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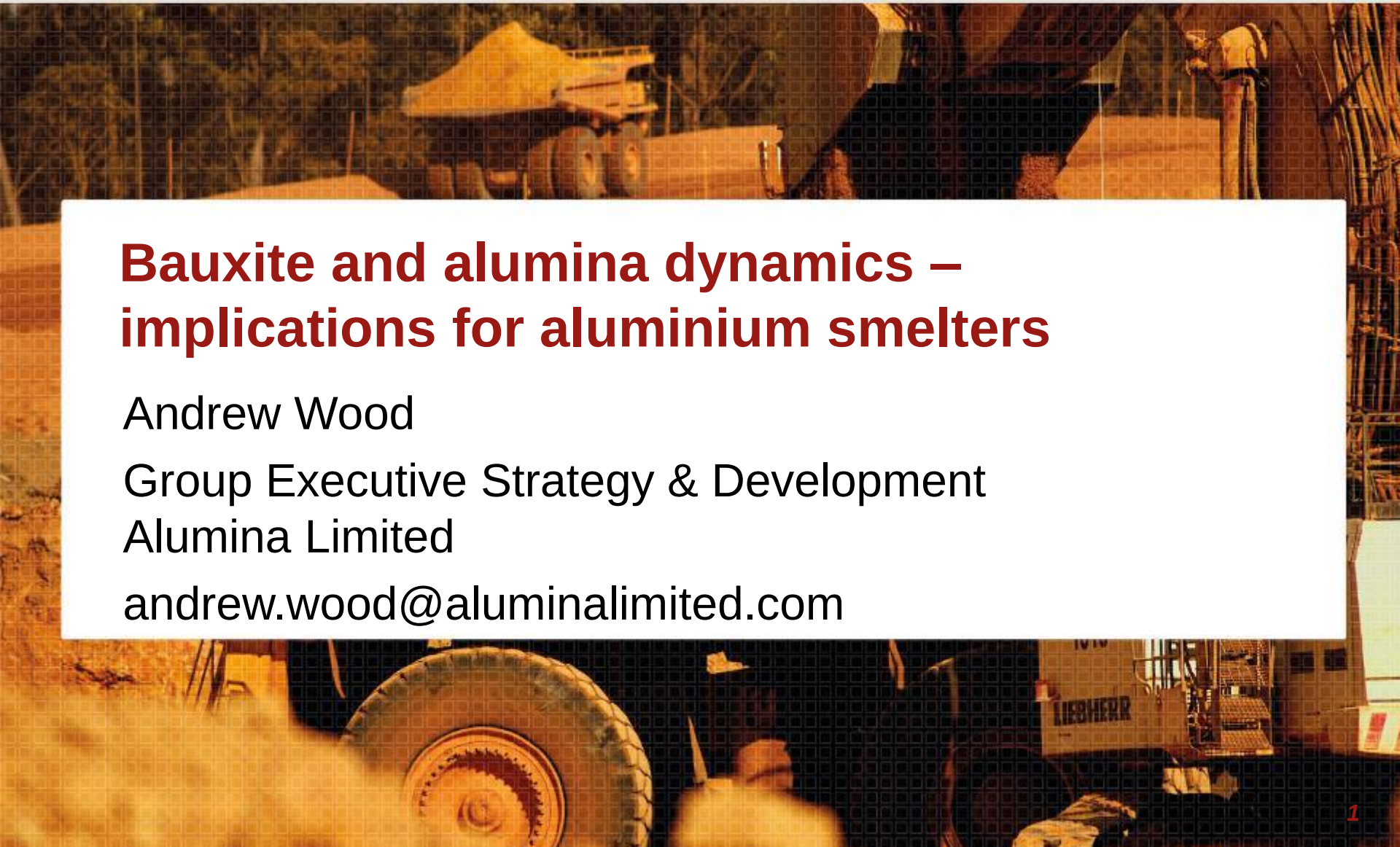

Bauxite and alumina dynamics – implications for aluminium smelters

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Medium term bauxite and alumina dynamics – implications for smelters

- Costs of bauxite (not integrated with refineries) to increase
  - Chinese bauxite imports forecast to grow sharply from 2020
  - More large-scale greenfields mines with reliable supply needed
  - Base supply from Pacific, likely at higher cost, given social pressures
  - Guinea likely marginal supplier to China, given deposits and grades
  - Atlantic bauxite freight rate exposure; foreign exchange impacts
- Alumina production to shift
  - Main growth forecast Asia, Middle East, closer to smelting growth
  - Chinese may spend more on capital costs seeking to lower opex
  - Further shutdowns and little growth expected in Atlantic
- Alumina pricing based more on its own fundamentals
  - Continuing change outside China to alumina spot-based indices
  - Emergence of alumina futures contracts may accelerate change
  - Regional bauxite indices for different standards are likely to emerge

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

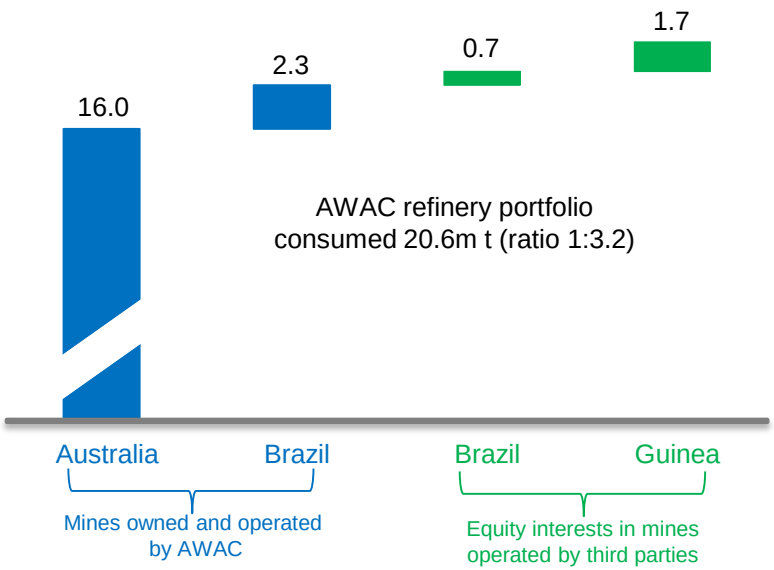
Cash cost of alumina production per tonne[(1)] $193/t (H1 2016)

- AWAC 2015 production:
  - **15.1 million** t alumina
  - 163,000 t aluminium
- Most refineries integrated with mines
- Suriname and Point Comfort now fully curtailed – average cash cost over H1 2016 without them was **$184/t**
- **Saudi** refinery expected to produce 1.5m t in 2016

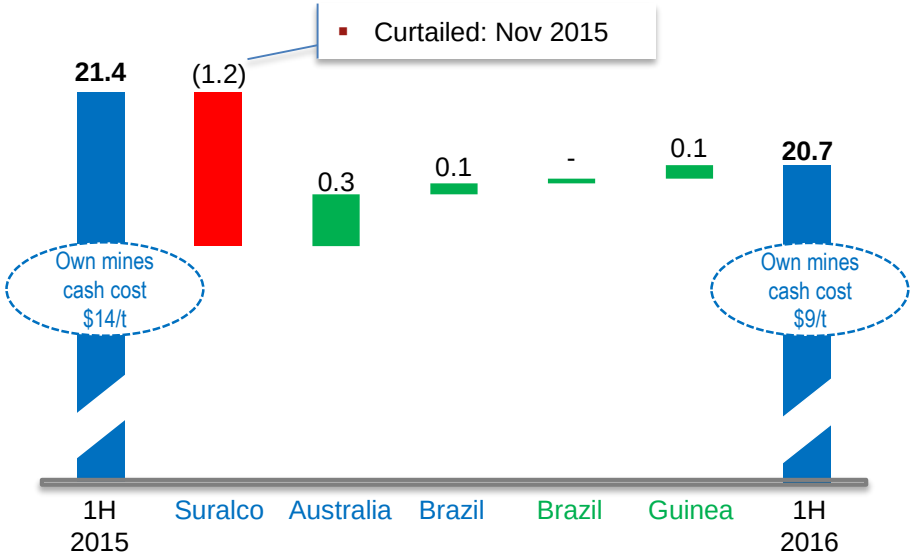
(1) *Defined as direct materials and labour, energy, indirect materials, indirect expenses, excluding depreciation. Movements can relate to usage, unit costs or combination of both, timing of maintenance, seasonal factors, levels of production and the number of production days and refinery mix. Includes the mining business unit at cost.*

2015 bauxite production of 43 million dry tonnes

1H16 production: 20.7m t



Change by region: 0.7m t decrease



Third Party Sales	1H2016	2H2016	2016
Equity Interests	2.5m t	2.6m t	5.1m t
Owned Mines	0.4m t	0.8m t	1.2m t
EBITDA Margin[1]	$7.8/t		

[1] Does not include margin earned in equity interest

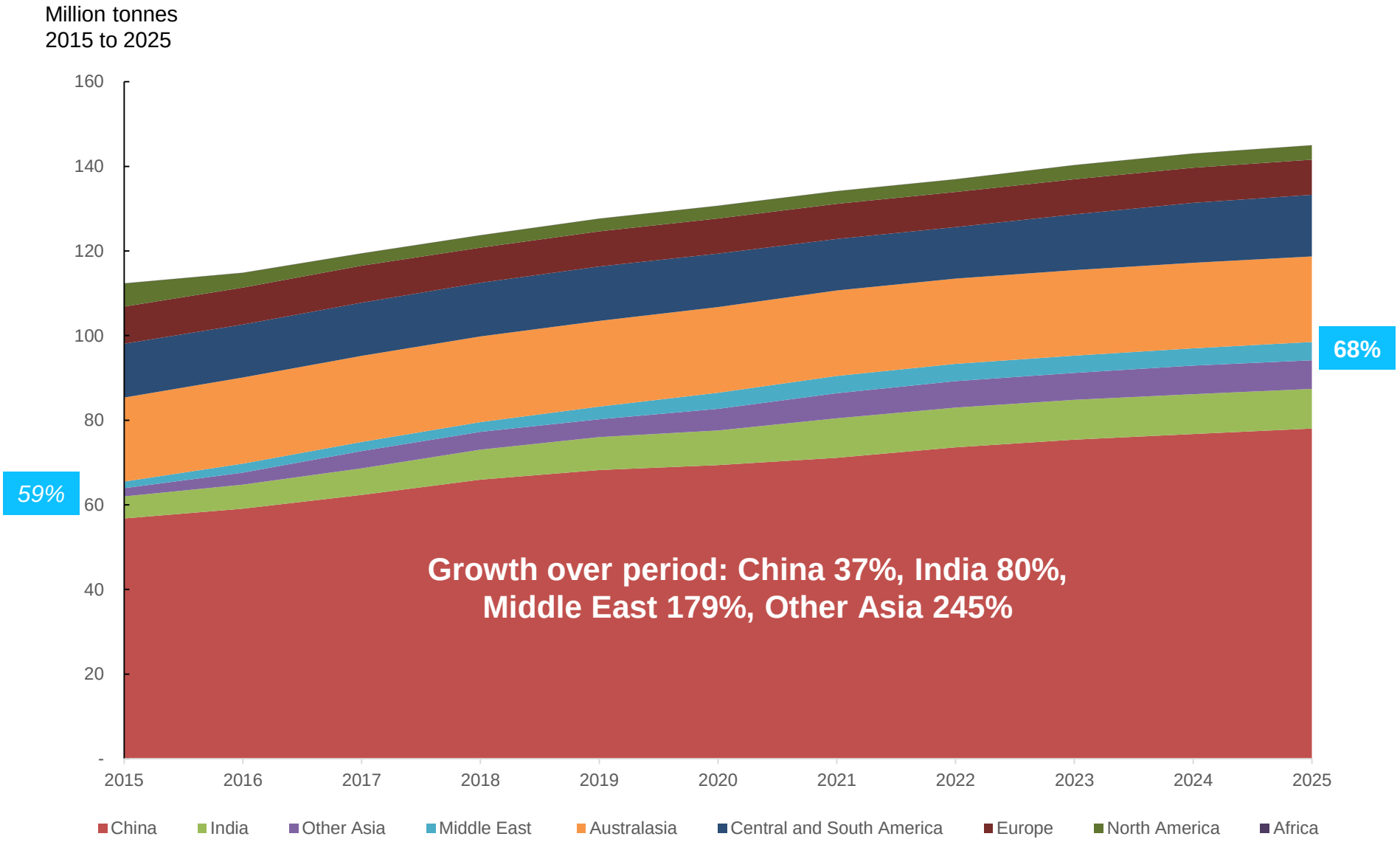
<u>AWAC 2015 production (including equity interests):</u>

43 million (bone dry) t bauxite

New bauxite business – supply to customers in China, Europe and Brazil (around **6.3 million** t in 2016)

Note: Tonnes are reported on a zero moisture basis, "bone dry". Mines in which AWAC has an equity interest are included if they supply refineries operated by AWAC.

Alumina centre of gravity moves Eastward



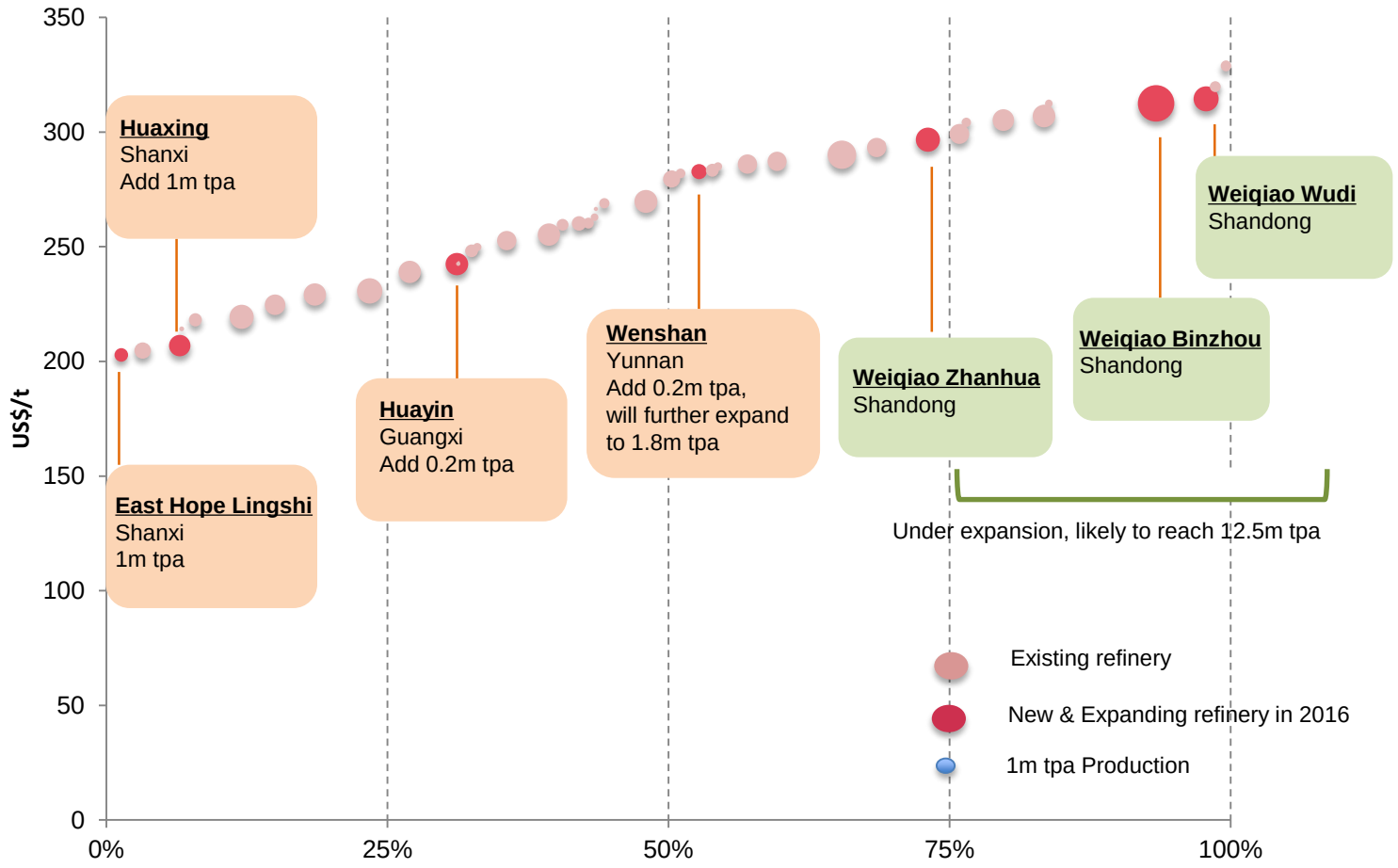
Source: CRU, July 2016

China near balance as 4m tpa of the 7m tpa curtailed alumina capacity has resumed

Province	Curtailed Capacity (ktpa)	Comment	New Capacity in 2H 2016
Henan	300	Curtailed capacity typically older, higher cost refineries. Unlikely to be restarted without a price increase above RMB2,000/t. Jinjiang's 400ktpa (Kaiman) refinery, Wanji's new 600ktpa and Yixiang's 100ktpa have all resumed production since the price recovery in Q1 2016	
Shanxi	900	Capacity curtailed is mostly Chalco Shanxi, given the new strategy of Chalco to divest high-cost assets. Capacity is unlikely to be restarted in the short term. Chalco Shanxi eliminated two obsolete Bayer Processing lines and is conducting technology improvement work on the remainder	Xinhua (Chalco Jiaokou) additional 550 ktpa
Shandong	1,800	1,200 ktpa from Xinfa is unlikely to restart, given it is one of the highest cost, non-integrated refineries in China. Weiqiao's announced capacity cut is yet to be implemented	Weiqiao forecast to reach 12.5 million tpa (up from 11.5 million tpa)
Chongqing	200	Bosai's 200ktpa capacity, based on high-cost imported bauxite, is unlikely to restart	
Guizhou	0	Curtailed capacity in Guizhou driven by limited access to higher bauxite grades in the short term. As more high grade bauxite becomes available, as well as the recovery of alumina prices, all curtailed capacity has restarted	
Total	**3,200**		

Source: CM Group, August 2016

Chinese refineries' alumina cash cost curve, increasing capacity in all Chinese quartiles

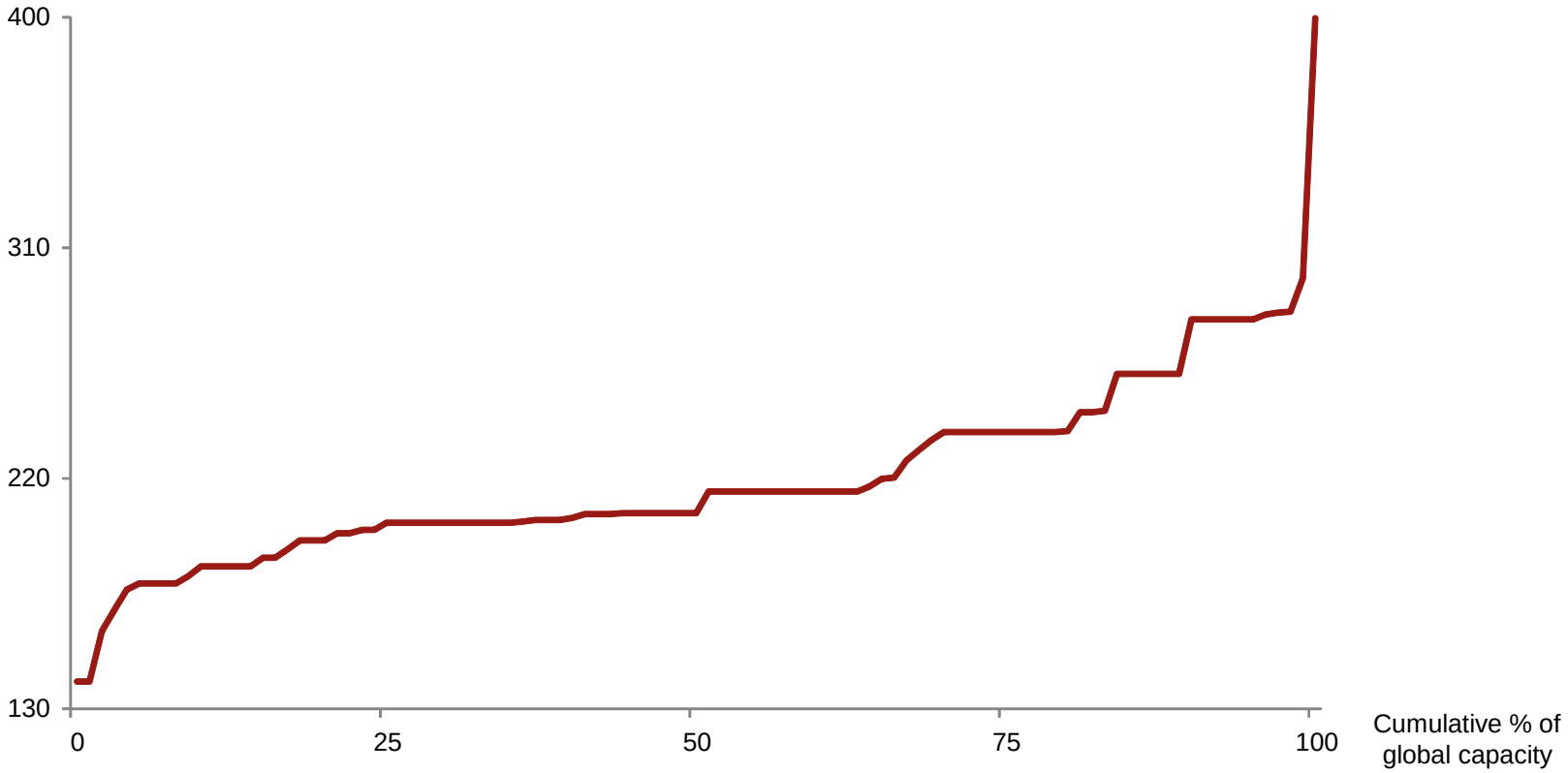


- Huayin (Guangxi) and Wenshan (Yunnan) refineries improved production efficiency during 1H 2016
- Weiqiao continues to build refining capacity, with three refineries at the high end of the cost curve
- After three years of suspension, East Hope Lingshi refinery has finally become operational and at the bottom of the Chinese cost curve. Huaxing (Chalco) has expanded to 2m tpa
- Both new projects in Shanxi are taking advantage of self-owned, high grade bauxite reserves

Source: CM Group, July 2016

Flatter world cost curve due to low cost energy and bauxite and currency

Global Metallurgical Alumina Industry Cash Cost* Curve by Company
(2Q 2016, $/tonne)

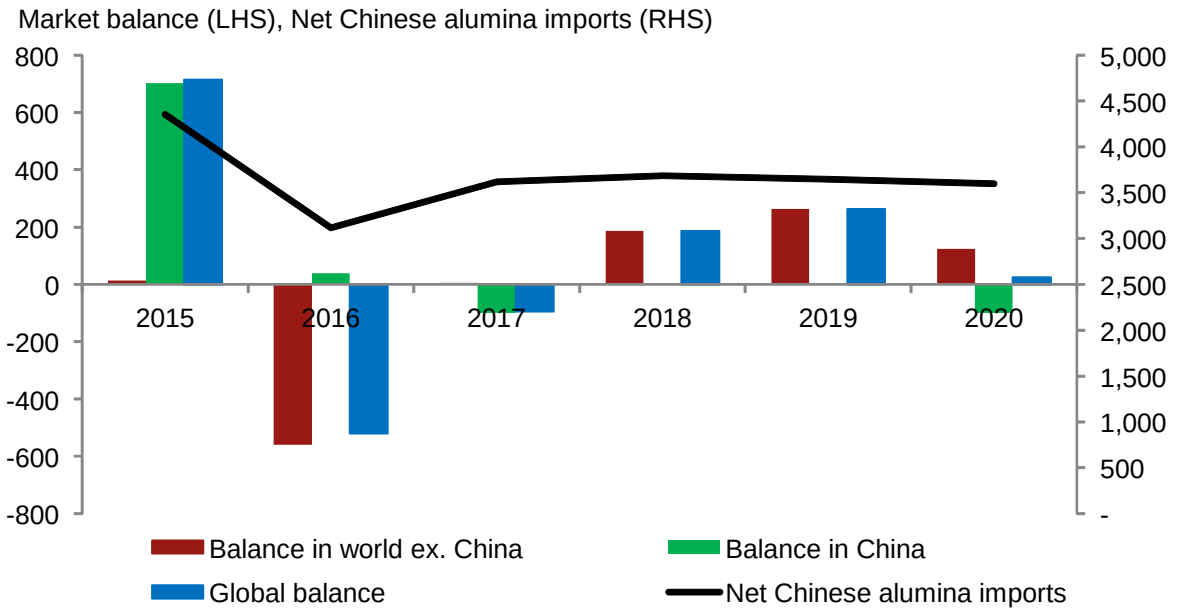


* *Does not include depreciation, interest payments, sustained capital expenses or working capital; excludes applicable VAT of 17% that Chinese Aluminium smelters pay on raw materials, energy and services*

Source: HARBOR Aluminium, August 2016

Alumina forecast shortfall nearing balance with recent curtailments and re-starts

Global alumina supply/demand balance 2015-2020 ('000 tonnes)



Source: CRU, August 2016

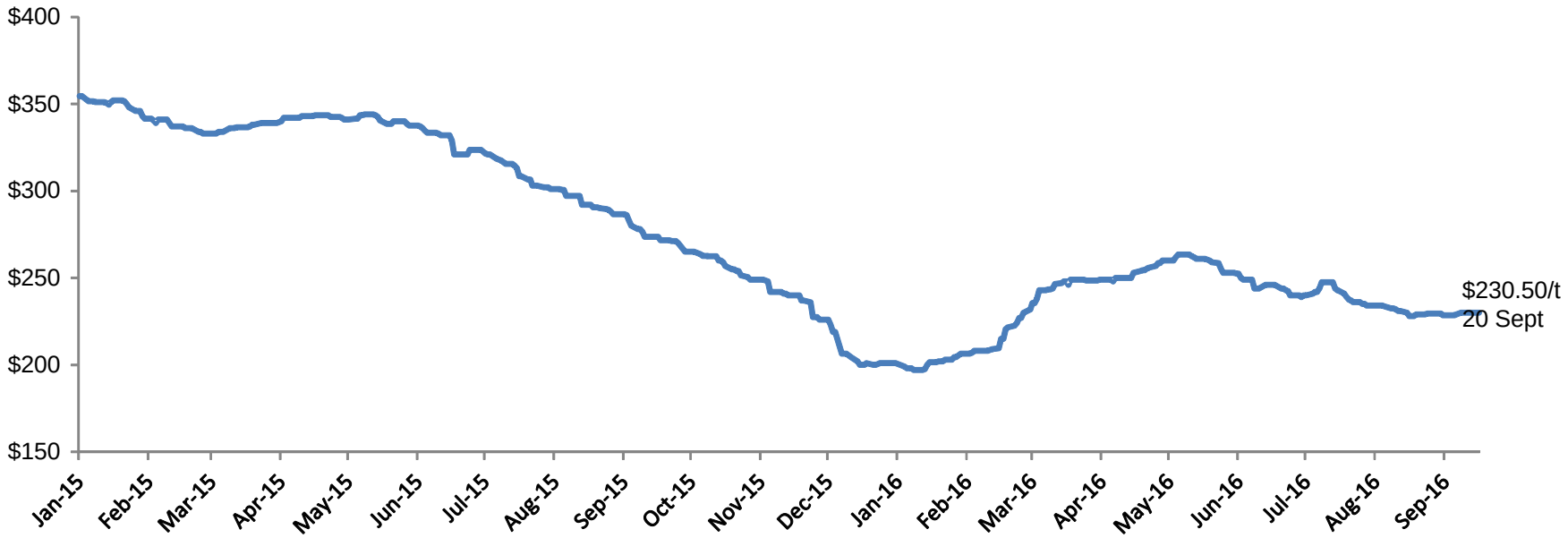
Risks for a tighter market

- High cost refiners curtailing production or abandoning industry amid negative economics
- Alumina project delays/cancellations in Indonesia, Guinea amid low prices, tough financing conditions
- Reducing USA alumina production: Point Comfort curtailing fully, Sherwin expected to close, Gramercy Chapter 11

Risks for well supplied market

- Slower demand growth amid smelting curtailments
- Chinese refiners resuming more of curtailed production if price rises

Spot-based alumina price indices reflect fundamentals of alumina



May 2016

- China ramped up 6-7m tpa of refining capacity (out of 8-9m tpa idled in Feb) and 0.5-1m tpa of smelting capacity (out of 4-5m tpa idled in Feb) in response to stronger margins

June 2016

- Low metal prices slows smelting ramps and restarts
- 4m t of curtailed alumina capacity restarted, overshot demand

July 2016

- Higher metals prices led to increased alumina orders, mini peak $248/t
- Aluminium price slide, Chinese alumina oversupply, lower Chinese cost

Aug 2016

- Oversupply in RoW and China. Weaker Yuan since June deterred Chinese imports
- Smelter ramps and sentiment up on Sherwin and environmental issues

Sept 2016

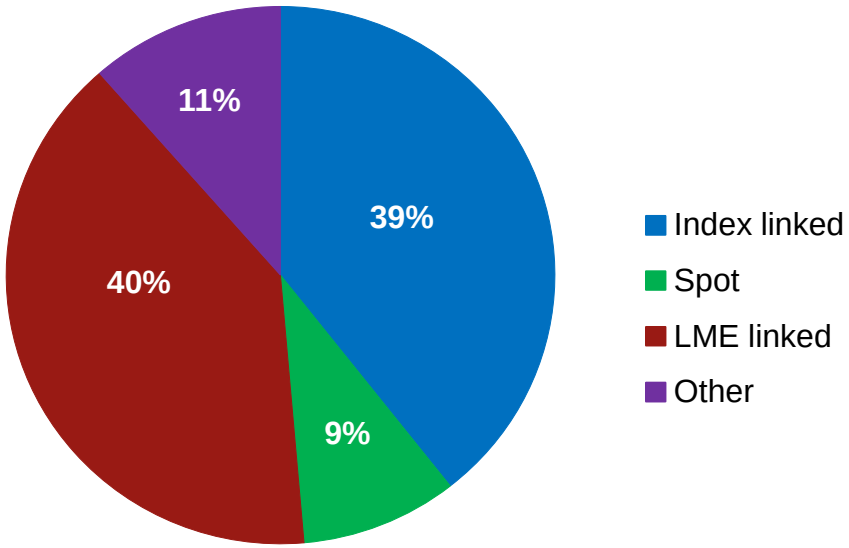
- Australian market supported by increases in China's domestic alumina prices and smelting growth rates (China returned estimated 1m tpa of idled smelting capacity, expect 1.6-1.8m tpa returned by year end)
- By 2017, China expected return of 8m tpa of refining capacity and addition of 4-5m tpa of new refining capacity

Source: Platts, PAX WA FOB, September 2016

The evolution of alumina pricing

Index Pricing – Gaining Momentum

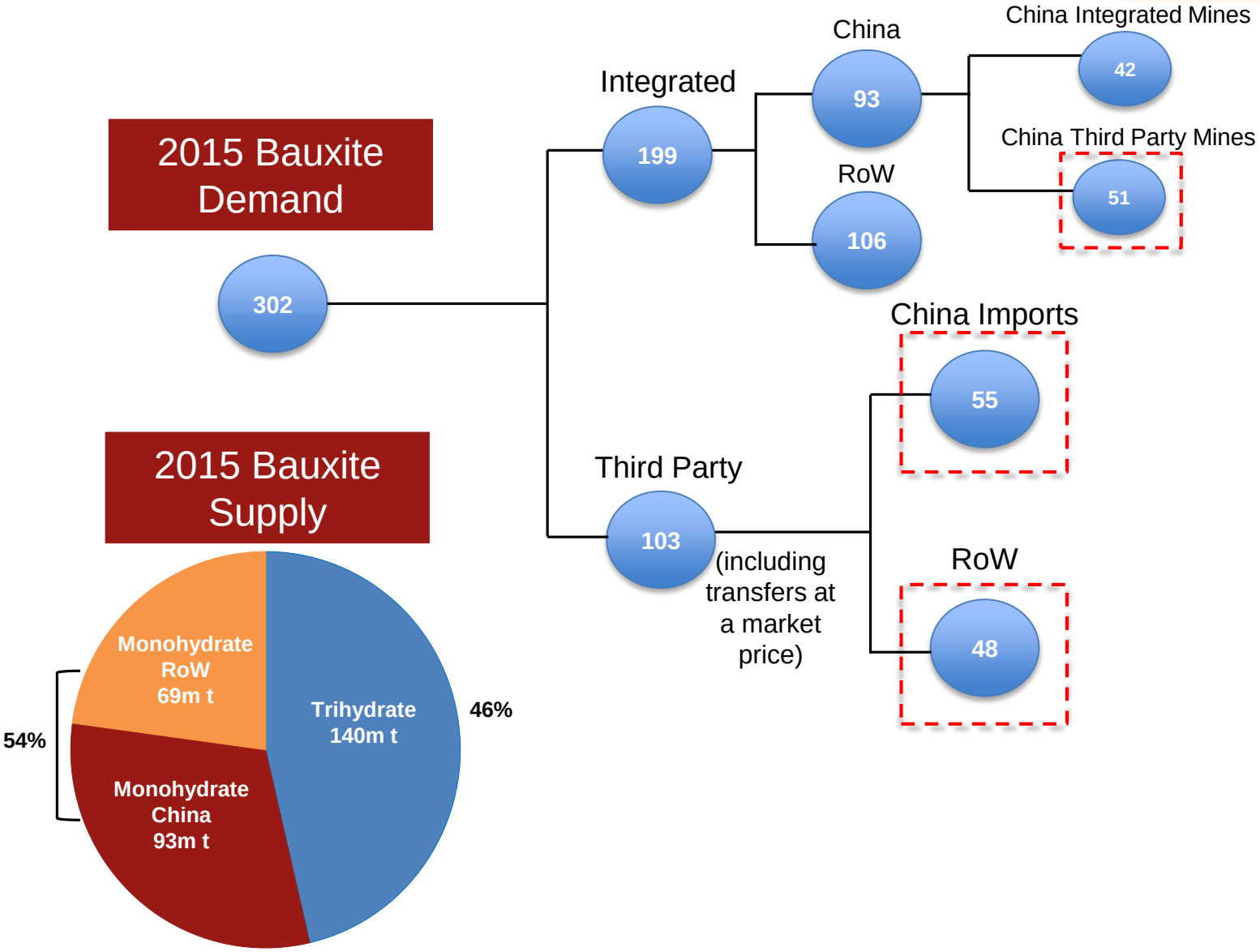
Alumina pricing arrangements in 2016 outside China, %



Source: CRU, September 2016

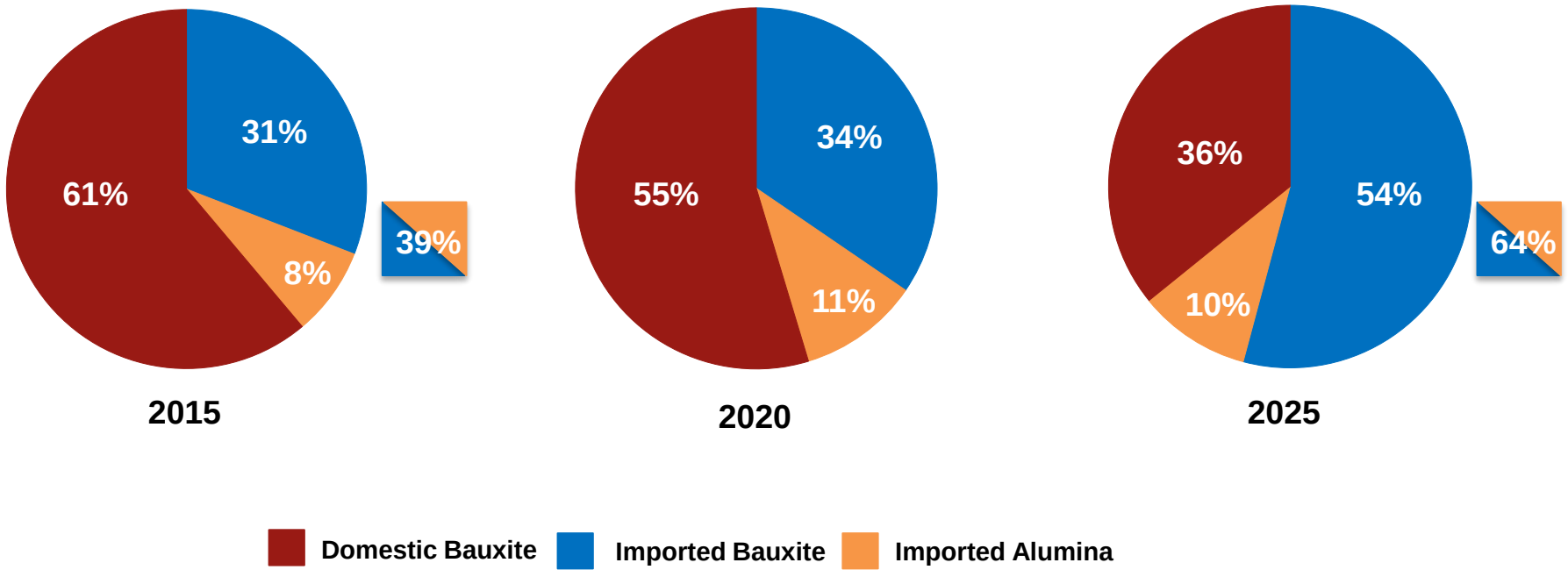
- In 2016, 48% of third party sales on spot or alumina index (up from 34% in 2013)
- 2018 forecast 47% index, 11% spot, 30% LME-linked, 12% other

Refinery growth in Middle East and Asia to fragment bauxite market further



Source: CRU, July 2016

Chinese primary production dependent on imported resources

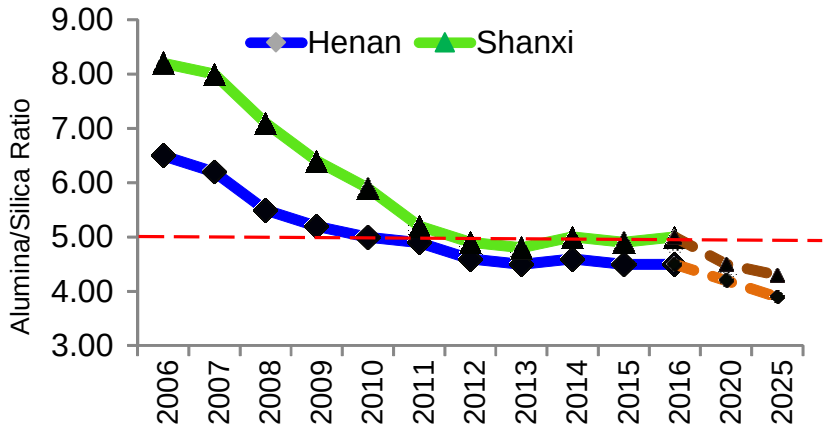


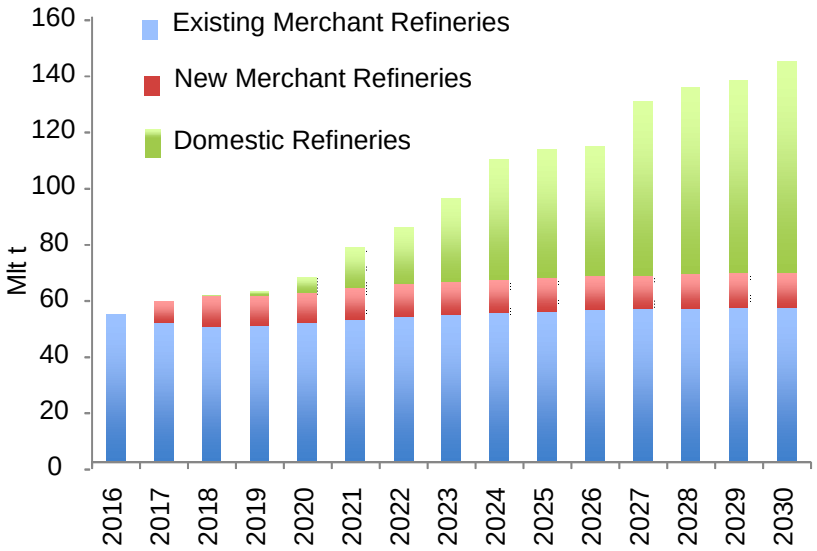
- Imported bauxite forecast to increase from 56m t in 2015 to 111m t in 2025

Source: CM Group, August 2016

Chinese bauxite imports forecast to rise

Declining domestic bauxite quality in key alumina producing provinces



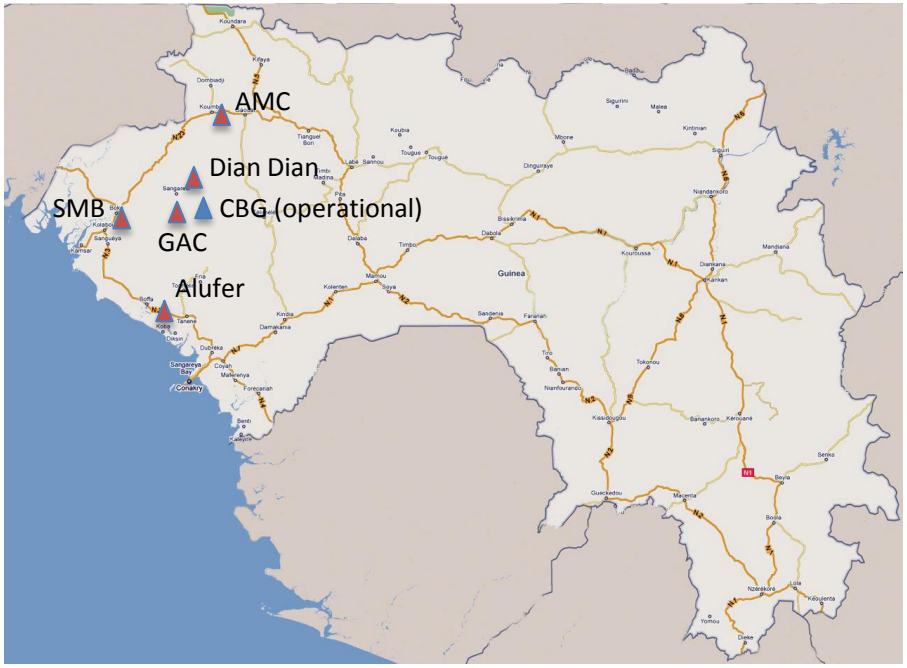


- Historical pure Bayer process economic limit is above 5
- Feed grade marginal increase in 2014 as refiners used allocated (not domestic traded) bauxite
- Mining costs are increasing as deposits go deeper
- Limited access to high quality bauxite deposits (allocations)
- Lower alumina prices over the past year have led to “high grading” of some deposit
- Likely inland refiners importing bauxite would relocate/build coastal capacity to reduce freight

Source: Left hand side: CM Group, August 2016
Right hand side: Chinese Imported Bauxite Cost, CM Group with China Customs Data, April 2016

Guinea – transformational development by the SMB/WAP* Joint Venture

WAP barge load-out facility at Katougouma, Guinea (August 2016)



Map of Guinea showing proposed new projects

- WAP Group built 16 million bone dry tpa barge loading facility at Katougouma river port site
- A second barge loading facility is due by end of 2016 (forecast to double export capacity)
- SMB is mining low grade bauxite currently (less viable at higher freight rates) - unclear whether WAP/SMB will gain access to higher grade bauxite tenements in the future

- Société des Mines de Boké (SMB)/Winning Alliance du Port (WAP)

Source: CM Group, September 2016

Guinea – rapid expansion has occurred with a full pipeline of new projects

Project Name	Current Output (million tpa*)	Planned Increase (million tpa*)	Proposed Completion Date	Total By 2020 (million tpa*)
CBG	15.5	3.0	2019	18.5
UC Rusal (Kindia)	3.5	0.0	-	2.5
SMB (WAP)	16.0	16.0	2017	32.0
Alufer	0.0	5.0	2018	5.0
GAC	0.0	6.0	2019	6.0
UC Rusal (Dian Dian)	0.0	3.0	2018	3.0
AMC	0.0	4.0	2019	4.0

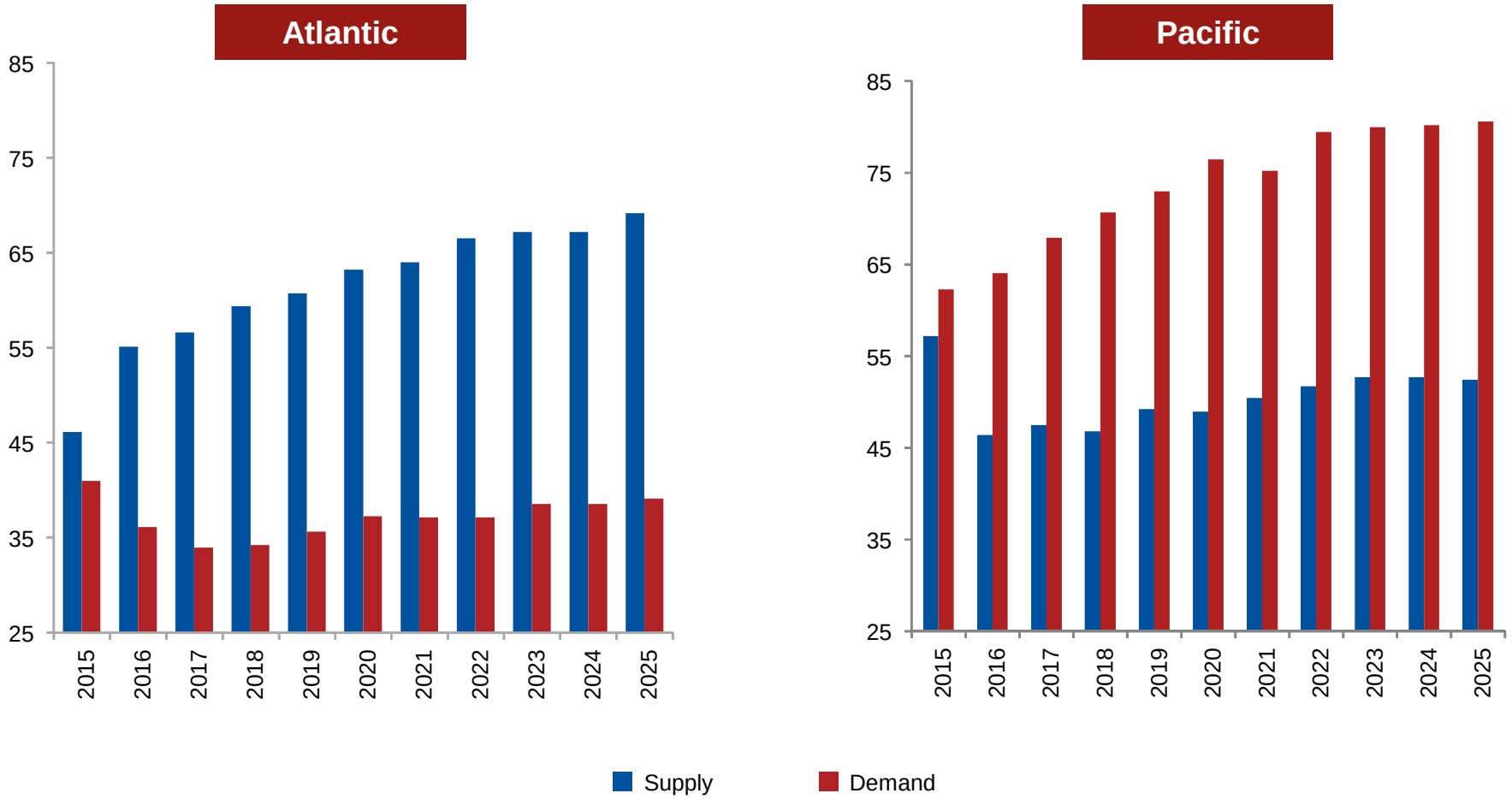
- Estimated 37 million tpa* of additional bauxite export capacity planned to come on-stream in Guinea by 2020. Additional projects planned beyond 2020
- Most of the increase is targeting the Chinese market; some of the increase is to non-Chinese new refinery projects and some are replacement tonnes
- Unlikely all projects will meet their proposed completion dates; some of the projects require financing and the demand forecast for the Chinese market is below the total Guinea export growth by 2020

Source: CM Group, September 2016

* Bone dry metric tonnes, except for CBG 3% moisture

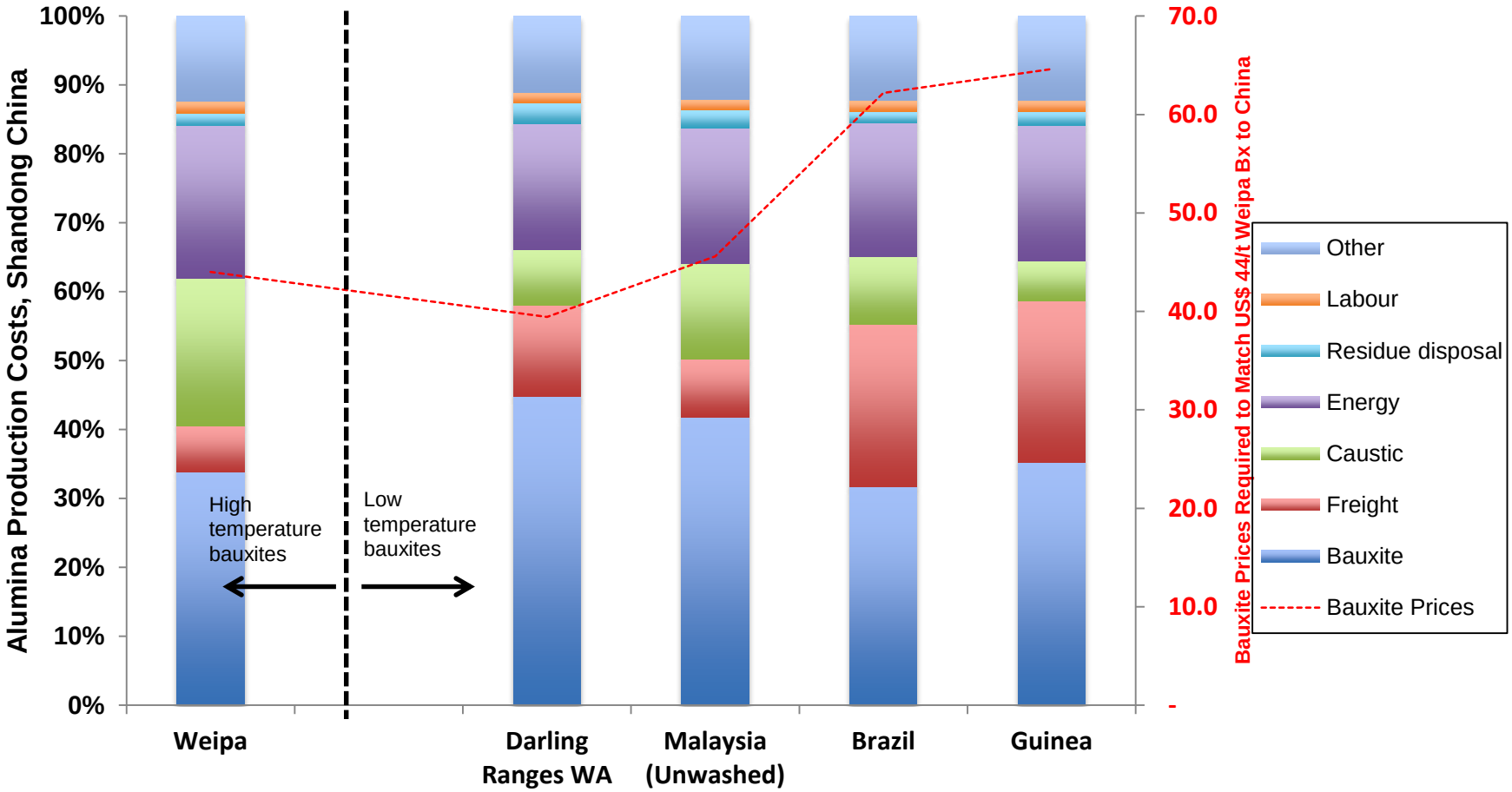
Bauxite availability increasing in the Atlantic

Third party bauxite supply and demand
(million tonnes)



Source: CRU, July 2016

Impact of bauxite source on key cost drivers for alumina production

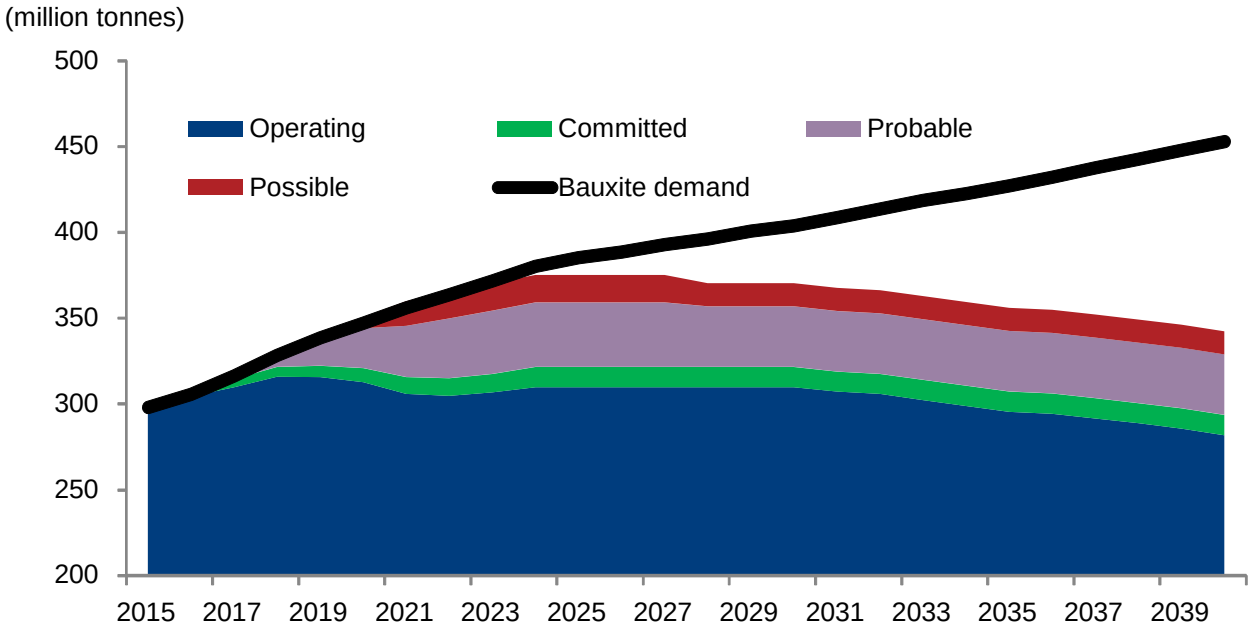


- Weipa is the only major high temperature bauxite supplier
- Darling Ranges bauxite is low in alumina, requiring more bauxite per tonne of alumina produced, but is very low in reacting silica, reducing energy and caustic costs, and may be amenable to blending
- Current low-cost freight market increases the competitiveness of Atlantic bauxite relative to Asia-Pacific bauxite delivered into China.

Source: CM Group, August 2016

Significant, large greenfields projects needed to avoid bauxite gaps

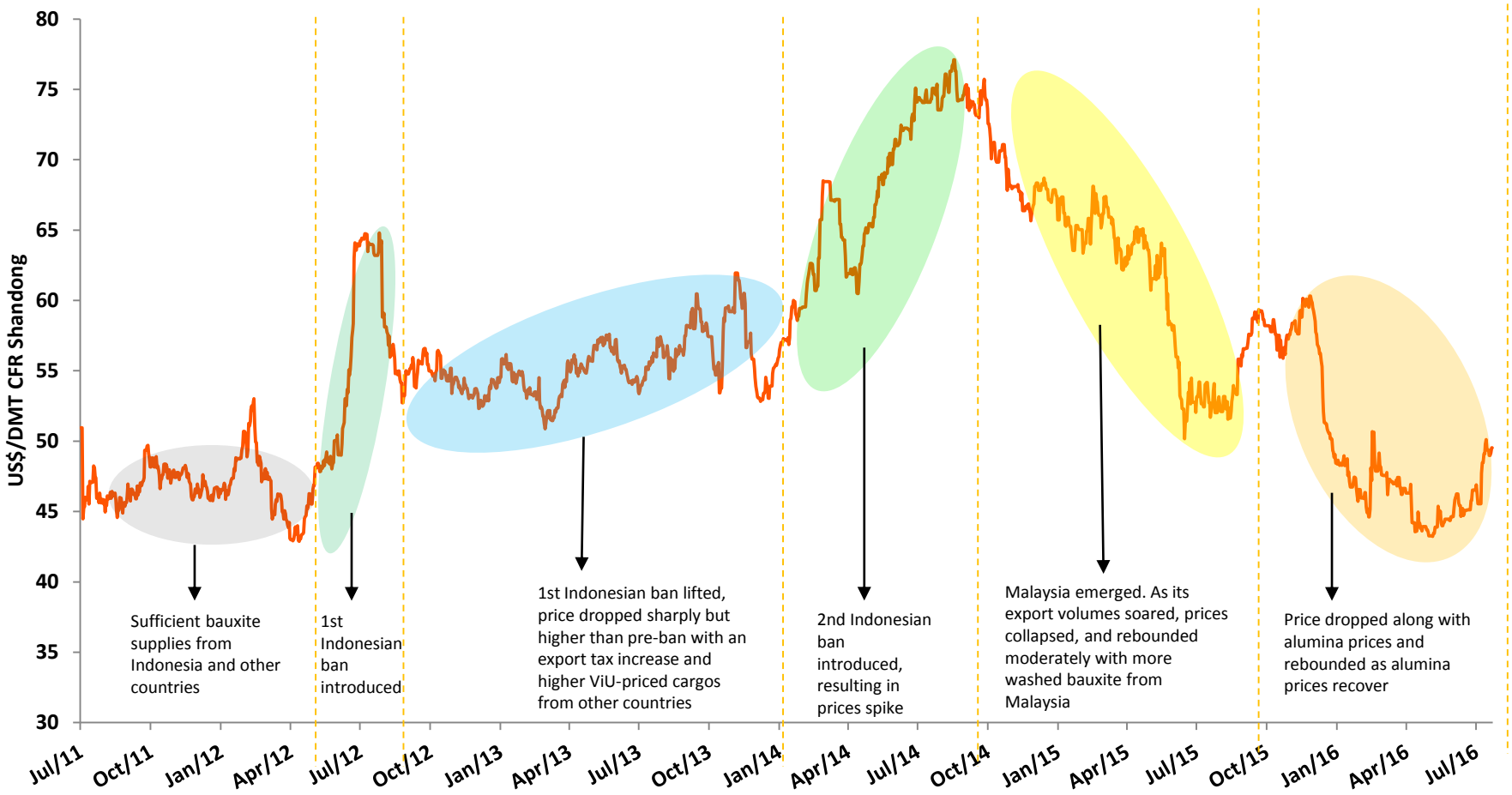
Global Bauxite Supply and Demand, 2015-2040



Source: CRU, September 2016

- Existing bauxite supply and committed and probable projects can meet demand in the next few years
- Supply risks arise from 2020 (when projects in the “possible” category need to come on stream) and more speculative projects to meet the gap from 2024

Value-in-use bauxite prices delivered to China - 2011 to 2016 (CBIX)*



- CBIX*: a value-in-use adjusted reference price for bauxite of a standard grade (50% reacting alumina, 5% reacting silica, 10% moisture) CFR China
- Harbor metallurgical bauxite China CIF prices (July 2016, unadjusted): Australia $43.20, Malaysia $45.30, Guinea $54.70, Brazil $56.40, Ghana $77.30

Source: CM Group, August 2016

Social licence lost, Malaysia continues to extend ban: lessons for other countries?

- Malaysian mining ban extended to the end of 2016
- Requirement to fully clear stocks and review position
- Environmental, safety: water pollution from wash plants, dust, overloading, heavy traffic, poor rehabilitation
- Illegal mining – licensing issues, royalty gaps
- Lessons if Indonesia resumes (or Vietnam starts) exports?

West Kalimantan, Indonesia, 2014

Kuantan, Malaysia, 2015

Social licence and downstream sustainability issues

- Increasing needs for miners and refiners to focus on legitimate community expectations
- Social licence in indigenous communities requires safe and environmentally and socially sustainable practices
- Examples of recent problems:
  - Samarco dam failure, Brazil
  - Community-related restrictions on access to bauxite in India
  - Malaysian community issues
- At other end of product chain, increasing expectations of consumers of aluminium products:
  - Want to see a complete chain of ethical, environmental and social responsibility (in choice of supplies to produce a finished product)

Medium term bauxite and alumina dynamics – implications for smelters

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Alumina production

- Near term balance
- Low prices challenge future investment
- Refining moving Eastwards
- Bauxite cost push for China

- US$ strength, lower energy and bauxite costs shift alumina cost curve down
- Primary aluminium demand growth solid: 3% for 2016 and 7% for 2017
- Approximately 23 million tonnes of new alumina capacity required by 2020
- Alumina near balance expected over next 5 years; refining moving Eastwards
- Refining issues in medium term
  - China: Cost and availability of bauxite, customizing bauxite streams
  - RoW: Long lead times and no financial incentive for new capacity

Bauxite production

- Bauxite well supplied currently
- Nearly 60 million tonnes of extra bauxite production required by 2020
- Chinese bauxite imports forecast to grow sharply from 2020
- Large-scale greenfields mines are needed; financing, social and freight issues
- Base supply from Asia-Pacific to China, Guinea likely marginal producer

Pricing issues

- Alumina pricing outside China de-linking from LME: 58% on spot/API by 2018
- Emergence of alumina futures contracts to facilitate hedging
- Expect development of some standard bauxite indices, by region and type