cost. The Saudi joint venture refinery is not included.

- Alumina medium term supply/demand and cost issues
  - healthy growth in demand forecast
  - matching growth in supply, stronger in China
  - higher bauxite costs for merchant refiners expected
- Strong Chinese Government sustainability focus – cost push
  - air quality improvements; coal to gas; Winter 2017/18 cuts required
  - close scrutiny of red mud dams
  - transport allocations and overloading restriction crackdown
- Transition of alumina pricing to index pricing
  - 40% LME-linked non-Chinese sales to reduce to 30% in 2018
  - Chinese alumina also moving more to fundamentals index basis
  - development of alumina futures market
- Bauxite price reporting – status and challenges
  - wider bauxite price reporting expected in 2017

# Tight alumina market expected from Asian smelting growth and Chinese reforms

**Alumina market balance (LHS), Net Chinese alumina imports (RHS), '000 tonnes**  
(Source: CRU, March 2017)



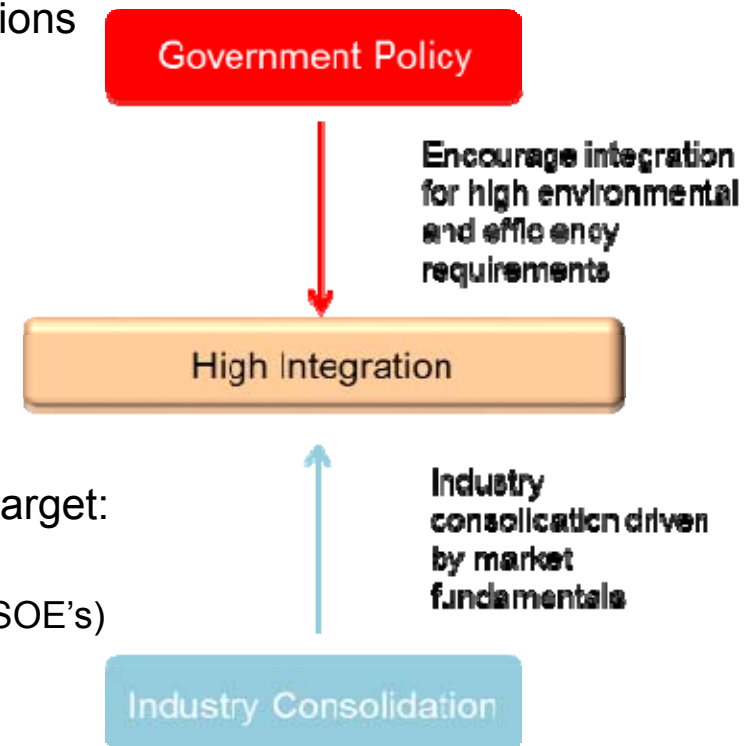
# Modest refining supply growth outside China – only Al Taweelah underway

## Upcoming Alumina Growth Projects

REGION	COUNTRY	COMPANY	LOCATION	2017	2018	2019	2020	TYPE	Comments
	UAE	Emirates Global Aluminum	KIZAD, Al Taweelah		2,000			Greenfield	First phase set to be completed in 2018. A Phase II could double capacity to 4.0 million tpy.
Asia exc China	Indonesia	Hongqiao Well Harvest Winning Alumina	Ketapang, West Kalimantan	1,000				Greenfield	Phase I started operating late 2015. Ramp up to full capacity in 2016. Second 1mt phase was scheduled for 2017 but has not been committed to.
		Inalum/Antam/Chalco	West Kalimantan			1,000	1,000	Greenfield	The refinery is planned to hit the market in 2019-2020.
	Laos	Yunnan Aluminum	Paksong		1,000			Greenfield	The company obtained approval from China's NDRC to build the project in Laos. Yunnan is currently waiting for the green-light from the Laotian government. Timing looks challenging.
China	China	China Various Greenfield	Various	500	7,200	800	0	Greenfield	
	China	China Various brownfield	Various	3,700	0	0	0	Brownfield	
TOTAL WORLD				5,200	10,200	1,800	1,000		
TOTAL CHINA				4,200	7,200	800	0		
TOTAL ROW				1,000	3,000	1,000	1,000		

# Market drivers and Government policy causing more Chinese integration

- Chinese alumina industry prior to 2012: large SOE's and small private companies mainly
- 2012-15: SOE's, private companies grew organically, acquired and consolidated
- 2015 onwards: co-operation between major groups (including SOE and private company deals)
- Further consolidation through mergers, JV's or acquisitions likely:
  - SOE joining private (equity or JV)
  - closure or acquisition of high cost, small refineries
- Industry seeking:
  - backward integration
  - economies of scale, lower opex
  - greater access to limited high quality bauxite allocations
- Government's industry development plan and policies target:
  - safety (transport, red mud)
  - efficiencies (overproduction, less support for loss-making SOE's)
  - environmentally responsible (air, red mud)





# Current Chinese alumina capacity

- Main producers in 2008 have grown significantly

Company	Refining Capacity 2016, mtpa	Refining Capacity 2008, mtpa
1. Chalco	17.7	12.0
2. Xinfu	15.9	4.0
3. Weiqiao	13.0	5.8
4. Jinjiang	8.3	3.0
5. East Hope	3.5	1.6
Total Top 5	58.4	26.4
Total Chinese	76.6	34.2

- More consolidation expected – also some growth by green/brownfields expansions, although net growth may be limited by Government controls on uneconomic overcapacity and environmental issues
- Consolidating refiners seeking greater exposure to alumina fundamentals by more index pricing

# Examples of M&A activity in the Chinese alumina industry

Refinery	Province	Capacity (mtpa)	Former owner	Integrated by	Year of integration
Yima Yixiang	Henan	0.5	Yima Coal	Jinjiang	2013
Wusheng	Shanxi	0.3	Private	Jinjiang	2014
Yangquan	Shanxi	1.1	Yangquan Coal	Xinfa	2015
Lubei	Shandong	1.0	Lubei	Jinjiang	2016

- SOE to SOE: Luneng sold shares in Jinbei (Shanxi) to SPI in 2011 (backward integration by SPI)
- More acquisitions are expected this year, leading to fewer, larger integrated producers in China
- 2017: Hongqiao, CITIC (SOE) agreed MoU for Hongqiao share issue (up to 10% of capitalisation)

JV between SOE and private:

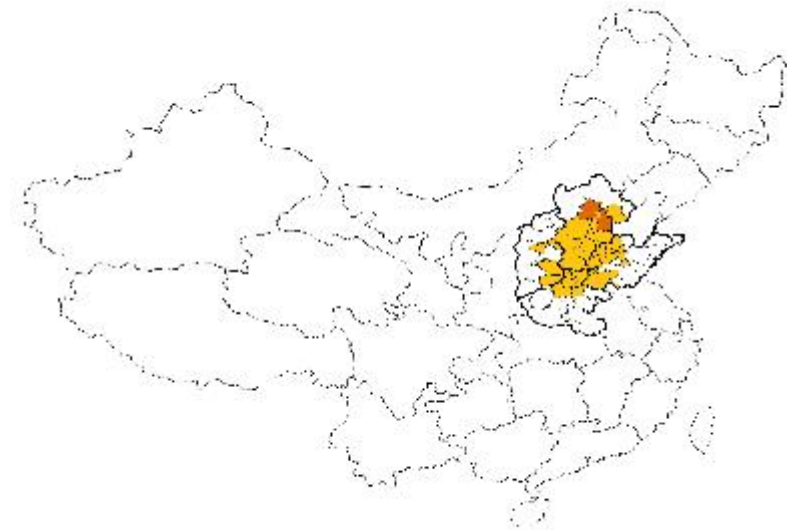


- 2015 Huajin JV refinery built by Chalco and Jinjiang. Main gains sought by new JV:
  - technology, plant management and productivity from Jinjiang leading to lower operating costs
  - access to valuable bauxite allocations from Chalco
- Refinery operating successfully; some company culture differences remain

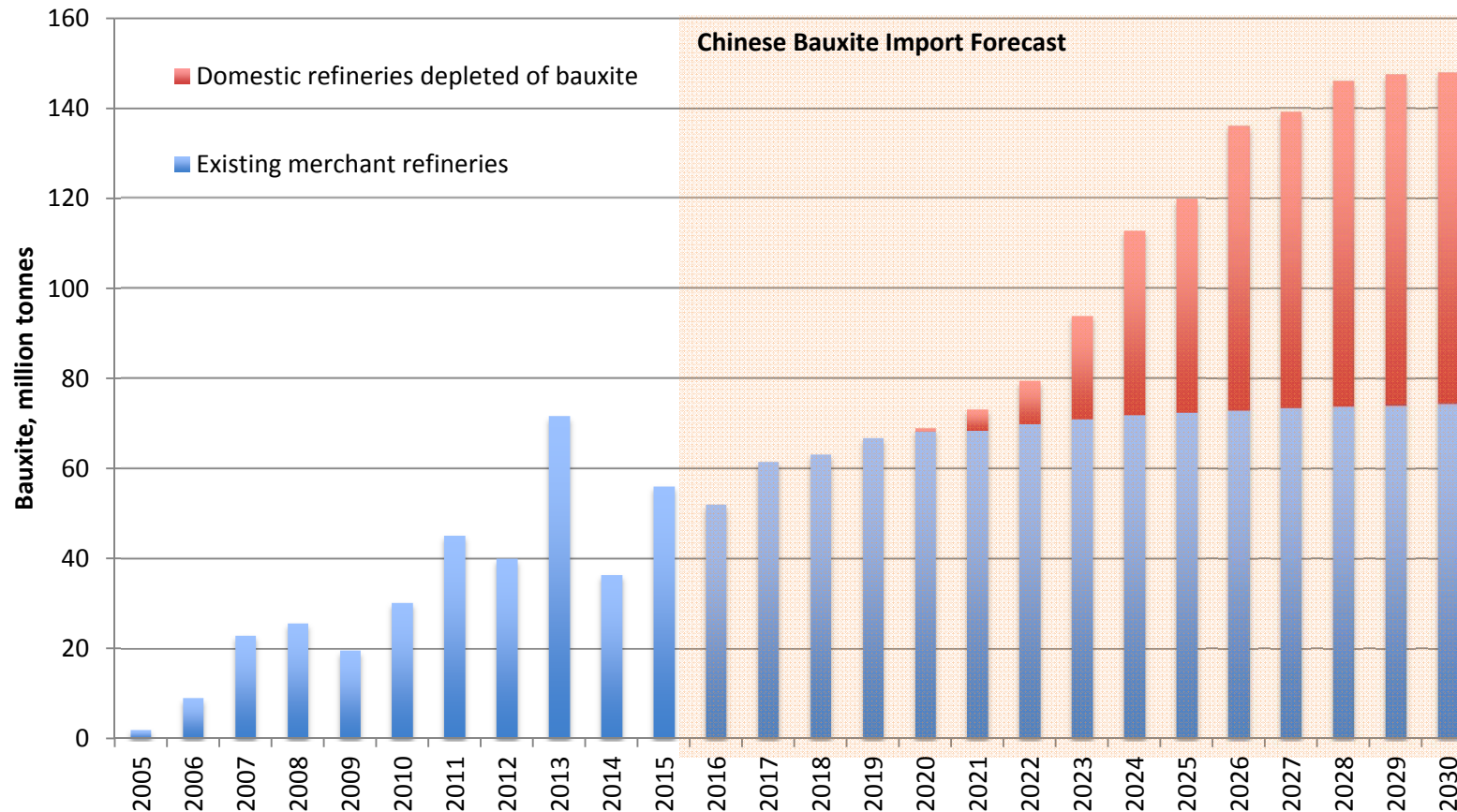
# Chinese air pollution policy

- Draft 2017 Plan of Air Pollution Prevention and Controlling:
  - unofficial but very likely to be implemented
  - impact in Winter 2017/18: heating period city-dependent, may be 4 or 5 months
  - 28 cities covered: Beijing, Tianjin, 8 in Hebei, 4 in Shanxi, 7 in Shandong, 7 in Henan
  - suspend 30% Al capacity (measured by cell numbers), 30% of Aa capacity (measured by output) and 50% of carbon production
  - plan to be co-executed with inspection by the Ministry of Environmental Protection
- Could amount to 2.7 – 3.4 million tonnes of alumina lost in total over the 4-5 month period
- Unclear how cuts may net out al and aa balances
- Limited scope to raise production elsewhere
- Non-operating capacity may count as Winter cuts – could mean more Aa cuts than Al cuts in Henan
- May be uneconomic to restart some capacity post-Winter

## 28 Cities Within Scope of the Plan



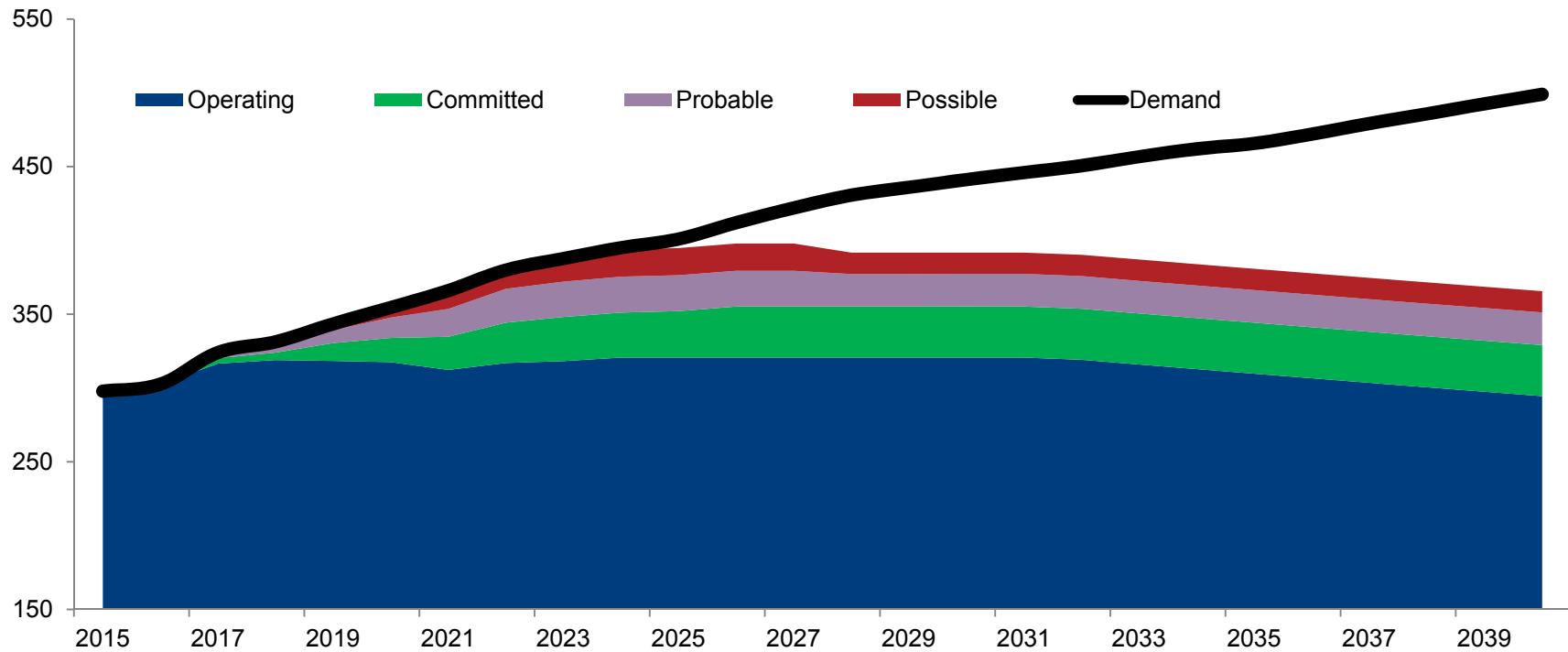
# Chinese bauxite import forecast – from 52m tpa to 120m tpa by 2025



- Declining domestic bauxite quality in key alumina producing provinces
- Bauxite imports forecast to grow by 68m tpa to 120m tpa (by 2025)
- Shanxi, Henan likely to relocate refining largely to coast e.g. Shandong, Liaoning, Guangxi

# Global bauxite supply gap from 2025 – likely supply will be at a higher cost

Global Bauxite Supply and Demand (M tonnes)



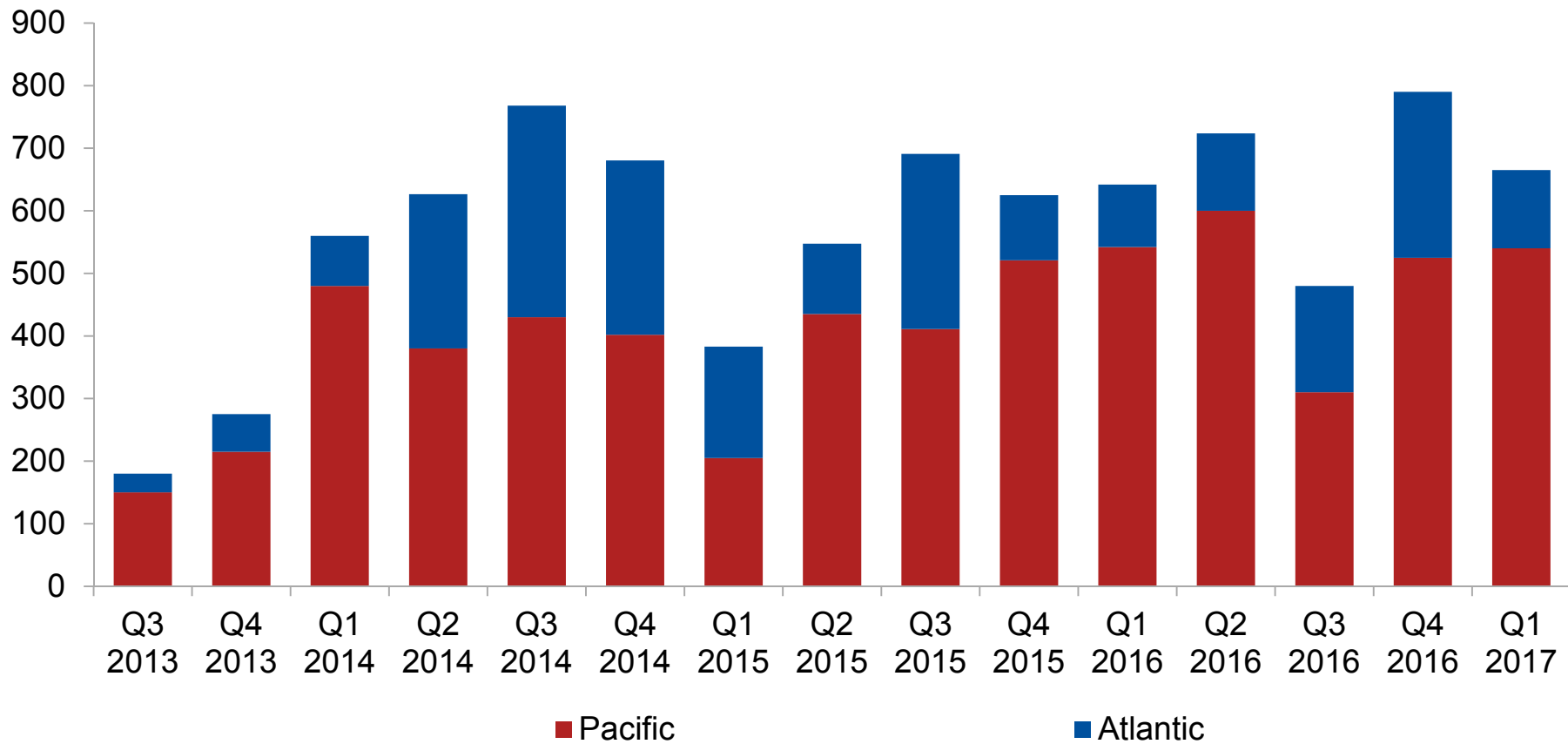
- Existing supply and committed and probable projects can meet demand to around 2020
- From 2020 on, projects in “possible” category required to meet expected needs
- Unknown or speculative projects needed for forecast demand beyond around 2025

# Evolving 3<sup>rd</sup> party alumina pricing to shorter term, market-based indices

- Purpose of index pricing - a published price reflecting the fundamentals of the market of that product, particularly:
  - supply and demand and capital and operating costs
  - aluminium price remains a factor (relevant to demand for alumina and capacity to pay for alumina) but one of a number of factors
- Index pricing should result in a fair price to seller and buyer
- Role of price reporting agencies (PRA's) in gathering and analysing information and publishing a representative index
- Alumina price indices (API) are:
  - daily/weekly price assessment of spot market (typical load 30 days)
  - actual spot sales basis or, absent trades, some on market analysis
  - not designed to measure long term pricing
  - supposed to be repeatable spot prices and exclude outliers

# Improved spot market liquidity in 2016, despite significant refinery curtailments in the Atlantic

Alumina Spot Transactions Reported to CRU, '000 tonnes



- Used in short/medium term contracts with the aim of pricing alumina on the basis of its own fundamentals:
  - usually based on previous month's average prices
  - CRU, Platts and MB WA FOB prices; CRU ABP Atlantic prices
  - usually contract price is fully exposed to index price

## Producers move to index pricing (as publicly announced):

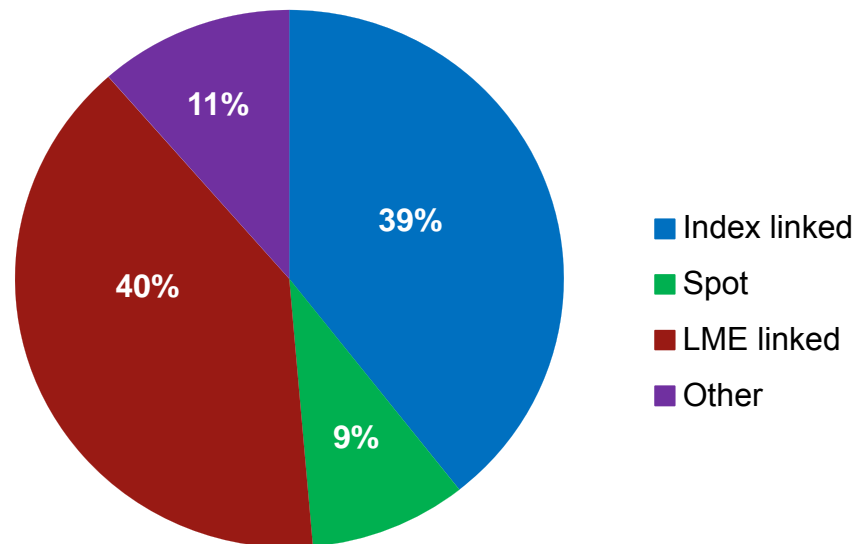
- AWAC:
  - 84% on spot/index in 2016; expected to level out at  $\approx$  94% from 2018
  - Alcoa now buying alumina from AWAC on index price basis
- Hydro:
  - 65% of Hydro's on index in 2017, forecast 85% index in 2020
- South 32:
  - all long-term contracts index-linked pricing, bar one legacy contract



# The evolution of alumina pricing to index pricing

## Index Pricing – Gaining Momentum

Alumina pricing arrangements in 2016 outside China, %



Source: CRU, September 2016

- In 2016, 48% of third party sales on spot or alumina index (up from 34% in 2013)
- 2017 forecast 43% index, 10% spot, 35% LME-linked, 12% other
- 2018 forecast 47% index, 11% spot, 30% LME-linked, 12% other

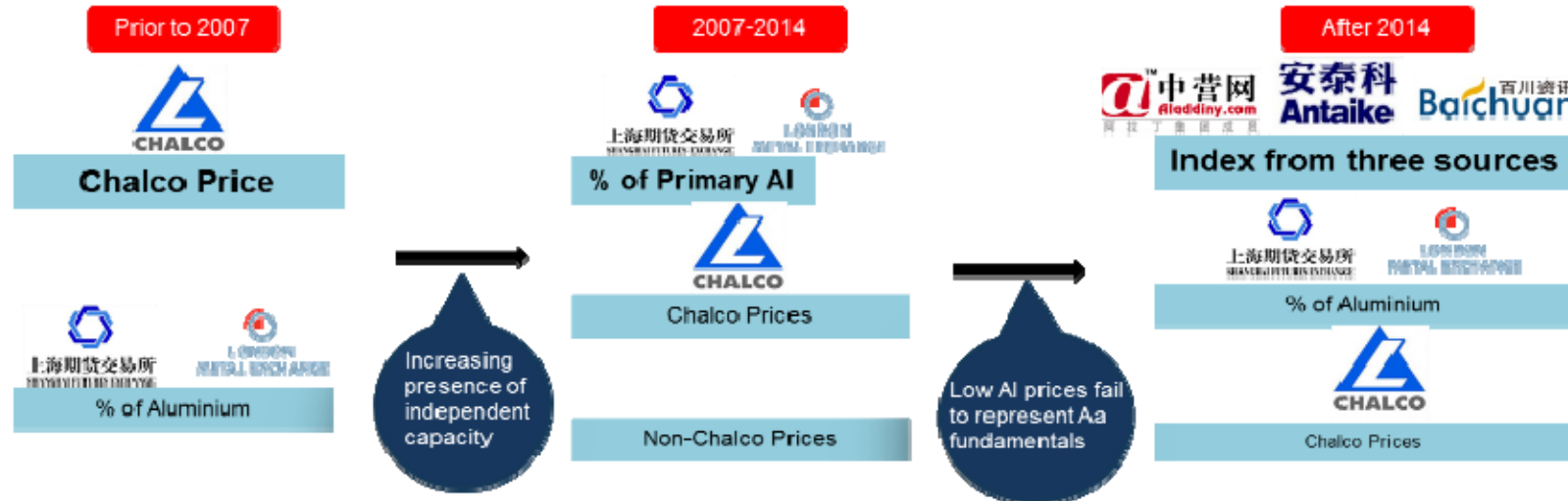
# Alumina futures markets to help manage alumina price risk

- CME alumina futures commenced trading September 2016
- Should enable parties to manage alumina price risk – help smelters to hedge in absence of LME-links
- May eventually lead to more conversions to index pricing
- So far, two agreed trades for modest volumes, being Alumina FOB Australia (Platts) Futures:
  - 60 lots (25/10/16 at \$275/t, when spot \$287, for Jan-June 2017) and
  - 100 lots (17/3/17 at \$315/t, when spot \$334, for Jul/Aug 2017)
- Development of market seems in line with CME's expectations:
  - takes times for clients to be educated and get comfortable trading
  - volatility in alumina prices towards end of 2016

e.g. Alumina FOB Australia Futures (S&P Global Platts) (100 MT) (28 April, spot at \$289):

<b>Period</b>	<b>Bid/Offer</b>	<b>Size</b>
<b>2H'17</b>	<b>\$285/-</b>	<b>(25/mo)</b>

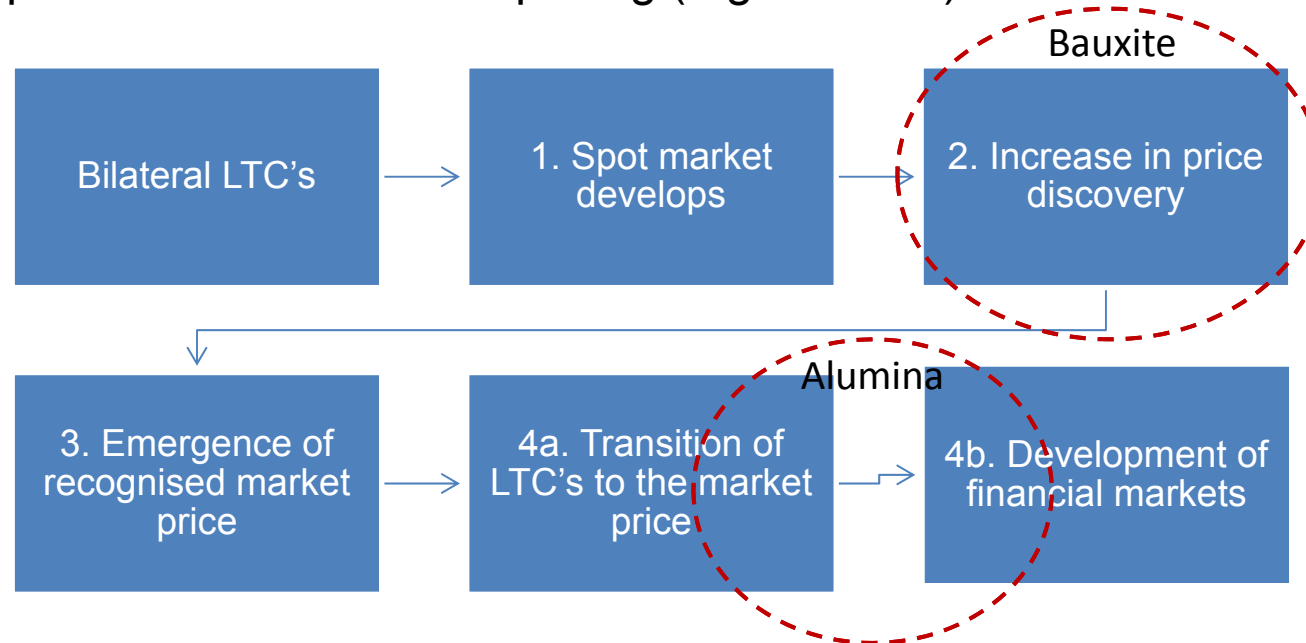
# Chinese alumina pricing also moving through aluminium link to alumina market-driven pricing



- Prior to 2007 Chalco was the key alumina price reference
- 2007-2014 a mix emerged of Chalco prices, links to primary AI prices and non-Chalco prices
- From around 2014 on, partly due to the refiners' consolidation, alumina index pricing has emerged, reducing importance of Chinese aluminium price link

# Common evolution path for long term contracts (LTC's) for commodities

- Standard path followed to market pricing (e.g. iron ore)



- Alumina near the end of the path
- Bauxite starting down path, needing:
  - more trades captured
  - more detail and accurate data provided to PRA's: price/quality/freight
  - PRA's to establish and publicise robust and transparent methodology to normalise different types and quality of bauxite

- Current bauxite “value-in-use” reporting:
  - CRU (BPI-G) and CM (CBIX) calculate and publish (weekly) weighted average, gibbsitic, VIU normalised bauxite price China CFR basis (normalised to 50% available (CM: 50% total) alumina, 5% reactive silica, dry tonnes, 30 day trailing average)
  - these prices include both spot and term contract (legacy) pricing so do not represent a pure “spot” market assessment
  - CM has online model for subscribers to calculate theoretical price for different bauxites by varying alumina, silica and moisture content
- Numerous parties publish:
  - FOB prices/ranges, key freight rates usually without data on quality
- Chinese Customs: volume, CIF (sometimes CFR or FOB), source country, Chinese port
- Proposed reporting by a number of price reporters:
  - regional bauxite indices: West Africa, Malaysia, North Australia, Amazon

## Bauxite indices: potential issues in use as term contract price-setter

- Published VIU and regional prices mix both spot and term contract prices (unlike alumina indices which are only spot)
- Unlike refining, which has high capital barriers to entry, bauxite mining has low barriers to entry e.g.:
  - Asian low cost small mines agglomerated into large shipments, with quite different bauxite fundamentals from new mines like Amrun
- Volume of spot sales is currently low
- More participants should provide data about more trades, more accurately and with more quality and freight data

## Bauxite indices: potential issues in use as term contract price-setter (cont'd)

- Price reporting agencies may consider whether to:
  - develop and publicise value-in-use normalisation models, so methodology of value-in-use prices is robust and transparent
  - publicise how they adjust for mineralogy, organics, content, temperatures
  - publish regional standard indices (underway) and methodology
  - convert the current value-in-use assessments to a “spot only” assessment (and exclude prices agreed more than say 6 months previously, where known)
  - consider developing a separate index for term contract supply from large mines
    - e.g. previous iron ore contract price assessments: say, quarterly/6 monthly/yearly assessments of large volume contract prices as an interim development
  - consider two bauxite indices – one for a standard low temperature digestion and one for a standard high temperature digestion
  - exclude some bauxite from consideration for the index beyond a certain specification range

- Alumina medium term supply/demand and cost issues
  - healthy world demand growth and balanced supply/demand outlook
  - cost push in medium term China, due to higher imported bauxite costs and Government environmental measures
- Transition of alumina pricing to index pricing
  - LME-linked pricing to reduce to 30% outside China in 2018
  - Cost push on Chinese alumina more likely to be reflected in price due to higher use of Chinese index pricing
  - alumina futures market developing to allow price risk management
- Bauxite price reporting potential improvements
  - wider and more accurate reporting of data by participants to PRA's
  - PRA's to increase price reporting by standard regions/bauxite types and publish value-in-use methodology
  - PRA's to separate reporting spot versus legacy or longer term prices



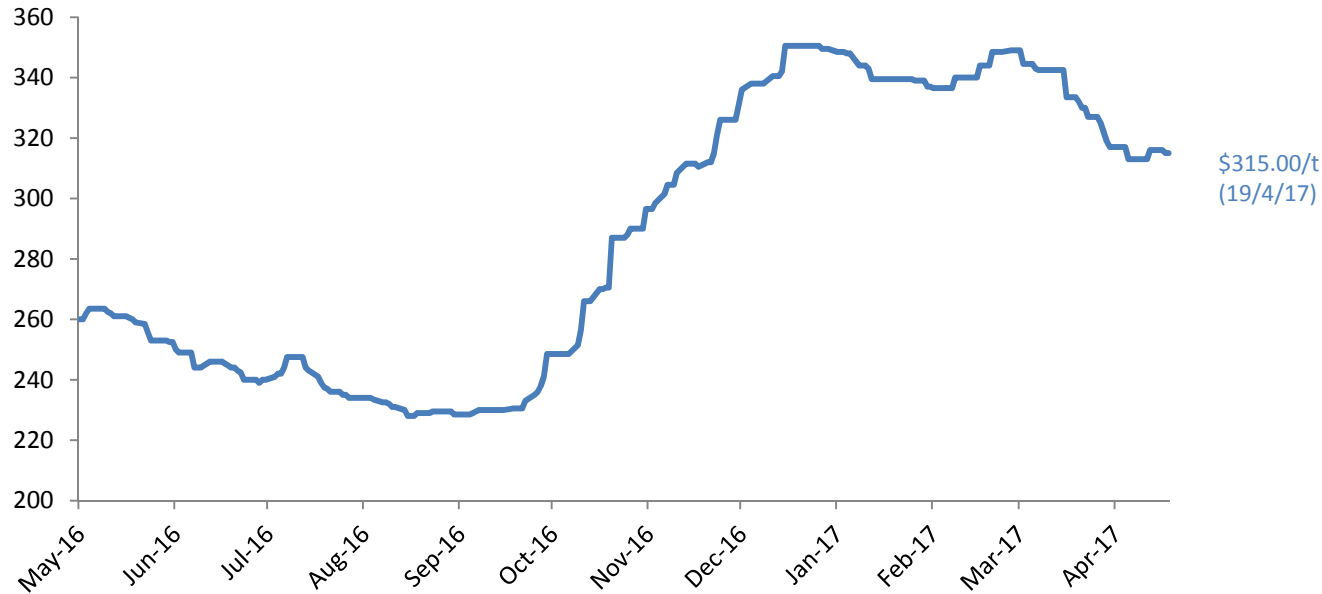


**Appendices**

The background image is an aerial photograph of an alumina processing plant. On the left, a long train of dark-colored railcars is parked on tracks. To the right, a series of long, parallel conveyor belts or drying beds are filled with a reddish-brown material, likely bauxite residue or alumina. The ground is dry and dusty, and there are some industrial structures and pipes visible in the distance.

# Platts Australian API last 12 months, reflecting alumina fundamentals

## ■ PAX FOB Australia prices (US\$/t, nominal)



### June-Aug 2016

- Low metal prices slow smelting ramps and restarts
- 4m tpa of curtailed alumina capacity restarted, overshot demand
- Aluminium price slide, cheap bauxite, lower Chinese alumina cost

### Sept-Dec 2016

- Chinese smelter ramps catch up, alumina balance tightens, China's alumina prices soar
- Sherwin refinery shuts, Atlantic tight supply
- Coal and caustic costs up
- Coal use, red mud, transport regulatory issues in China restrict supply
- Chinese seasonal stocking

### Jan 2017

- China pauses restocking as LNY holiday approaches

### Feb-Mar 2017

- High global smelting rates, healthy alumina consumption
- Short covering, restocking by India, Mideast smelters, western traders
- Australian market at par/\$4/t discount with China
- Freight rates rise
- Coal, caustic soda prices rise

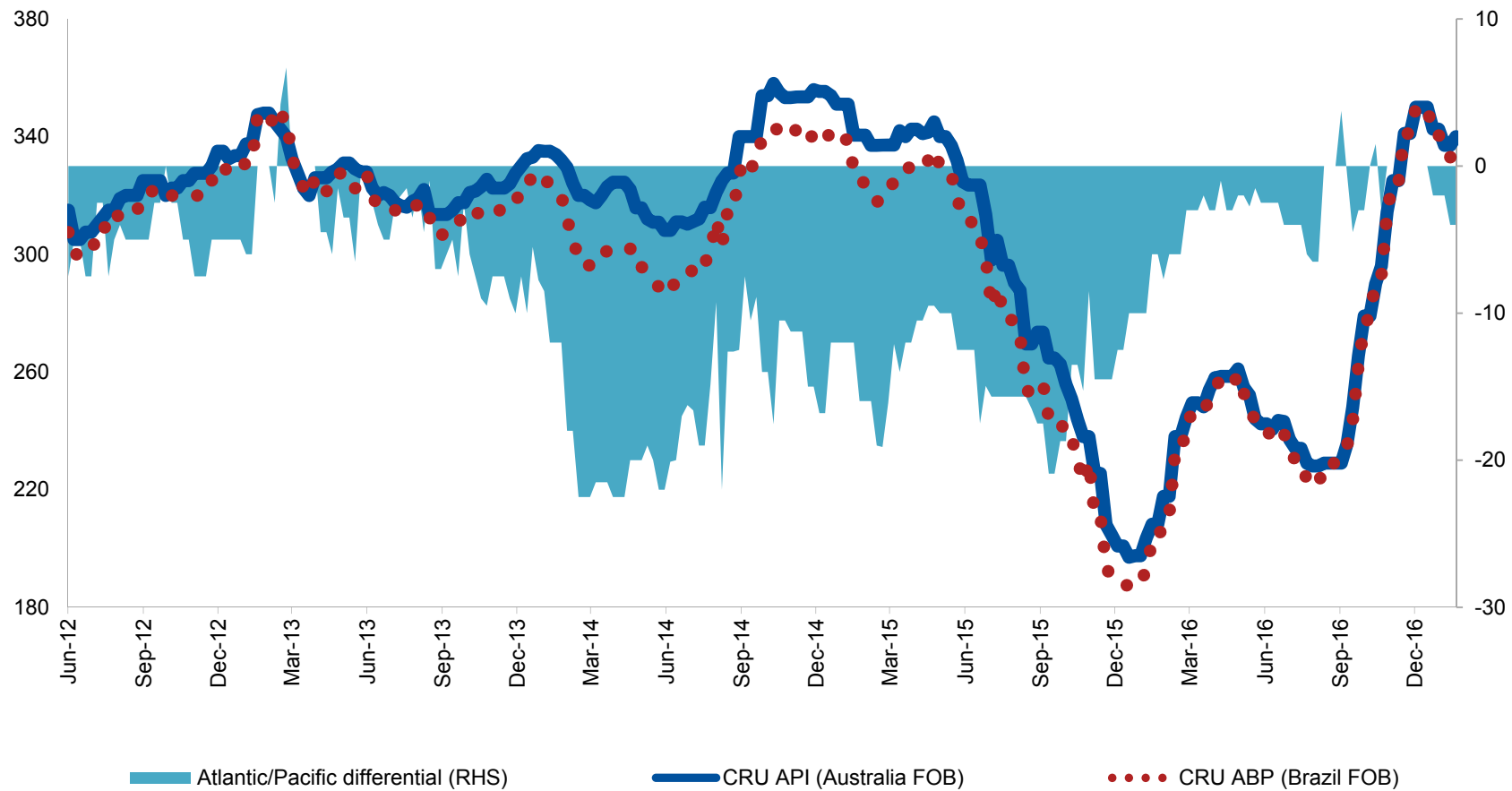
### Mar-April 2017

- Longs in China, Vietnam, Indonesia, Brazil
- SE Asian bagged tonnes discounted to China by at least \$3-5/t
- China domestic prices fall, Australian premium swells from ~\$20/t to ~\$40/t
- China suspends spot imports for nearly 3 months, ample cheaper dom supply
- China produces aa, al at high rates
- Aust market supported by India, Mideast demand
- Beijing announces plans for Winter cuts
- Coal, caustic soda prices rise

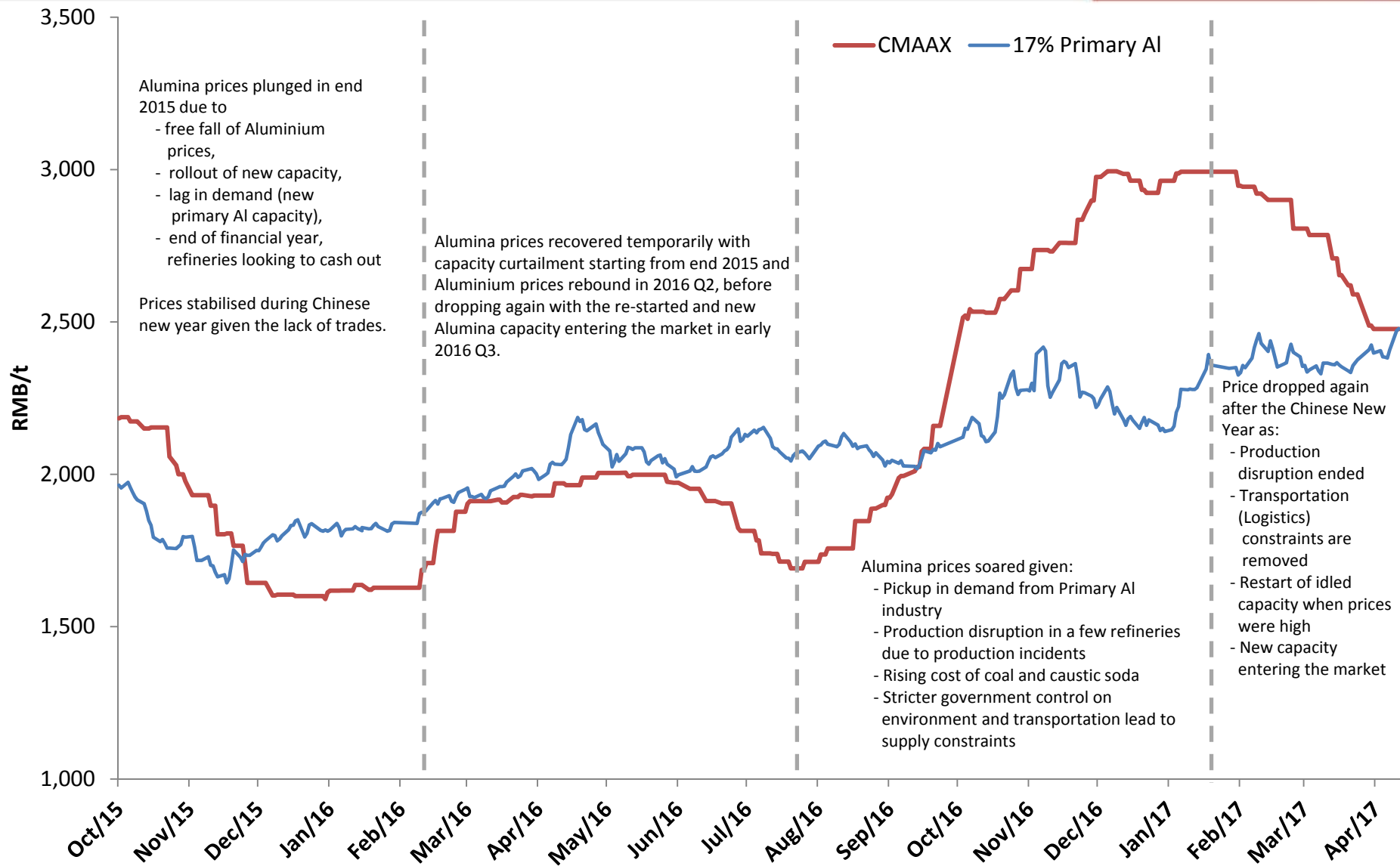
Source: Platts, PAX WA FOB, April 2017

# CRU's index prices over longer period, also respond to market fundamentals

### CRU Alumina Price Index, \$/t FOB



# Chinese domestic alumina price move with China's alumina fundamentals



Source: CMAAX, CM Group, March 2017